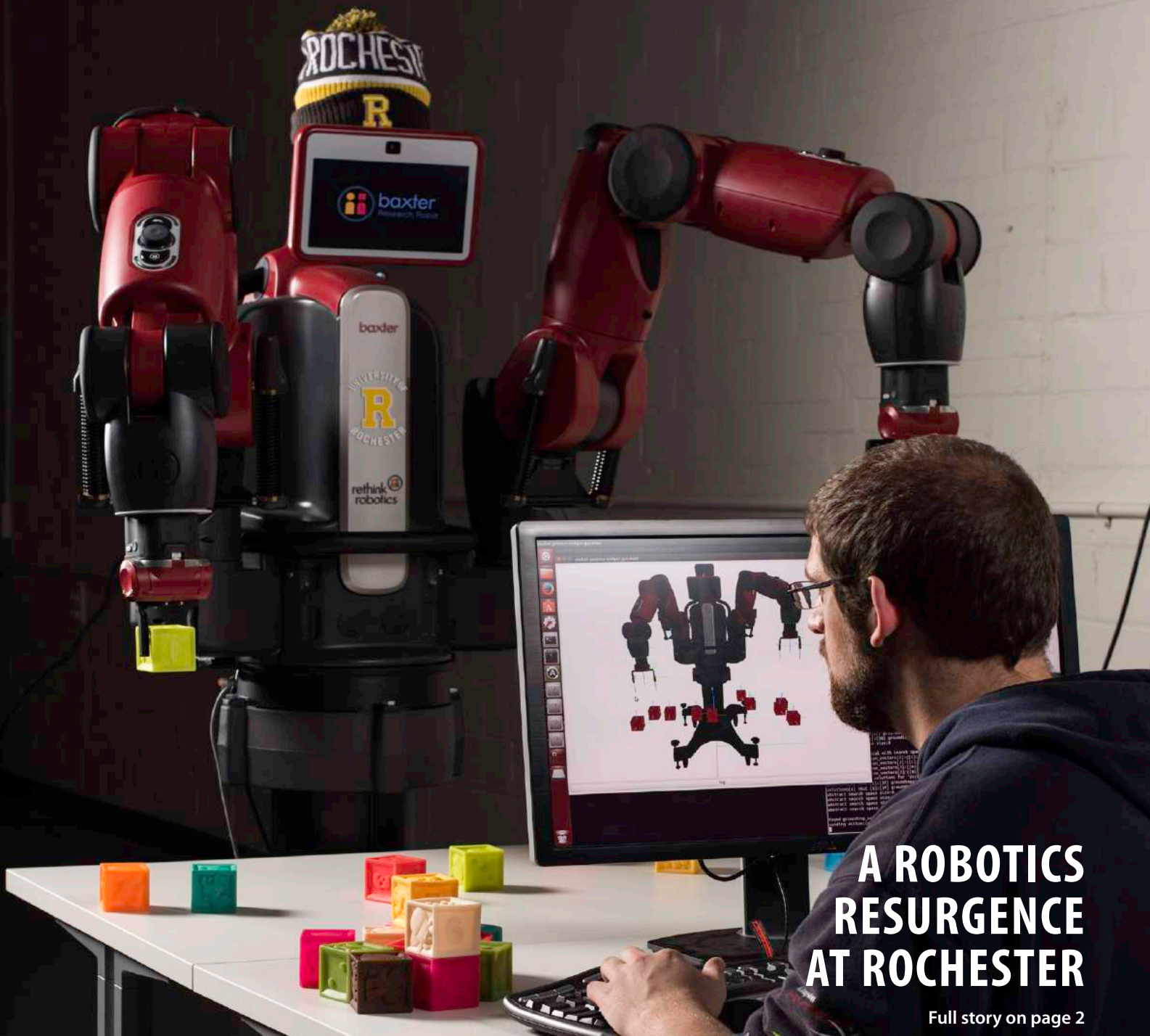


MULTICAST

THE DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF ROCHESTER



A ROBOTICS RESURGENCE AT ROCHESTER

Full story on page 2



HAJIM
 SCHOOL OF ENGINEERING
 & APPLIED SCIENCES
 UNIVERSITY OF ROCHESTER

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A ROBOTICS RESURGENCE AT ROCHESTER

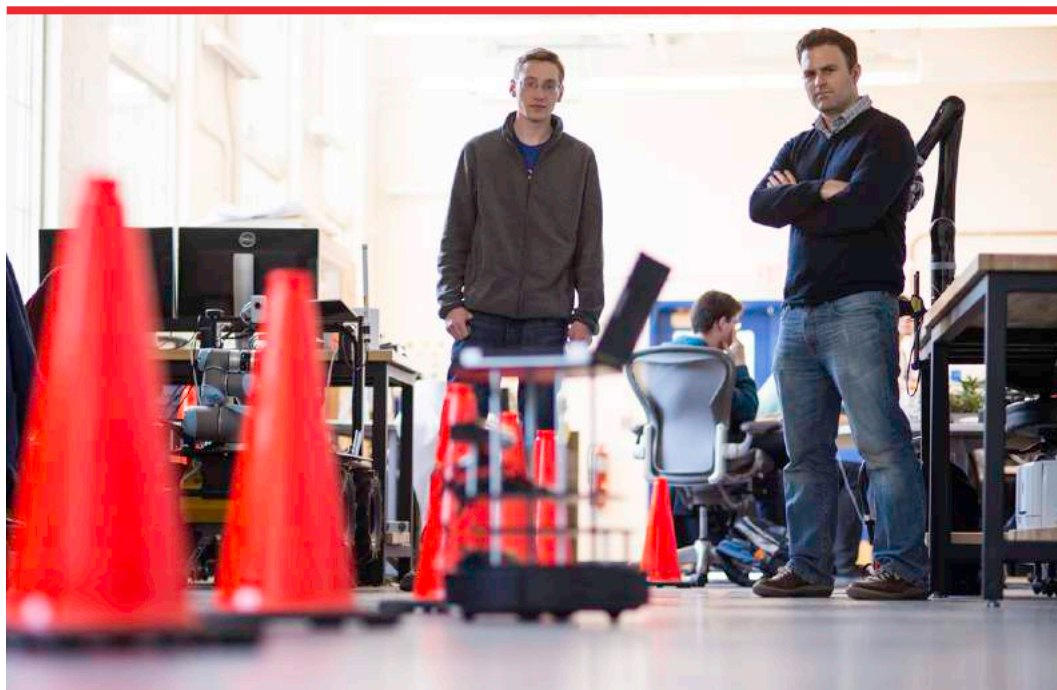


As I look back at the time I spent at the University of Rochester as an undergraduate in the early 2000s, I enjoy reflecting on how good we thought we had it technologically. We could use the wired network access in the dorms to complete our WebWork on bulky desktops and CRT monitors, print lab reports from iMacs in Rush Rhees from our rewritable DVDs and Zip disks, and check our grades using an arcane web-based interface (arguably still true). This was also a time of significant advances in robotics, particularly in field robotics, unmanned aerial vehicles, and planetary exploration, culminating with the landing of NASA's Mars Exploration Rovers on the surface of the red planet in 2004. Robotics was a discipline that had always piqued my interest and motivated me to dual major at Rochester and pursue advanced degrees in robotics and control.

