

MULTICAST

THE DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF ROCHESTER



LOOK HOW WE HAVE GROWN!

Meet Our Newest Graduates on Page 23



HAJIM
SCHOOL OF ENGINEERING
& APPLIED SCIENCES
UNIVERSITY of ROCHESTER

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'Changes in Latitude, Changes in Attitude'



In May 1996, URCS awarded its first bachelor's degrees: 10 in all, 5 BAs and 5 BSs. The lucky graduates had started their computer studies in the math department, but thanks to the then brand-new undergraduate program, they received their degrees in the CS department. In May 2018, that number had grown to 102.

The intervening years have witnessed major changes in URCS. What was a small arts and sciences department of about 10 faculty, awarding only PhD degrees, has grown to a full-fledged engineering department with over 20 core faculty lines—and the largest undergraduate and master's enrollments in the Hajim School.

There have been ups and downs in the undergraduate program along the way. Our first three classes, representing students already studying CS through the applied math program, were about the same size as the first one. We then experienced sudden growth with the new CS degree program, and in 2003, 50 bachelor's-degree candidates graduated—five times the original class size.

Back in 2000, however, the “dot-com bubble” had burst, followed by the “Great Recession” of 2007. Freshman enrollment declined, and four years after the crash, our graduating class had dropped to below 30. With the economic recovery beginning around 2010, enrollments increased, and the class of 2014 was finally back up to the pre-crash level of 50. Since then, enrollments have exploded, and our graduating class exceeded 100 this year. Next year's class promises to be even larger.

Through 22 years and 5 chairs, the undergraduate CS program has had one constant, stabilizing presence: Marty Guenther, our undergraduate coordinator. Marty had been working for the department part time since 1992 and became the full-time coordinator with the start of the UG degree program. She has served as advisor, confidant, and CS den mother to virtually every CS major since the beginning of the program. She knew them all by name. When one of the faculty ran into an issue with one of their advisees, Marty was always the first stop. And, it was nearly always true that she already knew about the issue and had a good idea of how to fix it.

The year 2018 saw Marty's retirement. Combined with the move 100 meters north to Wegmans Hall and the explosive program growth, it seems like the start of a new era. We now have a mature and vibrant program, but with more than 500 undergraduates, it is one that has grown too large for one person to embrace. Luckily, Marty has prepared us well by shaping the culture of the undergraduate program into an inclusive and encouraging family. After shepherding hundreds of undergraduates through the program, Marty's contributions to our department can only be adequately described in the words of the students themselves.

Seema Plaisier '04

“When I started at URCS 17 years ago, she was comforting and helpful. Marty did the little important stuff, like getting transcripts and handing out the key cards for logging into the network. I looked forward to chatting with her as she took care of things for me. Marty got the answers to my questions—some that I didn't realize I had yet. Marty watched over me, over all of us; made sure that even though I was struggling through the classes, that I didn't fall too far behind. So much so, that I graduated with honors. Marty stepped up when we needed her; she was the one who came to class to tell us when 9/11 happened. Marty has kept up with me and so many other alumni that have gone on to do all kinds of things all over the world, and, in the process, she gave me advice when I really needed it. Marty has been the smile and the heart of the department. I will be forever grateful for her guidance and love. I know that whatever she does in the next chapter of her life, she will continue to make a huge difference in the lives of everyone she meets.”

Nazmin Kharodia '14

“I wouldn't have been a computer science major if it wasn't for Marty.”

Veneet Sawhney '03

“How were you always there, at any moment of any day, to answer our questions?”

“Someone needs to solve this puzzle.”

Bram Adams '16

“Marty is not only the lifeblood of the CS department, she's a phenomenal friend and mentor as well. She is visibly passionate about making each and every student feel unique and, most importantly, welcomed into the CS family. I met Marty my first day of freshman year and she remained a mainstay throughout my college career. Be it her delicious cookies, or the fact that her door was ALWAYS open, I always felt I had a home in the department. There were many times during my time at Rochester that I thought I wouldn't be able to graduate, and, so many times, I felt like I was inadequate in my courses. Each time, Marty proved herself a dear friend by consoling me and helping me gain the confidence to graduate with a BS! The saddest part about Marty's retirement is that the students of the future won't know how much of a pleasure it was to have her as their guardian angel.”

Kunal Mukherjee '03

“My statement will probably be repeated by most CS majors, but I would not have graduated without Marty. She not only provided encouragement during really difficult times but was almost like a guardian to me and two of my closest friends (jointly referred to as the 3 Musketeers by Marty).”

Darcey Riley '12

“I never would have graduated if not for Marty! I dropped a linguistics major at the last minute and completely forgot this meant my social sciences cluster wouldn't be satisfied. Marty noticed and made sure I got the paperwork filled out for a linguistics minor so I could graduate on time. Thank you so much, Marty, for this and everything!”

Nawrose Nur '03

“When I was ready to quit, Marty reached out and showed the path forward. She knew us better than we knew ourselves at times.”

And finally, from Joshua Pincus '99

“A long time ago in a freshly minted degree program far, far away, you were the warm, friendly, and reassuring voice whose sage counsel soothed many a scared and confused undergrad. ‘So what reqs do we need from math? I studied Pascal in high school. Can't I skip CSC 171? Do any of the CS courses actually have textbooks? Can we sleep in the undergrad lab?’ For all questions academic or pedantic, there was ONE person to whom we could turn. And turn we did. On behalf of all the kids we once were, thank you! On behalf of this kid, I have something more to add. My dad passed away during my senior year, just before my Take 5 year. That year and the subsequent year were difficult. My head was not in the right place. Things happened behind the scenes to make my life and the life I've lived after graduation better. You never said anything, but you most definitely did things. I've had and continue to have a successful and enriching career in no small part due to those silent efforts. I will be forever grateful.”

To a remarkable tenure must be added Marty's support of women in computer science. That first class in 1996 had no women. Zero. During the height of the bust from 2005 to 2010, an average of one woman per year graduated from our program. We clearly had a gender gap. Marty spearheaded a years-long initiative to encourage and support UG women's participation in URCS. This effort included the creation of UR Women In Computing (URWIC) (www.csug.rochester.edu/URWIC/home.php) as a subcommittee under the Computer Science Undergraduate Council, yearly trips with our undergraduate women to the national Grace Hopper Celebration of Women in Computing (<https://ghc.anitab.org>), and participation in the multiuniversity BRAID (Building, Recruiting, And Inclusion for Diversity) initiative (<https://anitab.org/braid-building-recruiting-and-inclusion-for-diversity/>). These efforts have paid off. Since 2016, the graduating class has contained approximately 30 percent women, nearly double the national average.

So there you have it. The undergraduate CS program at Rochester has completed a 20+ year transition from small beginnings to a thriving enterprise preparing the next generation for careers in the information economy. The faces are changing, but the legacy of those who shepherded the program through its childhood and adolescence is alive and well. To paraphrase a lyric, the future is wide open. *Meliora.*

From the CHAIRS

2017–2018 in Retrospect



Dwarkadas



Scott

2017–2018 has been quite an action-packed year as we settled and grew into Wegmans Hall. The building has a light and airy feel, and it is delightful to see how well utilized the public spaces are for students to meet in study groups, eat lunch, or just hang out.

We had a graduating class of 149 students: 109 students graduating with a bachelor's degree—40 BA and 69 BS, and 32 MS and 8 PhD students. An additional 33 students did a minor in computer science. More than a third of our undergraduate students completed a double major, with second majors in electrical and computer engineering, math, business, studio arts, applied music, Japanese, digital media studies, economics, linguistics, brain and cognitive sciences, physics and astronomy, history, optical engineering, biology, psychology, chemistry, and statistics.

We had a truly impressive class of 2018. Many are now in industry at companies such as Google, LinkedIn, Cisco, Facebook, Amazon, Spotify, Factset, 1010data, Salesforce, IBM, JP Morgan Chase, ActionIB, Lcid Perspectives, Accenture, SRC Inc, Velo3D, EY, YourMechanic, Mathworks, Snap, Microsoft, Elemental Cognition, and Verneek. Some are off to graduate school at universities including Brown, Cornell, Rutgers, UC Davis, UC Santa Barbara, UC San Diego, UCLA, and our very own University of Rochester;

others are at research institutes such as IMDEA. The breadth of placement is truly breathtaking!

In head-to-head competition with teams from other universities, our undergraduates returned this year from the CS Games in Montreal with six trophies, including first place in theoretical computing, machine learning, and functional programming. Our ACM programming team came in first place in the preliminaries and fourth place in the regional finals. Departmental awards at our Commencement Ceremony went to Andrew Read-McFarland and Haosen Wen (Outstanding Graduate Teaching Assistants); Shir Maimon (Outstanding Undergraduate Teaching Assistant); Vivian Li (Women in Computing and Excellence in Undergraduate Research); and Edward Newton (Outstanding Senior Award).

Our PhD students have been involved in a range of research topics, among them: mitigating side-channel and speculation (Spectre and Meltdown) attacks launched by compromised operating system kernels; emerging nonvolatile memory interfaces; and the analysis of emotion, humor, and hate speech from images and text. Several of them have research internships this summer at locations that include Adobe, Amazon, Expedia, Google, Huawei, IBM, JD.com, Lawrence Livermore National Labs, Lincoln Labs, Microsoft, Philips, Qualcomm, Snap, Tencent, and Z2AI Corporation. Additionally, more than 20 percent of the senior undergraduate class has been involved in research with our faculty as have almost all of our MS students. Undergraduate Vivian Li received an honorable mention in the Computing Research Association's (national) Outstanding Undergraduate Researcher Award. Shir Maimon received Rochester's Doris Ermine Smith Award for significant achievement in mathematics. PhD student Joseph H. Izraelevitz received a commendation for his dissertation in Rochester's 2018 Outstanding Dissertation Awards competition.