A decade later, I was excited to return to the University with a PhD in robotics from Carnegie Mellon and research experience from NASA/JPL and MIT to establish a new laboratory focusing on the intersections of robotics and artificial intelligence.

My time in graduate school was spent developing motion planning algorithms for robots that drove on-road and off-road, the highlights certainly including testing my code on research rovers at NASA/JPL and contributing as a member of the self-driving

car team that won the DARPA Urban Challenge. I followed that by working at NASA/JPL for three years on the DARPA Autonomous Robotic Manipulation program, as a member of the flight software team on the Mars Science Laboratory, and in a variety of other research tasks involving various aspects of autonomous navigation. It was during that



Casey Waldren '17 (left) watches as his software navigates a TurtleBot2 mobile robot through an obstacle course in the new Autonomous Mobile Robots course with Assistant Professor Thomas Howard (right) in the Robotics and Artificial Intelligence Laboratory. Photo by J. Adam Fenster/University of Rochester

A standard day in the Robotics and Artificial Intelligence Laboratory: Michael Napoli and Harel Biggie operate a Husky A200 unmanned ground vehicle (right), while Jacob Arkin and Jack Valinsky work with the Baxter Research Robot (middle right), and Christian Freitas programs the Jaco2 Robot Arm (left). Photo by T. M. Howard/University of Rochester



time that I also became interested in enabling robots to exploit higher levels of intelligence and interaction, which motivated me to join MIT's Computer Science and Artificial Intelligence Laboratory to work on new models for natural language symbol grounding.

The research thrusts of this new laboratory, which include human-robot interaction, robot motion planning, and assistive robotics, are focused from my experience of working with more than a dozen different robots in a variety of different domains over the past decade.

ROBOTS AND STUDENTS

When I arrived on campus in January 2015, what would become the Robotics and Artificial Intelligence Laboratory in Gavett 146 was in the early stages of renovation to the modern development and experimentation space that exists today. The laboratory began as a storeroom on the third floor of Hopeman Hall, and it was within those tight confines that we first unboxed our Baxter Research Robot and established our first software repositories to begin work in new models for natural language interaction. By the time that we moved into our refurbished space in May 2015, our fleet of robots had grown to seven by adding an unmanned ground vehicle (Husky A200) and five indoor mobile robots (TurtleBot2). Today, the laboratory develops with 20 robots that serve as experimental platforms for research funded by sponsors including the National Science Foundation and the Department of Defense and for education in undergraduate and graduate classes and outreach programs.

The laboratory is currently staffed by seven University students who work on a variety of different research topics that contribute to the core missions of the laboratory.

Jacob Arkin, a second-year ECE PhD student, is developing new probabilistic models for efficient natural language symbol grounding. His work on Adaptive Distributed Correspondence Graphs, which he recently published at Robotics: Science and Systems (RSS) 2016 with our collaborators at MIT, earned the recognition of Best Paper Award. He has followed this with another publication on natural language symbol grounding with Linear-Temporal Logic (LTL) for robotic manipulation with our collaborators at Cornell University that will appear at IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS) 2016.

Michael Napoli, a first-year ECE PhD student, is investigating probabilistic models for adaptive robot motion planning search spaces for autonomous planetary navigation.

Michelle Esponda, a first-year BME MS student, and **Christian Freitas**, a first-year ECE MS student, are developing multimodal assistive devices for common household tasks.

Siddharth Patki, a first-year ECE MS student, is developing algorithms at the intersection of computer vision and language understanding to improve the scalability of robot perception pipelines.

Harel Biggie, an ECE junior, and **Jack Valinsky**, a CS senior, both served as David T. Kearns Center Xerox Engineering Research Fellows this year and are working on control set adaptation for mobile robot navigation and semisupervised learning for natural language understanding, respectively.

The laboratory is also proud of alumni and visitors who engaged in research with the laboratory as students, including Minsoo Lee (BS ECE '16) and Marlon Baez (BS ME '16), who worked to develop neural networks for adaptive collision detection representations as Xerox

Members of the Robotics and Artificial Intelligence Laboratory (from left: Harel Biggie, Thomas Howard, Michael Napoli, Michelle Esponda, Jack Valinsky, Jacob Arkin, Christian Freitas, Siddharth Patki)



Engineering Research Fellows; Logan Gittelsohn (MS CS '16), who engaged in research on robots for experimental evaluation of energy harvesting devices and human-robot interaction; and Daqing Yi, a visiting PhD student from Brigham Young University, who also will be publishing a paper at IROS 2016 on work he started last summer in our laboratory on the topic of expressing homotopy constraints to sampling-based motion planners via natural language.

EDUCATION AND OUTREACH

Research is, of course, but one of several missions of the laboratory; we seek to translate the benefits of our efforts through undergraduate and graduate education and various outreach programs at UR.

This past year saw the introduction of two new courses on robotics in the Hajim School of Engineering & Applied Sciences: Robot Control and Autonomous Mobile Robots. The first course focused on the mathematical underpinnings of single-input/single-output feedback control in the context of various mechanical systems and electronic circuits, analysis of robot kinematics and dynamics, and the development of centralized and decentralized control architectures for multi-degree-of-freedom robot manipulators. The second course, which emphasized probabilistic models of robot motion, perception,

estimation, planning, and mapping, led to a final experiment that required the students' software to navigate a robot through an obstacle field without human intervention.

The laboratory also recently completed its second five-hour module on robotics as part of the David T. Kearns Center Upward Bound Math/Science program, where high-school students were immersed in learning how to program mobile robots to sense, plan, and act upon changes in their environment.

LOOKING AHEAD

Many important contributions to robotics have been made at Rochester, including some of the early work on robot vision for control of robot arms (PUMA) and end-effectors (Utah/MIT Hand). We are eager to expand upon this with collaborations with other departments, institutes, and researchers to establish this laboratory as an important center for scientific study and education on robot intelligence at this important time in the history of URCS and the field of computer science.