In addition to the knowledge they have gained in computer science, our undergraduates are also multitasked. More than 10 percent of this senior class were varsity athletes in sports including rowing, track and field, cross country, and football. Aurek Ransom received the first-place award in the Writing, Speaking, and Argument program's contest for outstanding writing in the humanities. Sidhant Ahluwalia won a Gwennie Award from the Career Center for his role in Meliora LaunchPad, a hotbed for sharing entrepreneurship experiences.

More than 15 percent of the senior undergraduate class has taken advantage of the study abroad program to explore countries that include Hungary, the UK, Sweden, Italy, and Spain.

Funded in large part by the BRAID (Building, Recruiting, and Inclusion for Diversity) initiative, now going into its fifth year, we sent 29 women, 3 staff members, and 2 faculty members to the Grace Hopper Conference Celebration of Women in Computing in October in Orlando, Florida. This past year, URWIC self-organized to reach out to more than 100 local middle and high school students in order to grow the pipeline of women in computing. The department also hosted a booth for recruiting women and minorities for graduate studies and faculty positions and held a dinner to network with alumnae. We will continue to receive support from the BRAID initiative for at least another year. Our participation in the BRAID initiative has yielded tremendous results: 32 percent of our 2018 graduating class were women, compared to a national average of 17.9 percent.

Our faculty continue to grow their research enterprise and reach, both nationally and internationally. Henry Kautz is director of the Division of Information and Intelligent Systems at the National Science Foundation (NSF) for the next three years. Ehsan Hoque received an NSF CAREER Award and

was also listed among *Science News's* 10 Scientists to Watch, Ji Liu was listed among *MIT Technology Review's* 35 Innovators Under 35 in China. Yuhao Zhu received an honorable mention for his dissertation in the ACM/IEEE SIGARCH/TCCA Outstanding Dissertation Award competition. Chenliang Xu received an NSF Big Data Science and Engineering award for his work on "Audio-Visual Scene Understanding." In addition to NSF, ONR, DARPA, DoD, and the NYS Center of Excellence in Data Science, collaborations with Adobe, Carestream, Futurewei, IBM, Google, Markable, Microsoft, NEC, SAIC Innovation Center, Samsung, Snap, TCL, Tencent, Yahoo, and Xerox fund departmental research. The department also received funding from the Anita Borg Institute (BRAID funding) and the Burroughs Welcome Foundation.

Among news from our alumni, PhD alumnus Xipeng Shen '06 was promoted to full professor in the Department of Computer Science at North Carolina State

University (NCSU). PhD alumnus Andrew McCallum '96 was named a fellow of the Association for Computing Machinery. We welcome Zhen Bai to the ranks of our tenure-track faculty and Eustrat Zhupa to our teaching faculty this coming year. Zhen earned her PhD at the University of Cambridge and comes to us via a postdoc at CMU. Her research area is broadly human-computer interaction, combining augmented and tangible user interfaces, human-robot interaction, educational technologies, computer-supported collaborative learning, and design for diversity. Her research is interdisciplinary, drawing from multiple disciplines, including developmental psychology, social science, learning science, machine learning, and natural language processing. We look forward to having her here. Eustrat earned his PhD at the University of Bari in Italy and was a visiting teaching faculty member at RIT prior to joining us.

This last year has seen several changes in our staff due to retirements and additions.

Brynn Wilkins '14 and Janet Ouimette joined us as undergraduate program manager and undergraduate coordinator, respectively, taking the place of Marty Guenther, who retired in December. Beth Corrigan joined us as staff accountant, replacing Pat Mitchell on her retirement in June. Kristi Kongmany is now the grants manager and assistant to the chair. Vanessa Phengsomphane is the new department coordinator. We are truly blessed to have an amazing staff.

Our student population continues to grow, with over 150 students in the entering undergraduate class of 2022 declaring an interest in computer science. Additionally, the interdisciplinary majors of data science, computational biology, and computational linguistics also continue to grow and draw heavily on computer science.

Sandhya Dwarkadas, Chair
Michael L. Scott, Interim Chair (Fall 2018)



New Faculty News: Zhen Bai

AR/VR Computing for Lifelong Learning



Zhen Bai will be joining the Department of Computer Science in fall 2019 as an assistant professor in Human-Computer Interaction (HCI). Zhen received her PhD degree from the Graphics & Interaction Group at the University of Cambridge in 2015 and was a postdoctoral fellow of the Human-Computer Interaction Institute and the Language Technology Institute at Carnegie Mellon University before joining the University of Rochester.

Building upon insights that the human mind exists not only in the brain but partly in the environment and people that we interact with, Zhen's research focuses on creating and evaluating augmented, embodied, and socially aware interfaces that transcend an individual's ability, motivation, and experience integrated with the immediate physical and social surroundings.

Zhen's research has particularly centered on seeking scientific, technical, and design innovation to support lifelong learning for people with diverse abilities (e.g., autism) and backgrounds (e.g., underrepresented students in STEM education). According to the Future of Jobs report by the World Economic Forum, 65 percent of children who started school in 2016 will work in jobs that do not yet exist. This profound transformation of the employment landscape requires advanced 21st-century skills such as creativity, curiosity, communication, and collaboration to approach complex challenges and obtain new knowledge in our ever-changing world.

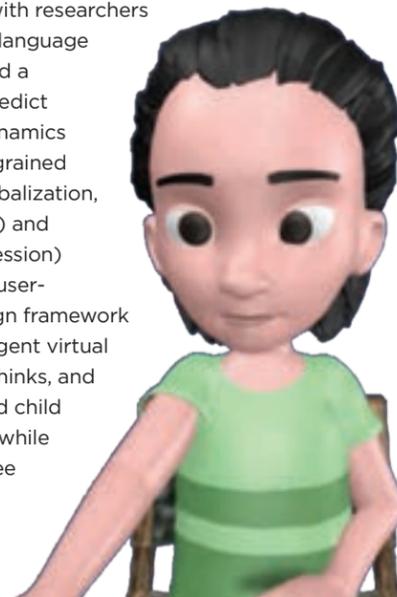


Figure 1. A typically developing child interacting with the proof-of-concept AR looking glass for imaginative play

Zhen has developed several playful and collaborative interfaces that cultivate the development of imaginative, social, and curious minds for children from 4 to 14 years of age. To address the situatedness and embodiment of cognition in social contexts, Zhen explores the design space spanning augmented reality, tangible user interfaces, and embodied conversational agent, and she embraces interdisciplinary theories and technologies in machine learning; natural language processing; and cognitive, social, and learning sciences. Zhen's work is published in leading conferences and journals in the domain of HCI, augmented reality, visualization and graphics, child-computer interaction, technology-enhanced learning, and intelligent agent (e.g., CHI, ISMAR, TVCG, IDC, AIED, IVA).

Zhen's PhD thesis investigated augmented reality technologies to enhance imaginative play, where everyday objects become imaginative ones through symbolic transformation (e.g., let's pretend the banana is a telephone). Imaginative play helps children develop theory of mind, which is the ability to understand one's own and other's perspectives but is often underdeveloped among children with autism spectrum condition. Zhen developed two augmented and tangible interfaces (Figures 1, 2) that support conceptualization of symbolic transformation, divergent thinking, socio-emotional reasoning, and communication by allowing preschool children with and without autism spectrum condition to overlay and manipulate virtual contents on physical surroundings and enact social roles with dynamic facial expression.

Zhen's most recent work focuses on fostering curiosity in small group learning for marginalized students in STEM education. Curiosity is a critical motivational factor for knowledge seeking, but it's often found to decline with age. Zhen developed the first theoretical framework of curiosity in social contexts that specifies how observable behaviors contribute to one's own and other's curiosity. In collaboration with researchers in data mining and natural language processing, Zhen developed a computational model to predict the temporal and social dynamics of curiosity based on fine-grained verbal (e.g., hypothesis verbalization, argument, and justification) and nonverbal (e.g., facial expression) behaviors. Zhen created a user-centered, data-driven design framework to develop a life-like, intelligent virtual peer (at right) that looks, thinks, and behaves like a 9-14 year-old child and aims to elicit curiosity while interacting with two to three children in a multiparty tangible board game.



Zhen is excited to contribute to the stimulating interdisciplinary research environment at the University by discovering emerging technologies through integrating human, machine intelligence, and interactive media in the coherent physical, cognitive, and



Figure 2. FingAR Puppet System that elicits emotion reasoning, divergent thinking, and communication in collaborative storytelling

social space. In particular, Zhen looks forward to innovating with AR/VR computing in lifelong learning, STEM education, mental health, aging, and civic participation by establishing collaborations with cutting-edge research in artificial intelligence, electronic engineering, psychology, neuroscience, medicine, and beyond at Rochester. Zhen is dedicated to developing compelling undergraduate and graduate courses that intersect with HCI, AR/VR, intelligent interface and education technology, and is eagerly anticipating to work with students with diverse academic backgrounds to explore their untapped passion and talent in interdisciplinary research, starting this fall!



MindSpace virtual reality laboratory at Rochester.

Faculty Research: Chenliang Xu

Computers Utilize Audiovisuals to Understand Unconstrained Scenes



Figure 1: Videos in the AVE dataset.



Understanding scenes around us, i.e., recognizing objects, human actions, and events, and inferring their spatial, temporal, correlative, and causal relations, is a fundamental capability in human intelligence. Similarly, designing computer algorithms that can understand scenes is a fundamental problem in artificial intelligence. Humans consciously or unconsciously use all five senses (vision, audition, taste, smell, and touch) to understand a scene, as different senses provide complimentary information. For example, watching a movie with the sound muted makes it very difficult to understand the movie; walking on a street with closed eyes and no other guidance can be dangerous. Existing machine scene-understanding algorithms, however, are designed to rely on just a single modality. Take the two most commonly used senses, vision and audition, as an example. There are scene-understanding algorithms designed to deal with each single modality. However, no systematic investigations have been conducted to integrate these two modalities toward

more comprehensive audiovisual scene understanding. Designing algorithms that jointly model audio and visual modalities toward a complete audiovisual scene understanding is important, not only because this is how humans understand scenes, but also because it will enable novel applications in many fields. These fields include multimedia (video indexing and scene editing), health care (assistive devices for visually and aurally impaired people), surveillance security (comprehensive monitoring of suspicious activities), and virtual and augmented reality (generation and alternation of visuals and/or sound tracks).