When, years from now, we reflect on this current time, we hope to see humor in the idea of robots *not* driving our cars, *not* farming our fields, and *not* assisting with household chores.

BALANCING A CAREER BETWEEN

INDUSTRY

AND

ACADEMIA



Jeff Schneider received his PhD in computer science from the University of Rochester in 1995, completed a postdoctoral appointment at Carnegie Mellon University (CMU), and launched a successful career in machine learning that has spanned both industry and academia. He currently is the engineer lead scientist for Uber ATC in Pittsburgh.

Ed.: Ed Hajim, for whom the Hajim School of Engineering & Applied Sciences is named, always tells graduates to “catch the wave” of new technology. Back in the early '90s when you were doing your research and thesis, machine learning was in its infancy. There were only a few neural net theories in development at the time. Chris Brown, your advisor, said you tried them all to see what would work in your research to train the robotic arm to hit a target. What was it like to be in the “Wild, Wild West” of machine learning and catch the wave? Many of these were just theories, but you were applying them to a real-world application. How did you make them work? How frustrating was that trial-and-error method?

J. S.: Yes, it really was the Wild West back then. Looking back with what we know now, it was like no one knew how to do anything. But that's also what made it incredibly exciting. There were tons of very simple, very successful ideas just waiting to be discovered, and we had a big playground to go find them amongst all the other ideas that were not so exciting.

I have many good memories from that process. I think it was the very fact that all you had was trial, error, and, really, philosophy, that made it so exciting. I arrived at the University of Rochester because I wanted to study computer vision. After about a year, I remember thinking, “this is just way too hard with the approaches we're using,” and then

deciding to do machine learning instead. Of course, now machine learning is the key method for doing computer vision, and I'm doing that as well.

I also remember the frequent debates I had with the natural language students. I would say it doesn't make sense to invest a lot of effort parsing a sentence for which you don't know the meaning of any of the words in any useful way. I argued that I could give them an unordered set of words and they would understand it much better than if I gave them a parsed sentence without the actual words. They would reply immediately with sentences that were completely ambiguous without the parse, and the debate would go on. Of course Bag of Words went on to be one of the most successful approaches to text once the Internet boom hit.

Ed.: Can you identify a turning point in your research that has been especially rewarding for you?

“After eight years, although we were profitable, we realized we had become a custom software and consulting shop and decided that’s not what we set out to do. The funny thing is that we were just a bit ahead of our time. The dream of a universal machine-learning platform is still alive and well, and many companies are trying to create that today.”

J. S.: There have been several. The first was the first time my Puma’s arm learned to whip its flexible link (a metal meter stick) to throw the ball a good distance accurately. I stayed up all night tending to it while it was doing its own automated trial and error. By morning when Chris arrived it was working, and I showed it to him right away. Everyone who saw the video was amazed because it truly learned something it hadn’t already been shown. It was really that moment that launched me onto the path as a successful robotics and machine-learning researcher. It also cemented my interest in active learning and optimization as the most exciting aspect of machine learning, and I’ve maintained that to this day.

In 1999 my first PhD student, Drew Bagnell, successfully hovered an autonomous helicopter whose controller had been learned from a test pilot’s data. That was amazing because prior to that, many people believed helicopter dynamics were simply too difficult to learn. The work launched his career and led to even more amazing acrobatics from Andrew Ng and his students.

In 2003 I began working with a biotech, Psychogenics, to use learning to recognize the effects of psychoactive drugs in mice. We built a mouse cage with cameras on the walls and ceiling and force sensors in the floor. We would treat mice with unknown drug candidates, put them in the cage, and then ask the learning algorithm: “Does that look like a mouse on an antidepressant?” To my (and everyone else’s) shock, it worked. The system could recognize a dozen different classes of drugs accurately, and it is still used to do drug discovery. That experience ignited my interest in doing machine learning for science. I describe it this way: For a long time we wanted to develop learning algorithms that would learn as well as a human. Now I want to develop learning algorithms that learn as well as *humanity*—that’s what science is. That work propelled me into cosmology, materials science, nuclear fusion, and many other scientific pursuits.

Ed.: During your graduate work at Rochester, Andrew Moore was at MIT. Knowing that he was the best person at the time for machine learning, what did it say about your advisor, Chris Brown, and

the flexibility of the URCS program that you were allowed to spend a semester with Moore’s research group at MIT? How did that influence your research and your life going forward?

J. S.: Ha-ha, an easier question would have been to list the things it did not influence. I went on to do a postdoc with Andrew at CMU during which I cofounded a company with him. He was a tremendous mentor and my primary collaborator until he left CMU to found Google Pittsburgh. We’ve stayed close ever since, and he remains a great professional influence for me.

I cannot say enough about Chris and the URCS program for making this happen. The possibility literally never occurred to me until Chris and I were discussing other people doing research relevant to my work, and he suggested I go visit their lab at MIT. He reached out to them on my behalf and gave me the freedom to go visit. Pretty much everything about my career would have been completely different if he had not done so.

Ed.: After receiving your PhD, you began a postdoc at CMU in the Robotics Institute. Simultaneously, you started a company called Schenley Park Research, Inc. to commercialize machine-learning applications. You held the position of CEO at that company until 2004 but maintained your research relationship with CMU during that period. Did the company continue after you left? Why did you feel it was time to move on?

J. S.: No, in 2004 we closed the company. We had a dream of commercializing our machine-learning work into a machine-learning platform that would be used across lots of companies and industries. After eight years, although we were profitable, we realized we had become a custom software and consulting shop and decided that’s not what we set out to do. The funny thing is that we were just a bit ahead of our time. The dream of a universal machine-learning platform is still alive and well, and many companies are trying to create that today.

Ed.: It seems like you are always reinventing yourself. For a two-year

“I want to see my ideas have a real impact in the world. I see my shifting between academia and industry as a virtuous cycle.”

sabbatical in 2004–06, you worked as the chief informatics officer at Psychogenics, Inc. in Tarrytown, New York. Your responsibilities included assembling the informatics group and leading the development of new machine learning–based drug discovery methods. You’ve always had a foothold in both academia and industry. How does that work for you?

How do these new involvements inform your research work and move it forward?

J. S.: I have never been a “pure” academic. I want to see my ideas have a real impact in the world. I see my shifting between academia and industry as a virtuous cycle. As good research ideas mature, I want to carry them through to commercialization. As I spend time in industry, it gives me an updated perspective on what the really big challenging problems [are], and I return to academia with a new research agenda.

Ed.: The list of companies that you have consulted for span many different sectors of business and industry. The categories include consumer electronics, food and beverage companies, pharma, finance, and government. What is the common denominator for their need of your services? How are you making their product or organization function at a higher level?

J. S.: Choosing machine learning turned out to be the right choice and the right time. Everyone who has data needs machine learning. And now everyone has data. Data and machine learning are the common denominator for almost everything now. This allows me to work in many different areas

and keeps things exciting for me because I always learn something new from each domain. While data and machine learning are the common denominator, the successes [are] all different. In pharmaceuticals it was the ability to discover central nervous system (CNS) drugs better, faster, and cheaper than ever before. For manufacturing companies it is running their processes more efficiently with better products and less waste. Some companies have developed new products based on machine learning. Others have used it to gain strategic insights into their customers and where their real profit opportunities are.

Ed.: You are one of dozens of CMU Robotics Institute faculty and researchers who recently moved to Uber’s Advanced Technology Center in Pittsburgh. There has been much press about how Uber “poached” the Robotics Institute to help them develop a fleet of self-driving vehicles. What is the relationship between CMU and Uber now? How can academia maintain their highly skilled faculty with the financial competition that industry offers?

J. S.: The press coverage got a bit out of hand on this one. The Robotics Institute has hundreds of people, so the fraction that left was not that large. It was a real feather in CMU’s cap. A university’s mission is to create and disseminate knowledge, and with Uber’s new lab, CMU did so very successfully. There is no other university that could have spawned such an amazing new endeavor at this scale. The relationship between CMU and Uber continues to be very positive.

Academia should embrace the future. The old model of a professor, a university, and tenure being locked together for life doesn’t make sense in a fast-paced high-tech world. It tends toward stagnation of ideas more than innovation. Universities should focus on creating a continuous incoming stream of new and returning professors along with the new ideas they bring. Then they can encourage and even facilitate their faculty’s engagement with the world outside of academia.

Ed.: Andrew Moore, chairman of computer science at CMU, has indicated that he encourages his faculty to avail themselves

of opportunities in industry for sabbaticals and limited-length commitments to help them benefit financially and give them experience applying theories in the world. He hopes that they return to academia with the knowledge they have gained while in industry. Do you foresee that you will return to CMU full time at some point in the future?

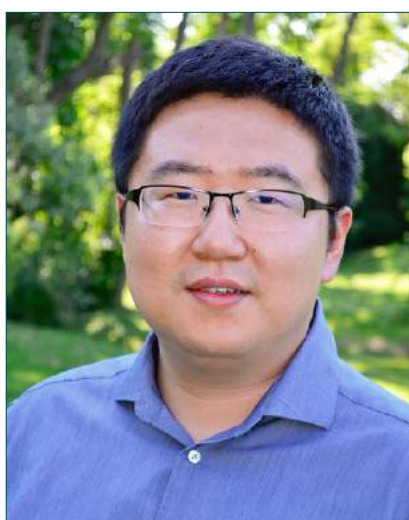
J. S.: Absolutely! The virtuous cycle will continue just as it has before.

Ed.: Your work schedule seems grueling, but there must be time for relaxation and recreation. How do you spend your non-work time? Do you have hobbies or passions?

J. S.: I like to play sports. Back in my UR days, I remember playing ice hockey, basketball, softball, ultimate, and tennis with the other people in the department. Now I’m more into beach volleyball, golf, and cycling. I also like Latin dancing, and I’m a big fan of travel—52 countries and counting!



INTELLIGENT SYSTEMS FOR COMPREHENSIVE VIDEO UNDERSTANDING



Chenliang Xu
Assistant Professor

Chenliang Xu is a new assistant professor in the Department of Computer Science at the University of Rochester. He received his PhD degree in computer science from the University of Michigan in 2016, his MS degree in computer science from SUNY Buffalo in 2012, and his BS degree in information and computing science from Nanjing University of Aeronautics and Astronautics in 2010. His research interests include computer vision, robot perception, and artificial intelligence. His work has focused primarily on problems in high-level video understanding, such as video segmentation, activity recognition, and vision and language.

Advances in technology and rapid growth of consumer electronics have made video capture ever easier and more diverse than before. In addition to traditional devices such as surveillance cameras and camcorders, videos are also being captured



Figure 1. The output of streaming hierarchical video segmentation. Supervoxels are rendered in different colors for visualization, and they are used for subsequent video analysis.

by smartphones, action cameras, wearable devices, dashboard cameras, and even drones. In the meantime, we are drowning in video content—YouTube, for example, receives more than 400 hours of uploaded video content every minute. This rise in large-scale, diverse video data has urged a new era of high-level video understanding. Xu's research goal is to design intelligent systems that understand the underlying semantics in videos that are consistent with human perception and even exceed humans in certain tasks, such as reconstruction and fine-grained recognition.

In previous work, Xu stimulated and advanced the use of supervoxel hierarchies as a new type of generic video representation in video analysis. Such a representation compresses

the vast pixels spanned in space and time of a video into more tractable sets that satisfy many homogeneous properties for subsequent processing. He designed the first approximation framework for streaming hierarchical segmentation that is able to generate multiscale decompositions for arbitrarily long videos with constant memory. His supervoxel library, LIBSVX, has been downloaded thousands of times, and its metrics and benchmark have become the de facto standard evaluation for subsequent supervoxel methods. Currently, Xu is writing a book on video segmentation that aligns with this line of research.

Xu has expanded his research to activity recognition in videos. He created a new problem space of actor-action video labeling



Figure 2. An example of the actor-action video labeling problem. A single frame is shown for each video. We aim to label each pixel in a video with a pair of actor and action labels.

that tries to solve the following three questions jointly: what action is happening, who is performing the action, and where is the action happening in space-time. As a first approach, he developed a series of probabilistic graphical models on top of supervoxel representations. These models exploit many unique characteristics of this problem space, such as the interactions of actors and actions and the utility of the multiscale decompositions.

Xu is also interested in exploring the multimodal modeling of vision and X. In the past, he has built systems to translate videos and images to natural language descriptions. His paper on video-to-text is among the first to investigate this problem domain. The

resulting YouCook dataset has been actively used for experiments by the computer vision community.

At the University of Rochester, Xu is excited about potential collaborations with other departments, such as electrical and computer engineering and brain and cognitive sciences. As video understanding becomes an emerging topic in many disciplines, Xu is looking forward to contributing his expertise in video analysis and computer vision.

Furthermore, Xu is interested in developing systems that learn from large-scale, diverse video data. Although there is much annotated video data available today, the annotations are usually noisy and semantically ambiguous,

which poses challenges to existing methods. He is also looking forward to applying video understanding methods to video from novel data sources such as autonomous vehicles, egocentric logs, and drones.