The above motivates a recent project, where my students and I aim to design computer algorithms to achieve human-like audiovisual scene understanding through big data analysis of internet videos. This project is supported by the National Science Foundation BIGDATA program and throws a radical curveball at both computer vision and computer audition communities. I will briefly talk about two projects supported by the program.

Audiovisual Event Localization in Unconstrained Videos

Like many AI problems, the first thing we needed to address is data. Observing that there is no publicly available dataset directly suitable for our purposes, we collected a large video dataset, named AVE, that consists of over 7,000 10-second videos with both audio and video tracks for over 50 audiovisual events. The events vary from animal sounds, e.g., dog, cat, and

goat, to playing music instruments, e.g., violin, guitar, and banjo, to human activities, e.g., man speaking, woman speaking, and baby crying, and to object sounds, e.g., helicopter, racing car, and motorcycle. With this dataset, we sought to answer the following questions about recognizing and locating these audiovisual events. Does joint inference over auditory and visual modalities outperform inference over them independently? How does the result vary under noisy training conditions? How does knowing one modality help model the other modality? How do we best fuse information over both modalities? Can we locate the content in one modality given its observation in the other modality?

We have proposed both baselines and novel algorithms to answer the above questions. We started with a baseline-sequence labeling model where we utilized convolutional neural networks to encode audio and visual inputs and adapted long short-term memory to capture temporal dependencies. Upon this baseline model, we introduced an audio-guided visual attention mechanism to verify whether audio can help attend visual features; it also implies spatial locations for sounding objects as a side output. Furthermore, we investigated several audiovisual feature fusion methods and proposed a novel dual multimodal residual fusion network that achieves the best fusion results.

Our systematic study has led us to these conclusive findings: jointly modeling auditory and visual modalities outperforms independent modeling; audio-visual event localization in a noisy condition is still tractable; the audio-guided visual attention is able to capture semantic regions of sound sources and can even distinguish audio-visual unrelated videos; temporal alignments are important for audio-visual feature fusion; the proposed dual residual network is capable of audio-visual fusion; and strong correlations exist between the two modalities, enabling cross-modality association. These findings have paved a way for our community to solve harder, high-level understanding

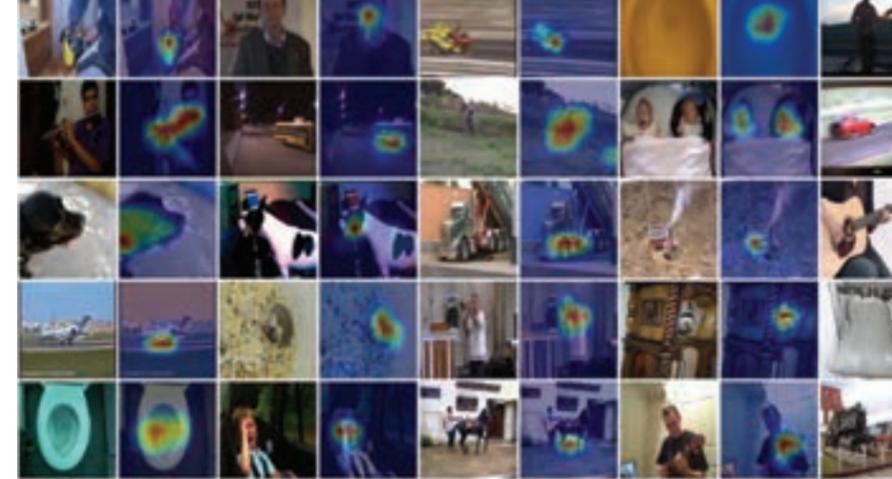


Figure 2: Qualitative visualization of audio-guided visual attention on AVE test set: The semantic regions containing many different sound sources, such as dogs barking, children crying, people talking or playing instruments, or a bus sounding its horn, can be adaptively captured by our attention model.

problems down the road, such as video captioning and video question/answering, where the auditory modality plays an important role in understanding video content but lacks effective modeling.

Cross-Modality Audiovisual Generation

A different point of view to explore audiovisual scene understanding is via cross-modality audiovisual generation. Cross-modality generation has become an important and emerging topic of computer vision and its broader AI communities, where it aims to synthesize data in one modality based on information in a different modality. We have considered the following task—given an arbitrary audio speech and one lip image of arbitrary target identity, generate synthesized lip movements of the target identity saying the speech. To perform well in this task, it inevitably requires a model to not only consider the retention of target identity, photo-realism of synthesized images, and consistency and smoothness of lip images in a sequence but, more importantly, to learn the correlations between audio speech and lip movements.

To solve the collective problems, we have explored the best modeling of the audiovisual correlations in building and training a lip-movement generator network. We devised a method to fuse audio and image embeddings to generate multiple lip images at once and proposed a novel correlation loss to synchronize different lip changes and speech changes. Our system runs in real time and is robust to lip shapes, view angles, and different facial characteristics. Notice that our system only requires one single image of the target identity that overcomes the limitation of conventional methods that

require many hours of footage per target identity to synthesize realistic videos. We expect that our system would assist aurally impaired people to better understand speech, especially when limited network bandwidth is present.

Research Group, Education, and Outreach

The research in my group is supported by multiple National Science Foundation grants. In addition to the audiovisual scene understanding project, the research thrusts of my group include computer vision and its relations to natural language, robotics, and data science. For example, we are developing a sound framework to perform higher-order inference in understanding web instructional videos, such that models devised in this framework are capable of answering questions such as *why* and *how* something happened in the video that depicts the reasoning ability in human intelligence. My group also conducts interdisciplinary research. A recent project is to apply advances in computer vision to improve models of multiscale systems in chemistry; in both the computer processing of videos and the modeling of multiscale chemical systems, reducing complexity via removing extraneous details is essential.

I joined URCS in fall 2016, and, since then, I have introduced two new courses in the Hajim School of Engineering & Applied

Sciences: Advanced Topics in Computer Vision and Deep Learning & Graphical Models. The first course exposed students to a variety of topics and state-of-the-art techniques in Computer Vision with an emphasis on video understanding and multimodal modeling. Students gained research experience through a semester-long project. The second course, which focused on essentials, including representation, learning, and inference of both structured models and neural networks, led to a final project that required the students to train their algorithms using the University CIRC cloud platform.

My group hosts REU students regularly through the NSF REU Site in Data Science. This year, we also hosted a Xerox Engineering Research Fellow for summer research. My group also recently completed a three-hour module on deep learning to a cohort of 17 high school students as part of the Data Science session for the Pre-College Program in the Hajim School.

Figure 3: (Bottom left) Lele Chen shows a real-time demo system that generates his talking face from a single selfie. (Top right) Based on a single face image and audio speech taken from President Obama's weekly address, the system generates various talking faces.



Featured Graduate Alumni: Amanda Stent

An EMT Tackles

NATURAL LANGUAGE PROCESSING in NYC



that can be used across the company and by our clients. I also teach NLP within the company to Bloomberg engineers and data scientists and do some research of my own. Although I was a little nervous to move into this role, it has been very interesting and deeply satisfying so far.

What have your experiences been like in academia versus industry? Why did you decide to re-enter the industry after being in academia?

Every work environment is unique, and only you can know what matters for you in a work environment. For me, it is that technical innovation should be encouraged; it should be possible to collaborate with smart people on interesting problems; the organization should have a general habit of ethical thinking and practice; and publication should be an option. Also, for me personally, autonomy in my workday is really important. All of these characteristics can be found in academia, in tech, and in other areas that hire PhD computer scientists such as telecommunications, finance, health care, and the law. Computer science is that relatively rare field where researchers can move back and forth between industry and academia, as long as they keep publishing.

You have authored more than 90 papers on natural language processing and are a coinventor on more than a dozen patents. Looking back at your career to date, what contribution in your body of work gives you the most satisfaction?

I loved working on TRIPS as a PhD student! Some of the papers from that work are still very impactful.

I remain deeply interested in grounding (the establishment of mutual understanding between participants in the interaction). One of the highlights of my career so far was working with Susan Brennan and Marie Huffman on a multiyear NSF-funded interdisciplinary grant, looking at grounding and related phenomena in human-human and human-computer interaction.

That said, not all contributions take the form of patents or publications. As computer scientists, software (or hardware) artifacts can be significant contributions. And, of course, it is our contributions to the development of others that are often most impactful in the long run. I am enormously happy to have had the privilege of supervising many undergraduate researchers, several MS and PhD students, and numerous summer interns.

After working at AT&T, Yahoo Labs, and as an assistant professor at the State University of New York at Stony Brook, Amanda Stent is currently a product manager at Bloomberg in the CTO Data Science group. She is also on the board for the CRA-W working on the DREU program. She was awarded her PhD from the University of Rochester in 2001, coauthored the book *The Princess at the Keyboard: Why Girls Should Become Computer Scientists*, and volunteers as an EMT.

Tell us a little about yourself: What are you doing now? What were you doing previously?

I've had a varied career (so far!). After my PhD at U of R, I did a six-month postdoc at AT&T Research and then went to Stony Brook University as an assistant professor. After I was awarded tenure, I went on leave back to AT&T Research, which at the time was a "pure research" lab. I had such a great time collaborating with a large team of NLP [natural language processing] and speech researchers at AT&T that I gave up my faculty position. After six years, AT&T Research changed its mission, and I went to Yahoo Labs, which was being "rebooted" under new Yahoo management. At Yahoo, I became a director of an NLP group and then also of a computer vision/video processing group. After Yahoo closed the labs, for several months I managed about 12 NLP and recommender systems researchers in an engineering group that supported Yahoo's news products. My plan was to wait for Yahoo to be sold and then go on the academic job market, but I was recruited to Bloomberg, and my husband liked the idea of not moving.

For the past two years, I have been in a product manager role at Bloomberg in the CTO data science group. My primary job is to work with Bloomberg engineering to build core NLP functionality

What is the next big challenge for NLP?