In addition to research, Xu plans to develop both graduate- and undergraduate-level courses in computer vision, video analysis, and deep learning in vision. He is excited about supervising undergraduate and graduate research in his lab. He anticipates contributing to the department's strength in artificial intelligence.

In his spare time, Xu enjoys outdoor activities and photography. He likes to record the natural beauty of all seasons.



Human Synopsis: In this video, the woman takes bacon, eggs, cheese, and onion in different containers. On a pan she cooks the bacon on low flame. Side by side she beats the eggs in a bowl. She removes the cooked bacon on a plate. In the pan she fries onions and adds the beaten eggs. She sprinkles grated cheese on the pan and cooks well. She then adds the fried bacon on the eggs in the pan and cooks well. She transfers the cooked egg with bacon to a serving plate.

Figure 3. A video from our YouCook dataset. We show sampled frames on the top and human synopsis on the bottom.

From the CHAIR

2015–16 IN RETROSPECT



Sandhya Dwarkadas
Chair of Computer Science

Another academic year has flown by with many events, accomplishments, and changes to report.

George Ferguson, URCS '95 PhD, joined the ranks of our faculty as senior lecturer and associate director of undergraduate and master's studies. George has tremendous history with the department, having been part of the natural language understanding research group for many years. We are glad to have him back!

We also welcomed Michelle Kiso last November as our new graduate coordinator and Robin Clark as our department coordinator. Michelle will be coordinating both our growing MS and PhD programs.

Two new faces will join the ranks of our faculty in the fall:

Chenliang Xu (PhD from University of Michigan) as a tenure-track assistant professor and **Tamal Biswas** (PhD from State University of New York at Buffalo) as lecturer. Chenliang's research is in the area of computer vision, focusing on problems in video understanding. Tamal has amassed significant teaching experience while a PhD student. We look forward to welcoming them in the fall. We will also be actively recruiting this coming year.

Construction of Wegmans Hall, which will house the Goergen Institute for Data Science as well as the Department of Computer Science, is in full swing and is slated for completion by the end of the year.

Sadly, **Kai Shen** and **Philip Guo** have decided to leave Rochester—Kai to Google NYC and Philip to UC San Diego, both to be closer to their respective families. They will still have an association with URCS and will remain involved in advising their students here until those students graduate. We wish both Kai and Philip success in their respective new journeys.

Our participation in the BRAID (Building, Recruiting, and Inclusion for Diversity) initiative is about to enter its third year. With the help of BRAID funding, we sent 20 women, two staff members, and one faculty member to the Grace Hopper Celebration of Women in Computing Conference in October in Houston. The department also hosted a booth at the career fair and held a dinner to network with alumni. The BRAID initiative has yielded tremendous results: the latest undergraduate class had 73 graduates and saw the largest percentage of women in our history—30 percent of the class of 2016.

Our bachelor's program continues to grow in popularity, with nearly 100 students in the entering class of 2020 declaring computer science as their interest. More than half of our majors continue to pursue double majors or minors in fields including mathematics, financial economics, linguistics, economics, studio art, and digital media studies, to name the most popular. We had three class valedictorians this year—Wolf Honore, Tergel Purevdorj, and Peter Stoeckl.

We continue to build relationships with universities around the globe. Seventeen seniors studied abroad in France, Spain, Australia, New Zealand, Russia, United Kingdom, Hungary, Italy, Denmark, South Korea, and Ireland. Additionally, students in the interdisciplinary majors of data science, computational biology, and computational linguistics draw heavily on computer science.

Our faculty continue to grow their research enterprise and reach, both nationally and internationally. In addition to NSF, DARPA, and DoD, collaborations with Adobe, IBM, Google, Microsoft, NEC, Samsung, TCL, Yahoo, and Xerox have yielded awards to fund research. International collaborations span Austria, Belgium, China, France, Germany, Greece, Italy, Poland, and Sweden. Three of our junior faculty were recipients of an NSF CRII award.

Michael Scott and I were awarded the titles of "Arthur Gould Yates" and "Albert Arendt Hopeman" Professor of Engineering, respectively. Michael released the fourth edition of his textbook, *Programming Language Pragmatics*, one of the definitive references in the field. Henry Kautz was elected as chair for Information, Computing, and Communication of the American Association for the Advancement of Science (AAAS).

Our students continue to do outstanding work. **Iftekhar Naim** received a commendation for the University's outstanding dissertation award in engineering for his PhD dissertation, advised by Daniel Gildea, titled "Unsupervised Alignment of Natural Language with Video."

Mitchell Gordon '16 won the Computer Research Association's Outstanding Undergraduate Researcher Award for his work in Human Computer Interaction. Rochester alumni **Morgan Sinko, Lucian Copeland,** and **Jordan Brooks** spun their award-winning project from the robotics club into a start-up called NullSpace VR in order to fold haptic feedback into consumer-level virtual reality.

All in all, it's been a great year!

Construction of Wegmans Hall is in full swing and is slated for completion by the end of the year.

Introducing MICHELLE KISO



Michelle Kiso
Graduate Coordinator

I was delighted to join the department as graduate coordinator in November 2015, taking over for Niki Pizzutelli after her transition to a new position with the campus CARE network. It has been an exciting eight months so far, and I have enjoyed supporting and getting to know our MS and PhD students. We recently finalized our incoming

graduate class, and as our MS program grows (our incoming class is triple the size of last year's), my role as graduate coordinator has expanded to include more responsibilities relating to MS-student-specific support.

A little about me: I received an MS in history from UCLA, and a BA in history and international studies with minors in anthropology, geography, linguistics, philosophy, and Spanish from Humboldt State University after transferring from the University of Costa Rica. I love to travel, cook, and learn new things—I especially enjoy attending thesis proposals and PhD and MS thesis defenses in the department.

As you may have noticed, some of the alumni information on our website is quite dated. **If you are an alumnus or alumna and have not done so already, please send me your updated information (current home address, employer, and email) as well as any news you would like to share! You can reach me at mkiso@cs.rochester.edu or connect with me on LinkedIn—I look forward to hearing from you!**



Rochester representatives to the North American Chapter of the Association for Computational Linguistics (NAACL):

Back row L–R: Alumni Tagyoung Chung, Benjamin Van Durme, Matt Post, Craig Harman, Brian Potter, Mark Kahrs

Middle row: Alumni Joel Tetrault, David McClosky, Andrew McCallum, Diane Litman

Front row: Current PhD students Omid Bakhshandeh, Nasrin Mostafazadeh, Linfeng Song

RECENT PhDs

Qing Guo

"Associative Computing with Resistive Memories"
(NVIDIA)

Anna Loparev

"The Impact of Collaborative Scaffolding in Educational Video Games on the Collaborative Support Skills of Middle School Students"
(Wellesley College)

Iftekhar Naim

"Unsupervised Alignment of Natural Language with Video"
(Google)

Received a commendation for University of Rochester Outstanding Dissertation Award Competition

Ian Perera

"Perceptual Symbol Grounding through Child-Like Natural Language Interaction and Learning"
(Florida Institute for Human and Machine Cognition)

Lingxiang Xiang

"Compiler Assisted Speculation for Multithreaded Systems"
(Intel Labs)

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and Facebook**



Graduate Alumni NEWS



Ashwin Lall



Galen Hunt



Dan Russell



Benjamin Van Durme



Jeremy Warner

Dzikovska, Myroslava PhD '04

I moved from the University of Edinburgh to Google London on 2 November 2015.

Guo, Qing PhD '15

Just welcomed a baby daughter into his family in April 2016!

Hoebel, Lou PhD '98

I'm living in Burnt Hills, N.Y., keeping bees and playing hockey. I am now spending winters in the Blue Ridge Mountains of North Carolina not far from Mt. Mitchell in the town of Little Switzerland. Visitors welcome. I am just finishing my 2nd summer at the Univ. of New Hampshire learning violin repair and restoration and also doing collaborative research into tonal effects of instrument wood properties.

Hunt, Galen PhD '98

Computer Science has entered its second generation in our family. My daughter, Emma, just finished her freshman year at BYU majoring in CS.

Lall, Ashwin PhD '08

I received tenure at Denison University, where I have been since 2010. I'll be on sabbatical in the 2016–17 year. I also recently celebrated my first year of fatherhood.

Russell, Dan PhD '85

I continue to work in Search Quality at Google, specializing in the overall search user experience (how well DOES search work for you?). To this end, I was the tech lead for CourseBuilder, which we then used to create PowerSearchingWithGoogle.com, a MOOC that has taught over 2.8M students how to do search more effectively. As a side effect, I end up traveling a lot to teach classes in user experience, research methods, and Google data analytics. Interestingly, I'll be at UofR to give a colloquium on November 7th. Look for me on campus then!

Spear, Mike PhD '09

Mike Spear has recently received tenure at Lehigh University.

Van Durme, Benjamin PhD '09

In the last year I have started as an Assistant Professor of Computer Science at Johns Hopkins University, had my first child (Henry Michael), and moved to the woods in order for him to have a big place to play.

Warner, Jeremy MS '16

I have been traveling around a lot and been busy with moving and finding housing in Berkeley where I will begin my PhD at UC Berkeley this fall. I have included one of the last photos of me in Rochester, biking past High Falls.

If you have any news you would like to share, please send it to Michelle Kiso (mkiso@cs.rochester.edu), along with a high-resolution photo if available.

NULLSPACE

Goes I-Corps

Nullspace VR (formerly Hapttech), the virtual reality startup founded by URCS Robot Club members Morgan Sinko, Jordan Brooks, and Lucian Copeland, received an NSF I-Corps Teams award with principal investigator Randal Nelson and mentor Ben Gibson to explore bringing their haptic touch suit to market. I-Corps, short for Innovation Corps, is a National Science Foundation (NSF) initiative founded in 2011 in collaboration with Stanford University, with a mandate to “strengthen the innovation ecosystem nationally and locally,” specifically by attempting “to increase the economic impact of research it has funded.”

The Teams program provides \$50,000, mostly in travel support, for focus teams consisting of one or two entrepreneurial leads (generally young students or postdoctoral scholars), a principal investigator (generally a university professor), and a mentor (usually a senior leader from the business community). These teams are charged to investigate the feasibility of bringing a product incorporating academic research to market. The primary venue for doing this is the I-Corps Curriculum, an intensive seven-week course based on Stanford University’s Lean Launchpad course. This course focuses on the elements of a start-up, defined as “a temporary organization dedicated to discovering a business model,” and, in particular, the process of “customer discovery.” This means finding customers who have an actual need (i.e., they will pay) for something your technology can supply.

The curriculum started with a three-day flash trip to Georgia Institute of Technology facilities in Atlanta. We had to be there two weeks after learning we got the grant. There we met the teaching team, who started by telling us and 15 other “cohort”

teams that everything we’ve been told about starting a business is wrong, and that what we think we know about what people will buy is an unsubstantiated guess and almost certainly false. More than 700 teams had gone before us, so the teaching team had some street cred. We were then introduced to the “business canvas,” a schema for representing and refining a business plan, and told to get out of the building and start talking to actual potential customers to test hypotheses about their needs.

How? Well, they told us, the Atlanta metro area is home to 5.5 million people and headquarters

of more than 1,000 multinational corporations, so start walking in. If necessary, call first. If you’re not thrown out by security a few times, you’re not trying hard enough. We did get thrown out of the first game company we tried to talk to, but the second gave us a lot of feedback, and the president himself stopped by (incognito). And we threw a pizza party for an Atlanta-area virtual reality developers group. Good start.

Then we came home with the assignment to repeat the process every week in cities across the country until we had at least 100 interviews. That’s what the grant money is for.

So Rochester, Buffalo, Syracuse, Albany, Boston, New York, Seattle, San Francisco, and Silicon Valley. And online class meetings and presentations every week. Finishing with a wrap-up meeting in Atlanta.

We learned that we were, in fact, naive about everything except our guess that people would be excited about touch feedback. Nearly everyone we talked to was. But, they would buy a peripheral only if it had good games for it and it was not very expensive. And game developers would generally not buy experimental tech on the chance that they might be able to make a good game with it. At best they might partner if provided with free equipment and support. But they would certainly be happy to be paid to develop a game.

And so, gradually, a plan developed. NullSpace now has its first investor funding and serious interest from a couple of angel investor groups. All in all, the Teams program was an invaluable, if exhausting, experience.

Memorable quotes from the Atlanta I-Corps teaching team:

“Start-ups are completely different animals than established businesses. Start-ups search. Businesses execute.”

“No business plan survives first contact with customers.”

“Customers are people.”

“Don’t be late!”

And most important:
“Get out of the building.”



Need-Finding Helps Build Better Systems

“Applications aren’t built for developers; they are built for the client.

You need to talk to end users, do surveys, and carefully observe.

Courses like Professor Hoque’s Human Computer Interaction class has taught us the process for understanding users and incorporating feedback into the design.

The heart of design is figuring out what people actually want and need.”