We are in a heady time for AI, with records being broken left and right. Yet most NLP that is actually used by people amounts to "perception" (speech recognition) or light "NLU" (machine translation). And the most commonly used NLP techniques in industry are still simple ngram counting and maybe some named entity recognition. We are only starting to address the hard problems of machine reading, real human-computer interaction, and information fusion. Tackling these will foster true collaboration between those who work on NLP, representation and reasoning. One of the reasons it's exciting for me to be at Bloomberg right now is that in the finance industry (where almost every language artifact can be grounded to an event or price) we are uniquely positioned to successfully work on some of these unsolved AI problems.

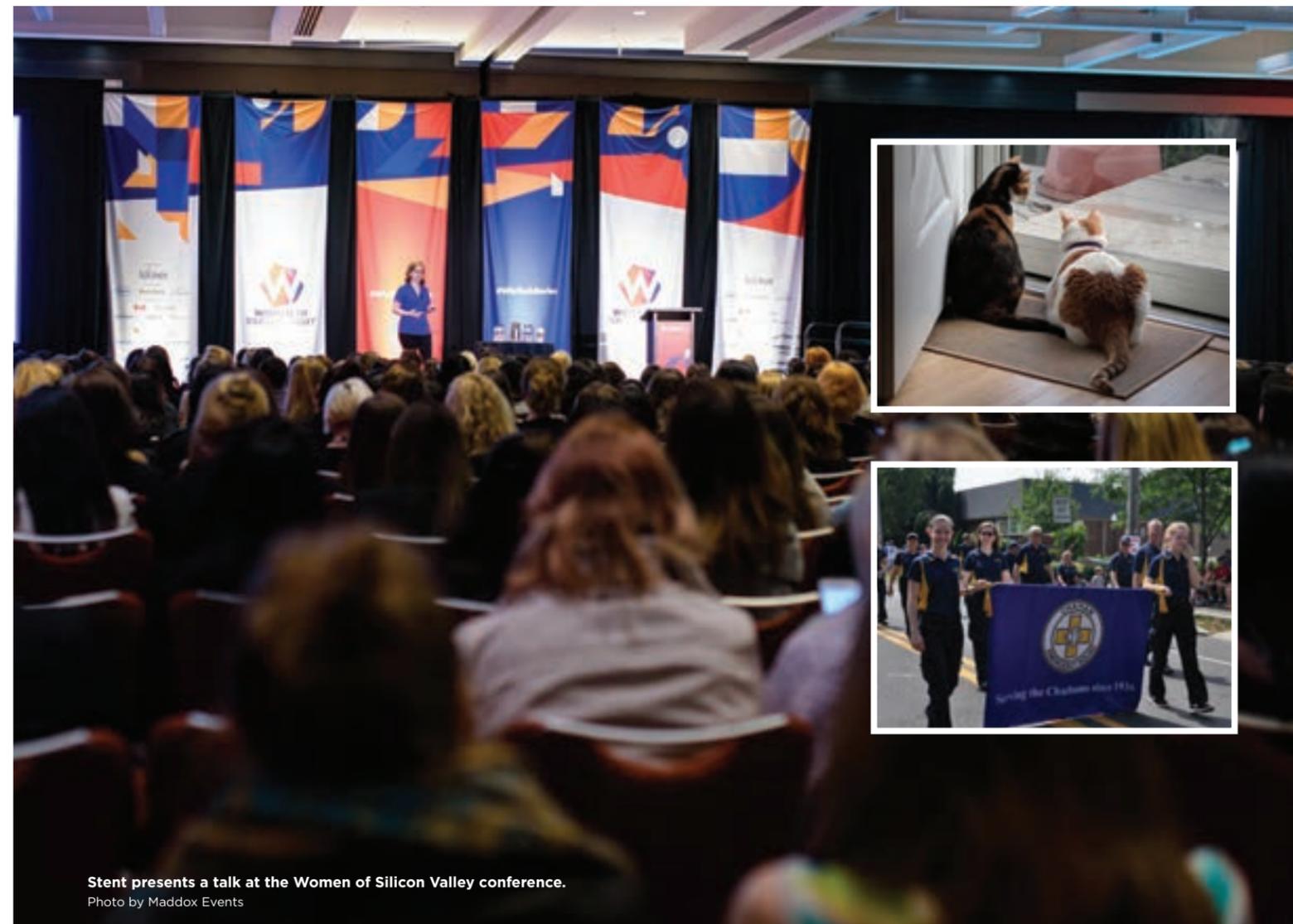
What inspired you to work on "Humor in Collective Discourse: Unsupervised Funniness Detection in the New Yorker Cartoon Caption Contest?"

Dragomir Radev was a sabbatical visitor in my group at Yahoo Labs. He had previously worked with Bob Mankoff, then long-time cartoon editor at the *New Yorker*. Mr. Mankoff gave a very

memorable talk at Yahoo Labs, and the *New Yorker* gave us some data and a challenge: to identify automatic ways to prune the list of submissions to the caption contest to help the individual tasked with selecting the finalists. It was a side project but not unrelated to important problems at Yahoo (such as identifying which comments on a story are worthy of highlighting).

Why does diversity matter in CS?

Computer science is currently one of the biggest drivers of societal change. When only part of society is contributing, then the societal change is lopsided and warped. We have all seen examples of this. We also know that diverse teams are more creative and productive than teams composed of members from a single demographic. So, as a computer scientist who cares about the long-term health of our field, I must care about diversity. For me, this means that part of my service to the research community is outreach. Currently, I am on the board of CRA-W (Sandhya Dwarkadas is also on the board), where I have just switched from coediting the newsletter to working on the DREU program. I also volunteer as a program evaluator for ABET. (Continued on page 26)



Stent presents a talk at the Women of Silicon Valley conference.

Photo by Maddox Events

Diving into Life



Kristaps Dzonsons graduated from the University of Rochester in 2004 with degrees in computer science and English. In the years since, he has started two companies and done research in distributed applications, high-speed operating environments, and mathematical and computational game theory at institutions in Latvia and Sweden. He is active in the open-source community, developing BSD tools, giving talks at conferences, and gaining an online following. He has spent the years since graduation in about half a dozen countries, and he actively speaks English, French, Latvian, ASL, and basic Thai. Dzonsons currently lives on the island of Malta but spends time in Thailand, enjoying free diving and scuba. After running his own consulting business for several years, he's about to begin working with a start-up.

While you were still completing your undergraduate degree, you and fellow CSC alumnus MengZhu Wang '03 had a business already in the works. I remember a discussion about an attic full of servers in your off-campus house to handle the workload. What happened to that?

Our company, Gradient, did what most companies do—failed. I still think the idea was a novel one: a self-organizing distribution network for security events on large, volatile networks. We still have a patent on it and haven't given up on other applications of the idea, should the time present itself. But in Gradient's day, just following the dot-com bust, the upstate New York market for high-tech firms was limited. If you're a student with an idea, just do it. Pull together a team of the brightest. It's an incredibly worthwhile investment of time no matter the sleepless nights.

Tell us about the tools you have created for BSD. Which tool that you have developed for BSD is the most widely used? Why do you think it has become so popular?

Curiously, my most widely used piece of open source software is mandoc, a formatter for manpages replacing the traditional groff, apropos, man, etc. I suppose its popularity is license (BSD vs. GPL), language (C vs C++), and speed. I stepped down as the maintainer several years ago, however. All in, I actively maintain about a dozen software utilities and libraries, the most popular being kcgi, a library for CGI and FastCGI; and acme-client, a client for ACME certificate servers. I exclusively write for UNIX systems, mainly OpenBSD, and mostly in C.

Most of my open source software is available from GitHub. I think it's worth imploring computer science students to participate in the open source community. Not only is it beneficial in terms of knowledge, but it's also about being part of a community. I've met a lot of incredibly talented and interesting folks at conferences and hackathons, not even to mention casual interactions on mailing lists and IRC. Collaborating with OpenBSD folks in particular has given me a significant incentive to write clean, well-documented systems. I always assume what I'm writing is going to be looked at by somebody smarter than me, and somebody who's just had a bad day as they sit to read my code.

After you worked for a while, you went back to school to complete a PhD in theoretical computer science at KTH Royal Institute of Technology in Sweden. Where did that lead you?

I did about three years of my PhD—I started in 2008, if I recall correctly. I'd been working on my PhD when I took a leave of absence to work as a researcher for Professor Jorgen Weibull at the Stockholm School of Economics. After realizing how much I enjoyed applying systems, versus studying them, I switched to full-time research work as my own company. I think I knew the moment I started working with Professor Weibull that I'd had enough with theory—the work was so much fun and so rewarding! I think this period stretched my knowledge to the utmost, as Professor Weibull's work involved tremendous simulations and systems related to game theory and mathematical biology. There wasn't a single day that went by without needing to learn something about linear algebra, compiler optimization, or floating-point rounding. This research was the beginning of k-Consulting, my business.

I found my clients (or they found me) through word of mouth. It's not enough to write good code or good documentation. You need to be able to network, and I'm still learning to do that. Sadly, k-Consulting is currently being shut down, as I've since changed work to a company that's still in formation.



What impact has your Rochester education had on your success? What are the classes you took while at UR that have been most useful and why?

A tremendous impact, for sure! The CS and math education at UR laid the foundation for everything I later went on to learn, research, and apply—from algorithms to operating systems to abstract algebra. I've tried to follow this with an "especially," but can't do so. To name one example, I don't work directly with AI, but knowing the foundations has helped me in writing maximization functions for "lumpy" topologies.

I credit Professor Michael Scott and Professor Sandhya Dwarkadas for having the most influence on me and my work. For the former, in having a thorough understanding of operating systems, compilers, and languages. For the latter, distributed and parallel systems. Both for demanding concise, clear documentation and implementations. I use the foundations from those classes on a daily basis.

I also strongly suggest the algorithms courses—every algorithm you learn, no matter how obtuse sounding, will come up again. Yes, even AVL trees. There's a lot of focus these days on new artificial intelligence and statistics. But when it comes to day-to-day work, I've found myself constantly revisiting the classics. This is doubly necessary if you find yourself working in applied mathematics or numerical analysis.