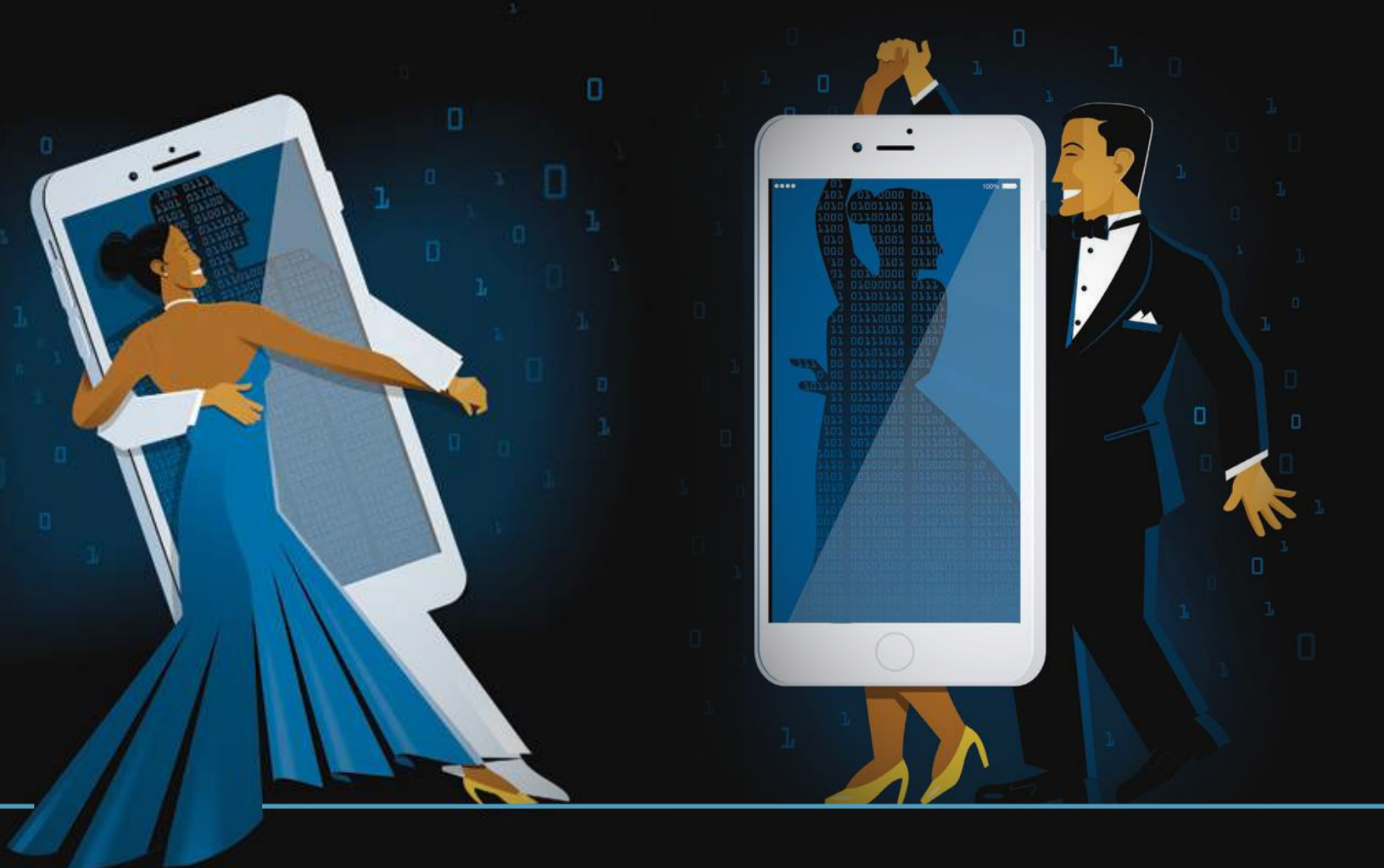
If one puts an ear to the ground and listens to the buzz of research and instructional topics in URCS recently, a common thread emerges. User-centered design, need finding, and human computer interaction are hot topics. New course offerings have expanded our curriculum to include more design. Web Design and Development and Advanced Front End Web Design are courses focused on design protocols currently used in industry. Instructor Robert Kostin explains, “Proper design at the outset makes overall time to delivery shorter, with fewer revisions.” While working with computer science students, Kostin often finds them in a rush to begin coding and has to coax them into giving more thought to the design before heading to the keyboard.

Will the understanding of client-centered design alter the approach our students take to create their projects? Will it make our students deliver products more usable by end users? Assistant Professor Philip Guo believes this training makes a difference. Students with training in user-centered design will be highly sought after. “More and more people are learning to program, but learning the skill of design will set them apart and assure them of gainful employment.”

Guo recently advised senior Dan Hassin’s honors research thesis, encouraging him to do more need finding with his target users, his fellow students at Rochester. Prior to working with Guo, Hassin had created a system for searching courses and schedules in order to register for classes. His application, called

Skedge (www.skedgeur.com/), is a feature-enhanced version of the University’s CDCS (course descriptions and course scheduling) tool, popular among the students and used by more than 2,000 unique individuals. Though Guo was impressed by the original system, he encouraged Hassin to collect more user data, such as page visits and button click events, analyze the results, and incorporate feedback into Skedge. Guo’s interest in crowd-sourced knowledge and seamless connectivity inspired the milestone feature that was developed in the second semester, Skedge Social, a feature that allows students to see courses taken by their peers. The interface is also more user-friendly, and the look and feel of the page has more features in common with current social media used by students. The modifications Hassin made based on user input improved Skedge, making it grow in popularity among the undergraduate student body. Guo had high praise for Hassin’s final version, saying, “A product like Skedge could not have been made by a giant corporation and include all the nuances involved. Only a student in touch with fellow students could produce this.”

“More and more people are learning to program, but learning the skill of design will set them apart and assure them of gainful employment.”



Ehsan Hoque's Human Computer Interaction lab (ROHCI) is a very active place year-round, with many students developing new projects or tweaking existing work. Some of the researchers confirmed that need finding helps build better systems. Vivian Li '18 stated, "Applications aren't built for developers; they are built for the client. You need to talk to end users, do surveys, and carefully observe. Courses like Professor Hoque's Human Computer Interaction class has taught us the process for understanding users and incorporating feedback into the design. The heart of design is figuring out what people actually want and need."

Need finding isn't always the easiest task to complete, as recent graduate Morgan Sinko realized. Sinko had been a student in Professor Hoque's Human Computer Interaction class and recalls that emphasis was definitely placed on knowing what the end user would need and want in the final product. As part of the Null Space virtual reality start-up, Sinko and his team received an ICorp grant from NSF to develop their business. An exercise they were assigned by the I-Corp team found them cold calling gaming companies in the Atlanta

area and collecting data about price point breaks, feasibility of manufacture, and market appeal. The entrepreneurs hoped that these companies would come to the same logical conclusions on which they had designed their business plan. Some did, but many others gave unexpected input. As a result of this exercise and the user/developer feedback, they revamped their entire business strategy, putting much less focus on the developers of video games, instead targeting gamers who would consider their product a "must have" for their gaming experience. This was a significant change of course that they wouldn't have come to realize till the product was in the marketplace. This would not have been possible without their face-to-face interviews with potential end users.