You double majored in English/poetry along with computer science at Rochester. How have you incorporated your love of literature and poetry into your busy life?

If I'd need to pick a major I enjoyed most, I'd probably tend toward English. You asked which CS courses I felt were instrumental, but

if I think of the tools I need in other walks of life, being able to write a decent email can be far more beneficial than a good A* implementation. And, as it follows in nonprofessional matters, having something interesting to say about Edward Albee will generally resonate more than the newest Intel mishap.

Many of our recent graduates dream of working remotely while traveling the world. What advice would you give them? Are there places in the world that are more conducive to having a wanderlust tech career?

My advice is first to get an accountant and a lawyer who can handle the interaction between localities, in particular for those with US citizenship. You do *not* want to overstay your entry permits, especially if you find reasons (romantic or professional) to stay longer where you are.

I'd also advise them to prepare for compromise and slow growth. Not being in constant touch with your employer (or contractors) makes it hard to integrate—which, for a time, may be what you want but also makes you easy to dispose. In time, being able to move around needs to balance against having the money to move around and having a path to move forward.

Working as a freelancer is brutally difficult but is also incredibly rewarding in being self-reliant and knowing all stages of how income gets from your client's pocket to your tabletop. And as mentioned elsewhere, open source will serve you very well in having a well-stocked toolbox! On the flip side, working as a freelancer is also important in discovering and celebrating what nonfreelancers have but don't necessarily appreciate: stability and reasonable income. Life conditions can change!

(Continued on page 26)

UR WIC SPURS TALK ON CAMPUS ABOUT SUPPORTING WOMEN IN CS

The Women in Computer Science (WiC) group has had a very successful and productive year. We are proud to have graduated nearly 34 percent female for the second year in a row, and we have been able to form subcommittees to better support the organization. With a strong executive board to guide the group, the committees of Public Relations, Diversity, Outreach, and Events each played their part to increase WiC's visibility on campus.

The Public Relations Committee is responsible for designing and distributing materials to publicize events and strategic goals. Whether it's flyers posted all over campus, social media posts announcing upcoming activities, or keeping the website current and dynamic, this group of women is raising awareness of WiC in a variety of ways. Learning new skills and promotional methods along the way, these students are building the community of women as well as their résumés.

The Diversity Committee's mission is to improve representation of women and minorities in computer science at Rochester. To that end, this spring's #SupportWomenInCS initiative engaged many students across campus in an important dialogue. To get the

student body involved, Sofia Carrillo, a member of the Diversity Committee, took her camera and whiteboard all across campus and photographed anyone interested in participating. Each person crafted their own comment to show their support of women in computer science, and the result was an outpouring of many great pictures and sentiments. Committee member Maisha Idris '19 noted, "What was nice about #SupportWomenInCS was the diversity in the number and type of students who participated. A lot of male CS and non-CS majors took their photos because they wanted to show support for women in CS at UR." This effort keeps the dialogue about inclusion at the forefront of the computer science department and campus community. Next year, the Diversity Committee hopes to finalize their video project, which includes interviews with faculty, students, and alumni. When completed, the video will be used during orientation and as a recruiting tool.

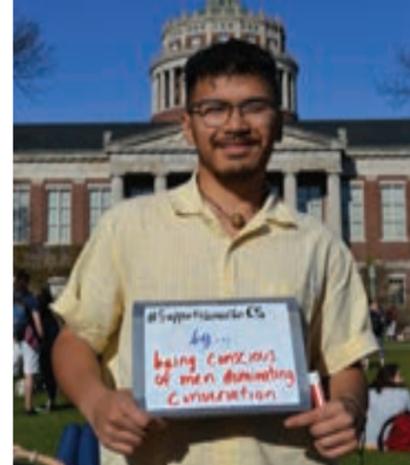
The Events Committee planned functions throughout the year that were both social and academic, including bimonthly coding parties, an internship and job search workshop, a big-little reveal party, Grace Hopper Prep and debriefing/swag swap, STEM Superstars event for Girl Scouts, CS Research Opportunities Panel, and WiC Hackathon with RIT. There is a core group who attend most of these events, but certain meetings had a wider appeal. The CS Research Opportunities Panel was the most well supported this year, indicating a strong research interest among our students.

This year there will be 40 women attending the Grace Hopper Conference for Women in Technology in Houston. About half of these women will be supported by the BRAID initiative that our department receives. Other attendees have received corporate or conference scholarships, are using research innovation grants, or are funding the trip privately. Faculty and staff from computer science, data science, and the Gwen M. Greene Center for Career Education and Connections will also attend. Past attendees have benefited not only from the job fair and varied talks there but also from the opportunities to develop new networking channels with our alumnae. The enthusiasm from the conference spreads to all WiC with the annual swag swap and debriefing when they return.

The executive board would like to thank the computer science department for the support they have received both financially and organizationally throughout the year. Along with all the planning for attending the Grace Hopper Conference, this year members of UR WiC received sweatshirts at no cost to them. Maisha Idrisi commented, "Personally, my favorite reactions were when . . . WiC members stopped to chat about their experiences at UR taking CS classes and how meaningful it was to them to have a group like WiC on campus."

Everyone in WiC is excited to welcome another female faculty member, Zhen Bai, to our computer science family this year. Creating a welcoming and diverse community is a continued goal, and, little by little, with all hands working together, we are making it happen at Rochester.

If you are interested in getting involved in WiC, either as a current student or an alumna, please email Brynn Wilkins at bwilkins@cs.rochester.edu.



Everyone in WiC is excited to welcome another female faculty member to our computer science family this year. Creating a welcoming and diverse community is a continued goal, and, little by little, with all hands working together, we are making it happen at Rochester.



Graduate Alumni Notes

(Now organized by class year!)



Uri Shani and Dana Ballard

Uri Shani (PhD '81)

Last year my PhD advisor, Dana Ballard, visited me in Israel. We had a good time reminiscing on our common history and the department. Was great fun.



Gary Cottrell (PhD '85)

I was elected a fellow of the Cognitive Science Society last year (2017). I was going to retire and stopped taking PhD students, but I

didn't realize how depressing that would be. My wife said I would be miserable if I retired, so now I'm not, and I'm depressed about that! But I took a new PhD student and I have an NIH grant with a colleague at Scripps Institution of Oceanography

to work on using Deep Siamese Neural Networks for Natural Products research. We map from the NMR spectra of small compounds into a cluster space where the clustering is based on the compound family. Now we can map new compounds into the space to see what they are similar to in structure, speeding the structure discovery process. I'm also working on a more realistic model of the visual system, improving on my old model, which I call The Model, since Tommi Poggio already claimed The Standard Model. This one will be deep, so it is The Model 2.0. Still enjoying sunny SoCal. Every summer I go backpacking with friends. Last year was relatively more exciting, as one of our party had to be helicoptered out due to heat stroke. My current dog is Wally, and he's in the Jellybean mold and knows how to jump up on the handicap button to get in and out of the CSE building.

Ronald Loui (PhD '88)

Ronald Loui has left academia again and cofounded LA-based CivicFeed with his nephew Nick. It's a showcase of AI and UX applied to legislative data. It's based on legal informatics tools used to win a recent IEEE data analytics competition (the lead: "old man with awk beats teams of Peking U PhD students at e-discovery on medical patent data"). One main technology is a stream-capable technical term extractor based on a comment once made by an NSA coauthor about English morphology and frequencies. Come visit and have a look. Ron also gave IEEE conference papers recently on ontologies for drones, copilot voice-AI for voice-UI, medical records and errors, ransomware targeting hospitals, ISP log obfuscation, server defense with dynamic port assignment, auralization of server state for monitoring mischief, information warfare piggybacking on cyberwar, and personalities that might not like object-oriented programming.

Also non-IEEE work with a Euro coauthor on online dispute resolution based on milestone dialectics, an approach to decision and risk based on path arguments (see also George Ferguson's dissertation). And a celebration of a *Harvard Law Review* article citing our work in AI and Law, a cleaner comparison of Kyburg's theory-formation in science and our theory-formation in law, and a response to a Harvard School of Government director on the necessity of defeasibility in law. Oh, and something about Snowden, privacy, and multistage algorithmic analytics. When this comes out, so will my essay for my first doctoral student's Festschrift. Yeah, the cart ahead of the horse. Right now, while his cofounders are in NYC making friends, here in Cleveland repainting the old house so it can be put up for rent. Basically all the charm of Rochester, N.Y., except that the RNC held its convention here, and Ivanka stayed in the house across the street, on the cliff above the lake.

Susan (Hollbach) Weber (PhD '89) and Jay Weber (PhD '89)

Our big news is that our eldest daughter Monica was married the weekend of June 9. Our younger daughter Audrey is making a career for herself in Europe as a language interpreter. Jay and Paul Cooper are collaborating on a new medical device startup, and Susan just celebrated 17 years at Stanford Medicine.

Peter Dibble (PhD '90)

I adopted a granddaughter a couple of years ago, bringing us to 12 adopted children and three stepchildren. We definitely don't suffer from any kind of "empty nest." I spent six months working with Google's SREs (<https://landing.google.com/sre/>) and am now working on Custom Search (<https://cse.google.com/cse/>). Working at Google continues to be exciting.

Brian Yamauchi (MS '90)

Brian Yamauchi is now a technical director at Anki in San Francisco. Anki builds robots with personality. Brian is leading the development of navigation systems for new robots that will expand the company's reach from the entertainment market into the broader home robotics space.

David Coombs (PhD '92)

Raytheon has many open positions at locations across the country, including summer internships and a Leadership Development Program for hires with advanced degrees. jobs.raytheon.com

Jozef Vyskoc (MS '92)

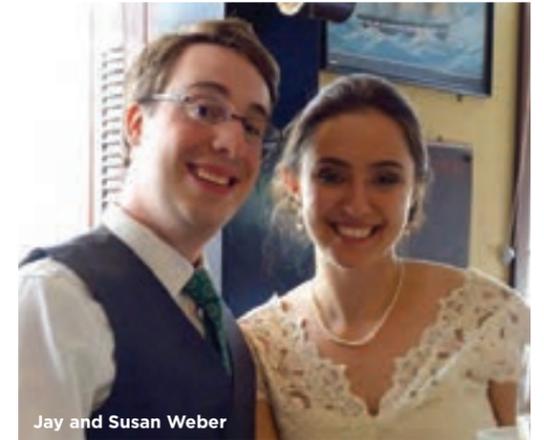
I formally entered retirement age in January but still keep working in security and privacy protection through my company, thus my life did not change too much.

Mark Crovella (PhD '94)

In summer 2018, I finished my five-year term as Chair of Computer Science, during which time the department's undergraduate population grew by more than 200 percent, and its tenure track faculty grew by more than 50 percent. Our family is looking forward to spending 2018-19 as a sabbatical year in Paris.

Massimo Poesio (PhD '94)

Changes in my life: well the main change from last year has been my move to Queen Mary, which, however, hasn't had much of an impact on my personal life or indeed my work life. I still live in Wivenhoe (a lovely village in Essex, very quaint) and still work mostly with my former colleagues from Uni Essex, also because we are still all involved in two big projects—in case you don't know already, one is my ERC Advanced Grant, DALI, on Disagreements in Language Interpretation (<http://dali.eecs.qmul.ac.uk/>); the other is the HRBDT centre for Human Rights in the Era of Big Data and Technology (www.hrbd.ac.uk/). In DALI, we use Games-With-A-Purpose to collect very large number of judgments about anaphoric interpretation (more than 5 million judgments so far), and we use the data to improve our understanding of the extent to which people agree with each other on the meaning of language expressions and to train advanced interpretation models taking these disagreements into account. In HRBDT, we use NLP technology to support NGOs (e.g., to find potential cases of human rights abuse), and we also examine how NLP technology can be used ethically. Hope to come back to Rochester sometime soon and look at the new Wegmans Hall; it has been awhile!



Jay and Susan Weber

Lambert Wixson (PhD '94)

I recently took a new position leading the Applied Machine Learning team at Clarifai in NYC. Clarifai is one of the pioneers in applying deep learning to computer vision tasks and exposing web APIs for doing so. We are hiring computer vision/machine learning people at all levels.

Andrea Salgian (PhD '01)

I am still at The College of New Jersey, and I have been promoted to full professor starting this fall.

Robert Swier (Undergrad '01, MS '02)

After moving to Japan about 10 years ago without fully knowing what I wanted to do here, I am delighted to say that I recently became a full-time permanent faculty member in the Faculty of Literature, Arts, and Cultural Studies at Kindai University in Osaka, Japan. Academic ranks are a little different in Japan compared to the US, but my position could be described as an associate professorship that is already tenured. I coordinate a program in communicative second language acquisition for about 2,000 students. Getting Japanese university students to speak English is in many ways less challenging than getting computers to do it, but in some ways, it is more challenging! In any case, I could not be happier with life at the moment. My wife and I recently bought and remodeled a beautiful older home in the Nara countryside, where we now live with a collection of rescued animals that currently includes eight dogs, three cats, and two chickens. We've also kept a few goats and rabbits in the past.

Matt Boutell (PhD '05)

Matt Boutell was recently promoted to professor of Computer Science and Software Engineering at Rose-Hulman Institute of Technology. He is taking a mini-leave for several months to do deep learning research for a small company in Indianapolis. It's not computer vision but is still a good way to keep growing the machine learning skills he learned while working with Jiebo and Chris!

Paul Ardis (PhD '09)

Not a lot to share this time, but: we did have a baby girl! Mae Carmen Ardis was born on 5/16/18 at 8:17PM, 20.8in, 7lbs 3.3oz.

Tagyoung Chung (PhD '13)

I got married to Youkyoung last September in Seoul. We went to the same university for undergrad. I still work for Amazon Alexa in Sunnyvale, California. I am now a senior applied scientist.

Jonathan Gordon (PhD '14)

I'm finishing my postdoc at USC and will be a visiting professor at Vassar College starting in the fall.

Hao Xu (MS '15)

This is a photo of my daughter and me celebrating my 27th birthday with a homemade cake by my wife. I'm missing my friends and everyone in URCS. It has been a great journey these three years after I graduated. Please drop by if anyone comes to the greater Seattle area.



Tagyoung Chung and Youkyoung



Paul Ardis's daughter, Mae



Hao Xu and daughter

We want to hear from you!

With staff turnover, we've lost contact information for many graduate alumni.

Please help us update our records by emailing Michelle Kiso (mkiso@cs.rochester.edu) with your current email, job, and mailing addresses so that we may stay in touch.

Undergraduate Alumni Notes

(Now organized by class year!)



Cristina Luis and son Lukas orienteering in the Santa Rita Foothills near Tucson, Arizona

Derek Denny-Brown '96

I am now the director of Virtual Networking, Oracle Cloud Infrastructure.

Cristina Luis '01

This summer we're moving back to the US, where I will start work as the executive director of Navigation Games, a Cambridge, Massachusetts-based not-for-profit that aims to bring navigational games and outdoor experiences to children in the Cambridge area.

Jennifer Rogers-Green '02

My current employer is GoTriangle in Research Triangle Park, North Carolina. My husband and I welcomed our second child, Alexander Rogers Green, into the world on April 30, 2018. His big brother, Calvin, is very proud.

Eric McCarthy '03

I'm still working for DesertNet in Tucson, Arizona—now going on 15 years! These days I am doing more and more front-end and back-end JavaScript development. More importantly though, Rebecca Reyes and I got married in March! Fellow URCS alumnus Nikita Imennov '04 was in attendance.

Jonathan Schmid '03

I've been working on the Joint Polar Satellite System (weather/climate satellites in polar orbit for Nasa / NOAA).

Lauren Wood '03

I left IBM and have been at Red Hat now for just over a year!

Jonathan Norwood '04

Things are great at work at Amazon. I get to manage the whole supply chain for AWS, from buying land and power contracts to demand planning for capacitors and hard drives we need. Tons of fun with infinite complexity :-). In this last move I was able to drag a dream team of engineers I'd worked with in various aspects over the past decade with me, and it's really just a ton of fun. Outside of work, things are going well, too. We just moved for the third time in Seattle and finally have a view! I've got a 4-year-old little girl (Locksley) who has completely captured my heart. Three German Shepherds and a partridge in a pear tree. I drive a fun Tesla right now, but I'm strongly considering a full-on midlife crisis car.

Karim Oussayef '04

I am still at Desmarais LLP. In a bit of good news, I was promoted to partner last year. We also bought a place in Harlem.



Eric McCarthy and Rebecca Reyes



Daniel Horowitz and family

Daniel Horowitz '05

We are doing great. Still at the same place in Brooklyn with our two boys Oskar (2) and Leo (4). I was recently promoted to CTO at 1010data (www.1010data.com/company/leadership/), and Lilya is starting a dental practice in Williamsburg.

Preethum Prithviraj '05

My son is a bouncing almost 5-year-old starting kindergarten in August, and we've now got a 1-year-old in the house, too! I do still have my business, though it's a one-man operation, that I try to keep up with on the side of being a stay-at-home dad until the kids get fully into school. I do still have my paramedic credentials, but I mainly do volunteering these days (race standbys, disaster drills, etc.).

Marshall Crumiller '06

I'm currently working as a contractor for Princeton Information at Genworth, building actuarial models. In other news, I recently got engaged to Autumn Lanoye, who was class of '09 at U of R!

Ryan Korsak '07

I am still at InfernoRed Technologies. My wife and I have a daughter (18 months old now) who is the center of our world.

David Lu '07

I had an eventful 2017. I started work at Locus Robotics as a senior roboticist, gave a talk at ROSCon 2017, and welcomed my first child, Elizabeth Ada Lu, to the world.

Michael Silverman '08

Things are well with me. I'm still working on my company, Silverware Games, Inc., which has grown to include a new full-time multitalented business consultant/producer and some new freelancers and collaborators. We already launched one game this year, MatchyGotchy (on Steam). We are hoping to launch a few more games in the "Matchyverse" later this year. Our hope is to be on track to grow the company, and hopefully we'll be able to bring on a sharp CS whizz at some point so I can move on to more artsy fartsy stuff and operations. It's been a long road trying to build Silverware Games, but we continue to make progress . . . better and better!

Chris Tice '08

Our daughter, Eva Cecilia Chao Tice, was born last September. I've been at Periscope Data for a little over a year now, working with other fellow Rochester alums, and it's going great. I'm currently on a three-month deployment in support of Operation Inherent Resolve.



John Pershing and wife, Kate Pershing

John Pershing '10

In the last year I've been promoted to VP of Software Engineering at 1010data; my department is responsible for developing data orchestration technologies as well as the self-service counterpart to 1010data's enterprise product. My wife, Kate, and I welcomed our first child this summer, the newest member of the class of 2040!

Emily Vukman '10

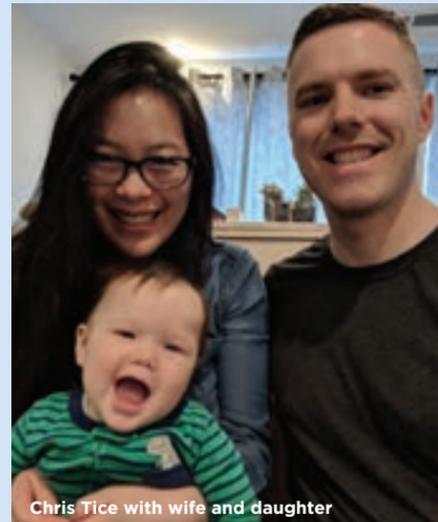
I'm still at MediSked and was promoted to "Lead Software Development Engineer" for the team I work on.

Preet Singh '12

I've been working at a start-up named CarLabs. They're based in LA and specialize in chatbots for the car industry. Kian, the Kia chatbot on their website and on their Facebook page, is from CarLabs. They're super early (haven't even done their series A); I've joined as their AI/Data Science go-to person. They're super cool so far, and I'm cautiously optimistic. They're really enthusiastic about AI research, and everyone is a car nut.

Matt DeMartino '14

I'm working at Corning, Inc. now in the Scientific Computing group. It's very interesting work. I get to work in the intersection of software development, machine learning, high-performance computing, computer modeling, and scientific research. I get to travel pretty



Chris Tice with wife and daughter

frequently now, too, as I'm on a project that has me visiting Blacksburg, Virginia, on a monthly basis.

Emily Eisenberg '14

I currently lead a team of ~8 engineers at Khan Academy. We build the tools that content creators use to create and manage the content, as well as the tools that our international partners use to translate and curate our content into other languages and curricula. It's a lot of fun, working closely with the content creators to help build world-class content, and we have many interesting technical challenges to grapple with (like handling many users modifying content at once, versioning content, and, as always, performance). Other than that, I've been



Ted Teumer and Callea Teumer

doing a bunch of baking in my free time! I recently started baking croissants and sourdough, which has been very rewarding (and tasty).

Ryan Swanson '14

I'm now a technical lead at Vanguard working in their security group, and it's definitely challenging work.

Ted Teumer '14

My wife, Callea, and I were married September 23, 2017, by Fr. Brian Cool at the Interfaith Chapel. At the beginning of October, we returned to Charlotte to close on our house in Clover, South Carolina. I was actually recruited to my new company, LiftOne, to continue working in Business Intelligence. LiftOne is the materials-handling division of Carolina Tractor & Equipment, which is also a Caterpillar dealer. This past March, Callea and I took a trip to Thailand for two weeks. Following our return, I was invited for a formal interview and was accepted into the Wake Forest University part-time MBA program, where I plan to begin my studies this upcoming fall.

Michaela Kerem '15

I just graduated from the Johns Hopkins University Whiting School of Engineering with a master of science in systems engineering (in May 2018). I completed the degree as a part-time student while working full time at Johns Hopkins APL.

Jennifer Uvina '15

I'm doing very well out in the Bay :) I just accepted a position at Pinterest.

Xing Yan '15

I worked for Microsoft for about a year, and in 2016 I joined Google.

Edward Barthelemy '16

I'm working in Hong Kong for Societe Generale.

Sarah Harari '16

I am still at Vistaprint. I've been promoted to senior software engineer and am enjoying growing within the company.

Geyang Yu '16

After graduating from UR, I had a full-time job in a small company for about eight months. Then I went to Columbia

University for my master's degree in statistics. However, I found myself still interested in software development. So after that, I went to Amazon as an SDE. I love my job now, and I don't think I could have made it without my experience at UR. So, thank you so much!

David Fink '17

I'm still working at MathWorks. I'm enjoying it a lot and think it's a good job out of college.

Connor Hunt '17

I'll be working at Libremax Capital as a quant developer.

Som Liengtiraphan '17

I still work at 1010data, and the UR community here is still growing! We have a couple of U of R interns this summer, and we are planning to keep going back to the career fair and possibly Grace Hopper. Since graduation, I have continued my illustration business and ballet. I have even done a few shows and sold a few pieces! Presently, I live with my roommate and a fully clawed, but adorable, attention-seeking cat named Coco.

Spotlight on Alumni Start-Ups

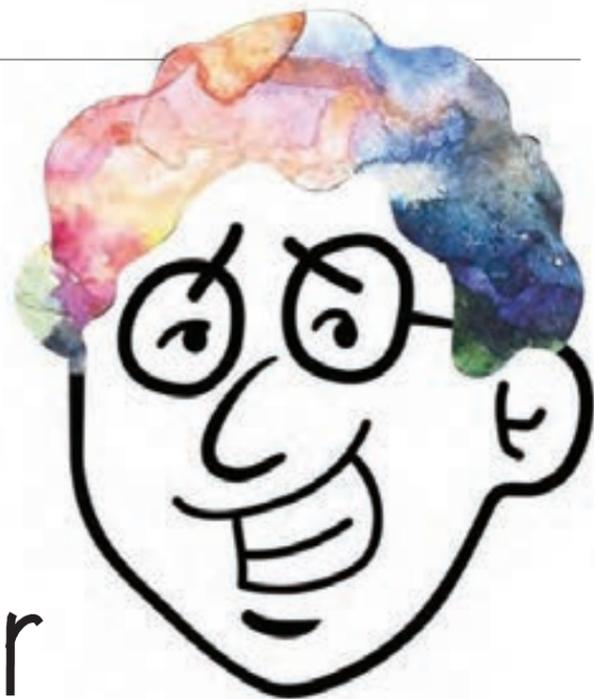
Qventus

Menlo Security, Inc.

Crazy Aaron's Thinking Putty

ArdentBlue Technologies

Life as an Entrepreneur



Many computer science students dream of the day that they can develop an idea for a start-up—perhaps becoming the next Bill Gates or Steve Jobs—and being able to call themselves “the Boss.” Some of our alumni have been working hard to make that dream come true. Though their businesses are not all tech start-ups, many use the tools they learned in CS for problem solving, business analysis, and marketing. The road for these alumni has come with a roller coaster of peaks and valleys, on-the-job training, financial responsibilities, and management life lessons.

Developing the business concept, determining the market niche, and building the business model from the ground up is one of the challenges nearly every new company must face. Often, the synergy and ideas come from friends or colleagues who decide to pool their skills. The company **Qventus** began as a collaboration among Ian Christopher '10, a fellow graduate student from Stanford, and a friend of his friend. Gautam Altekar '04 said his five cofounders of **Menlo Security Inc.**, came together via an introduction from his Berkeley professor. “We were all interested in innovating in the computer security space and wanted to combine our skill

sets (tech and business) to disrupt the space.” Aaron Muderick '98 kept it simple with “**Crazy Aaron's Thinking Putty**”; his only cofounder is his wife. Whether the partnerships develop from former jobs, academic environments, or networking, each company needs a balance of skills to fill the gaps in corporate functions.

Convincing new talent to join your company is a struggle for nearly everyone. “Many talented young people want to work for a ‘big name,’” says Muderick. “I think there is a misperception that great ideas come from big companies. They don't. They almost always come from little companies who are acquired by the big names once it is a sure thing.” Edward Liveikis '01, who started the software consulting business **ArdentBlue Technologies**, uses

personal references and word of mouth to find people who will fit well with their team dynamics because it's such an important part of productivity. Wherever the new hires come from, they need to believe in the product and the goals of the company for a good fit. Michael Seid '10 of Naytev cautions employers to “hire carefully and fire fast.” Incompatible employees can be disastrous to a small company.

Financing is a challenge for every business. Though many have used venture capitalists (seed, series A and series C), some of these organizations have chosen to bootstrap or grow slowly enough to self-capitalize. After



Gautam Altekar '04 is the cofounder and chief architect of Menlo Security, Inc.



Ian Christopher '10 discusses start-up strategies with undergraduate University students on the annual Silicon Valley Trek.



Aaron Muderick '98 built his business, Crazy Aaron's Thinking Putty, from the ground up.



20 years in business, Muderick says, “Capital comes with strings, and they are not always in your long-term best interests.” He and his wife have been able to grow their company step by step over time without requiring any large capital infusion. Successful capitalization is one of the biggest reasons for business successes and failures.

As far as marketing their products, many of the alumni state that word of mouth from satisfied customers is the most effective advertising. Altekar from Menlo Securities says “There's nothing more effective than word-of-mouth recommendations from existing customers. For example, CISOs in the financial industry all talk to one another about what products they like and don't. If you can do a great job with just one, that CISO will talk to other CISOs about your project. That will lead to further opportunities.” Menlo Securities has also used industry events, hosted dinners for key decision makers, placed informative

articles in top media venues frequented by key decision makers, and used blogging.

There will always be challenges which become learning opportunities. Some of these include getting enough capital to get through the early times; getting clients to take the business seriously; leaving the security of a cushy job for the unknown; failing to get agreements in writing; having little experience running a business that includes hiring/firing, payroll, and taxes; taking on projects beyond the scope of the business; knowing when to say “NO”; not having clearly defined goals; putting too little emphasis on business development while developing the product; not focusing enough on user experience; not realizing that products won't be perfect on the first attempt; and growing too quickly to scale infrastructure to match the demand. *(Continued on page 26)*

“Growth is a blessing and a curse. There were times that too much growth was going to break this business and break me personally. We moved and expanded constantly. I moved from my parents' basement to my apartment to the basement of my first home to a small office, a bigger office, a factory, a bigger factory, and now to our forever home at a new facility in Norristown, Pennsylvania. The million little details of operating a physical plant on top of managing a business can be overwhelming.”

—Aaron Muderick '98

“After having built many such platforms at Yahoo, I thought this would be a piece of cake. I soon realized that technology is the easy part. It's the business that's hard. How do you figure out the exact pain point, the exact product or service, the perfect pricing, the first sale and then scale? With the extremely high failure rate of start-ups, is it possible to have a framework for success? It's been a long learning curve for me but an extremely exciting journey while I learn more about myself and the need for constant innovation in a super-fast-changing world and find answers to these questions.”

—Sapna Chandiramani '98



KAUTZ TO LEAD Information and Intelligent Systems Division at NSF



Henry Kautz recently accepted a three-year appointment as division director for Information and Intelligent Systems (IIS) at the National Science Foundation (NSF). He recently completed his first month at NSF and loved it! He has been involved in helping launch several new programs for funding research in artificial intelligence (AI) and related areas and is cochairing an interagency working group on AI. One of the most enjoyable parts of his job is

that he can decide to fund some proposals out of a special budget that he controls. Although every proposal must be peer reviewed, Kautz can exercise judgement in supporting proposals that may have some flaws but also great potential.

The biggest challenge is that the interdisciplinary nature of much of the work IIS supports, together with the great interest in AI and big data across other NSF directorates and other federal agencies, means that he has a lot to learn, a lot of people to meet, a lot of committees to serve on, and, in general, a lot to do! Before arriving at NSF, Henry only knew a few of the people he would be working with. He has been very impressed by everyone's professionalism and goodwill. Henry also really likes the way that staff at all levels are treated with great respect.

Now that he and his wife, Christine, are settling into the DC area, they have found new places to explore there. They like the Washington area because it is really exciting and cosmopolitan. There are incredible museums and historical sites, of course, but everywhere one goes there are new buildings, stores, and restaurants under construction and crowds of people from all over the world. Henry says that the NSF is in a brand-new building in Alexandria, Virginia, in an area that has been completely redeveloped in the past two years.

After many years living in a historic home in Brighton, where he and his wife hosted many department Christmas parties, they realized they seem to have a thing for old houses! Henry notes, "Our Rochester home was built in 1829. We just rented a house in Alexandria that was built in 1809!"

Henry will be retaining his faculty appointment and maintaining his University connections by coming back to Rochester once a month to meet with his PhD students. He states, "So far, they are all doing brilliantly in my absence! In addition, I will be coming to Rochester to visit my son Alex, a student at UR, and my mother, who lives near Buffalo."

We all wish Henry Kautz well in this new adventure and look forward to his monthly visits.

New NSF headquarters in Alexandria, Virginia

Computer Science Community Mourns the Loss of

TAO LI (PHD '04)



"[Dr. Li] was one of the most prolific collaborators I have had the privilege to work with," says Dr. Mitsunori Ogihara, Li's thesis advisor and former professor and chair at the University of Rochester. "With his unwavering devotion to research and his unmatched brilliance, he affected every collaborator."

It is with great sadness that the computer science department shares news of the death of Tao Li '04, a graduate of the University of Rochester's computer science PhD program. Li is remembered as a truly brilliant computer science researcher, extraordinary teacher, vibrant mentor, caring colleague, and beloved friend.

Li was serving as an associate professor and graduate program director in the School of Computing and Information Sciences at Florida International University. In addition to his dedication to FIU, Li was also the head of the Computer School at Nanjing University of Posts and Telecommunications. Li's research interests included data mining, machine learning, information retrieval, and bioinformatics.

Among his many honors, Li was the recipient of the NSF CAREER Award, multiple IBM Faculty Research Awards, FIU's Excellence in Research and Creativity Award, and a Xerox Research Award.

Joel Seiferas, associate professor emeritus of computer science at the University of Rochester, reflects that "[Dr. Li] was determined in a very collegial way to learn, to be reliable, and to excel. All who knew him will miss his friendship and collaboration."

Recent PhD Graduates

Jacob Brock
Pareto Optimization for Cache and Memory Management
Hewlett Packard Enterprise
Faculty Advisor: Chen Ding

Joseph H. Izraelevitz
Concurrency Implications of Nonvolatile Byte-Addressable Memory Commendation in the 2018 Outstanding Dissertation Award competition for Engineering
Institute IMDEA - Software
Faculty Advisor: Michael L. Scott

Rahman Lavaee Mashhadi
Profile-Guided Memory Layout: Theory and Practice
Google
Faculty Advisor: Chen Ding

Yuncheng Li
Weakly Supervised Learning from Noisy Data: From Practice to Theory
Snap, Inc.
Faculty Advisor: Jiebo Luo

Xiaochang Peng
Mapping Natural Language Sentences to Semantic Graphs
Facebook
Faculty Advisor: Daniel Gildea

Quanzeng You
Sentiment and Emotion Analysis for Visual and Multimedia Content: Methodologies and Applications
Microsoft
Faculty Advisor: Jiebo Luo

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What do you remember fondly about URCS?

The lounge was a great place to eat lunch or take a break, with the inspiration of bottles from previous PhD students on the wall. I also remember the research group I was in with great fondness: George Ferguson, Mary Swift, Donna Byron, Lucian Galescu, Myrosia Dzikovska, etc. We were a large group (especially for such a small department), and I think we could not have made the dialog systems contributions we did if we had been just working independently.

What do you do in your spare time?

My husband and I both work in New York City, but we live in suburban New Jersey with our two cats, Rock and Roll. In my spare time I am a volunteer EMT in my town (it's great!—the opposite of research—you pick a patient up, transport them, and drop them off and then it's completely done! No "future work"!) and a bird watcher.

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Tell us about your very exciting life outside of work. How many languages do you speak?

I more or less actively speak English, French, Latvian, ASL, and basic Thai. And no longer speak a few more. These days I'm trying to improve my Thai (and Maltese), but English is far and away the language I speak most. I have both Latvian and US passports but don't have much of an "originally from," having moved around a lot. If pressed, I just say I'm Latvian, as the lion's share of my life has been in Europe.

When not hacking on open source projects or working (though the two intersect fairly often), I free and scuba dive wherever and whenever I can. I prefer free diving, but I am certified as a technical scuba diver as well. Diving adventures have taken me from fighter plane wrecks at 50 meters to free diving with whales.

I currently live on the island of Malta with my wonderful partner and our dog, though I spend time in Thailand as well. When

Continued from page 23

How the company reacts to each of these challenges will determine its later success.

Skills learned while studying at Rochester have served these alumni well. Ian Christopher says "CS fundamentals are a tool I constantly leverage. More importantly though, I learned how I learn, which is essential given the number and variety of issues that will pop up at a start-up. Be it a new web framework or a new systems paradigm in our infrastructure, I know I can pick it up quickly and largely independently." Steve Gattuso '16 mentions the variety of cluster coursework that complemented his computer science classes as well as the opportunity to study abroad, which taught him how to build a life in a new country. Whether it was a particular course that built a skill set, an emphasis on logical problem solving, or building a network of future partners, the University of Rochester experience has informed their entrepreneurial efforts.

Knowing what you know now, what advice would you give to current CS students at Rochester?

Graduate school can seem all consuming—work is life, life is work. But the life of the mind can be balanced. I encourage you to make a list of what matters to you and then proactively seek opportunities in those areas and say "no" to everything else. I also encourage you to budget and track your time and make sure that the "life" buckets aren't squeezed out by the "research" and "service" buckets.

URCS is a small and collegial program. It's important to build your professional network through internships, conferences, and volunteering, but it's also important to enjoy the community of URCS.

in Malta, I speak mostly English—Maltese is a tricky language, although I love the sound of it. When in Thailand, I try to speak Thai, but that's a work in progress. Thais are incredibly helpful when it comes to learning the language.

One language that's been of tremendous utility to me has been sign language. (When underwater it's integral, though surprisingly it doesn't have a large following in the diving community.) There's a significant deaf community in Rochester—and a very friendly one, too! I highly recommend learning a bit and attending a deaf theater performance.

As always, I recommend spending time in whichever sea is closest to you. Because you don't know what you're missing till you've come up close to a five-meter-wide manta ray or bumped heads with a whale or learned to surf or just spent time in a rowboat with a companion of choice. Lastly, no matter where you are, find somebody to spend the time with you.

Our entrepreneurs advise anyone interested in starting a business to understand the labor of love this takes to survive. Muderick offers the following advice: "If you are the kind of person that likes to be really busy, then this is the job for you. Every day you will work a checklist of must-do tasks. At the end of every day, that list will be longer than it was in the morning. The next day you need to effectively choose which tasks you will complete. In 10 years you might just start to see light at the end of the tunnel. If that sounds like a fun challenge, you are cut out to be an entrepreneur. If all that pressure combined with working nights and weekends sounds like a panic attack, I would suggest against it." Other alumni advise to read up on the topic and benefit from others' mistakes, try an internship at a start-up to see the risk and rewards of a small business, and understand that you'll be getting very little sleep—much like your college years. But if it is your dream, there is no better time to try this than when you are young!

CONGRAULATIONS TO THE CLASS OF 2018!



Alejandro Abreu
Benjamin Ackerman
Kennedy Agusi
Sidhant Ahluwalia
Thomas Anderson
Samantha Bahr
Daniel Barnett
Bradley Beyers
Rohun Bhagat
Jeremiah Bill
Nina Bose
Steven Broida
Juan Pablo Castaño
Moreno
Yukun Chen
Noah Christiano
Joshua Churchin
Stephen Cohen
Nathan Conroy
Colin Corliss
Cesar De Hoyos
Gonzalez

Danielle Delooze
Yufei Du
Kyle Edgette
Yidi Fan
Yiwen Fan
James Fazio
Tyler Fulcher
Shengbo Ge
Ari Geller
Andreas Georgiadis
Noah Gorstein
Ali Hamdani
Alexander Hankin
Kurtis Haut
Annie He
Manan Hora
Ravi Jain
Thomas Jeffries
Zhengliang Jiang
Hunter Johnston
Adam Kravitz
Raina Langevin

Xuan Thuong Le
Evan Lea
Gayeon Lee
Yeonwoo Lee
Matt Levin
Sean Levin
Vivian Li
Shuyang Liu
Yumeng Liu
Zixiang Liu
Santiago Loane
Lilian Ludford
Gianna Macri
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Shir Maimon
Justin Maldonado
Abdullah Al Mamun
Nicholas Martucci
Marcelina Martynek
Aaron McClure
Graeme McGuire
Akihiro Minami

Jason Natale
Mario Natalino
Amos Newswanger
Edward Newton
Jacob Niebloom
Luis Nova
Jien Ogawa
Joshua Pachter
Yiming Pan
Michael Parrish
Naropa Perez
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Aurek Ransom
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Grant Sorbo
Daniel Stegink
Zachary Teicher
Xiaoxuan Wang
Maria Weber-Nieves
Conrad Wehner
Joshua Whitehouse
Brandon Willett
Samuel Wlody
Ryan Wong
Charlotte Wright
Jiejiong Wu
Sophie Wu
Linxiuzhi Yang
Yiming Yang
Xinyue Yuan
Zhizhou Zhang
Wen Zhou



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Computer science major Gordon Xu '21 adjusts Blob-bot: A Robotic Amoeba at Hajim School Design Day on May 4. Professor Randal Nelson's Robot Construction course built a novel robot platform consisting of a flexible icosahedral shell animated by 30 linear actuators co-incident with the polyhedral edges. Photo by J. Adam Fenster