As technology insinuates itself more and more into everyday life, novice users will need improved design to make their user experiences frustration free. Dan Hassin says, "As we start to rely on technology for a rapidly increasing amount of services, it becomes painfully obvious when user interfaces and workflows neglect real users and offer them

poor and frustrating experiences." Students and researchers at Rochester will continue to study people's needs and wants in an effort to make applications and products more satisfying for both the technical user and the nontechnical masses. Combining functional design and efficient coding will ensure user happiness for all.



Ehsan Hoque
Assistant Professor

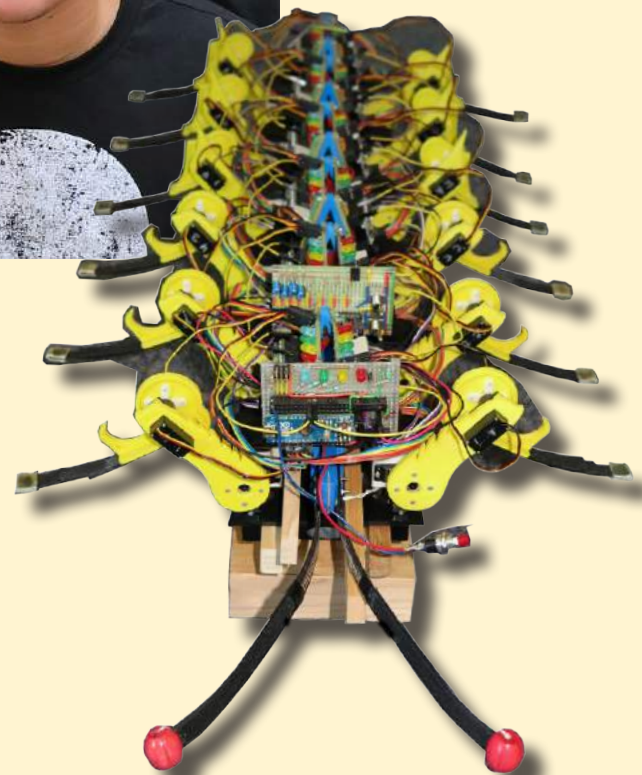
The Story of Squiddlemadunk



Back row: Celine Anand, Jiarui Yang, Lukas Zheng
Front row: Ana Paula Tavares, Sidhant Ahluwalia, Elmer Rodriguez
Not pictured: Connor Dent, Elizabeth Fox, Joel Howard, Ruby Reynoso

The members of Randal Nelson's Robot Construction Class (CSC 297) created a robotic centipede as the course project. The control architecture takes a clue from living centipedes in having a separate microprocessor (a "ganglion") controlling each leg, and by using a propagating wave gait for locomotion. This modular design allows segments to be added and removed freely with no need to modify the central control algorithms. Scaled up, the architecture could be useful as a "land train" for transporting materials over rough, obstacle-filled terrain such as mountains or forests.

To construct the critter, the class needed to acquire skills in diverse areas including microcontroller programming, 3D CAD design and 3D printing, basic machining, mechanical stress analysis, electrical power analysis, electronic circuit design, layout, assembly and soldering, mass production, and quality control. Making the control boards required over 2000 hand-soldered connections, every one of which had to be right. The centipede was completed just in time for the Hajim Senior Design Day, and (somewhat to our surprise) actually got up and walked on its first public trial.



Featured UNDERGRADUATE ALUMNA: Pamela Vong

INSPIRING THE NEXT GENERATION OF FEMALE ENGINEERS

Pamela Vong graduated from URCS in 2008, one of only two women to graduate that year. Pam was the first undergraduate the department sponsored to attend the Grace Hopper Conference (in 2007). She has lived in Washington, D.C., for the past six-plus years and is currently working for InfernoRed Technology, where her official title is “Tech Wizard.” She consults in a wide range of software development projects (from LOB systems to mobile apps) and for a wide range of clients (including start-ups and nonprofits). Some notable Windows 8.1 apps she’s developed this year are the “Elmo Loves ABCs” game for Sesame Street and the “Be A Martian” app for NASA. Pamela received her master’s degree in information and communication technology from the University of Denver. Pam was married in June 2016 to Jason Zelbo, also a University of Rochester alumnus. She has been recognized by DC FemTech as one of the 2016 Powerful Women Programmers and participated in the White House TechJam in December 2015. Pam and her husband live with their dog and pet rabbit, who keep Pam company while she works from home.

Ed.: In 2007, you became the first undergraduate to be funded by the Department of Computer Science to attend the Grace Hopper Conference. You were able to attend GHC again in 2015. Comparing 2015 with 2007, how has it changed?

P.V.: The conference in 2015 was almost nine times bigger than it was in 2007. When I went as an undergrad, there were about 1,400 attendees, which felt huge to me at the time because I had never been around so many other technical women before! I also attended the conference in 2012, when it was starting to feel like it was getting too big to handle the logistics as well. But the 2015 conference in Houston was very well done. The venue was just the right size for the unbelievable number

of attendees (almost 12,000!) and there was enough variety in the sessions that there was always something interesting for anyone, regardless of their experience level. The only negative change due to the growth of the conference

conference felt like such a “safe” place, which is very rare for big tech conferences. Many people came out of their shells (me included) and were able to freely talk and bond with one another. The social satisfaction I got out of GHC is like no other tech conference in the world, and I still vehemently recommend it to every woman in tech that I meet.

Ed.: When you returned from the 2007 conference, we held our first UR Women in Computing event, and you shared your experiences from Grace Hopper with our cohort. Did this experience influence your desire to mentor women in computing, which seems to be a common thread through your career?

P.V.: Sharing my GHC experience at the first UR Women in Computing event was definitely a stepping stone on my path towards mentoring and advocating for women in computing. I’m definitely not a natural when it comes to speaking in front of groups, so preparing to give a talk about a topic I had just become passionate about was quite a challenge for me. But, being able to do it in front of a safe and small group helped me grow a lot from that point, and I’m much more comfortable now, although I’m still not a natural. One of the things I learned

that I would complain about was that the food and dining experience in 2007 was a lot better.

Though the size changed, the spirit of the conference felt the same. A majority of the women there related to each other’s experiences being the only woman or one of the very few women in their class/team. GHC showed us that we are not alone, and that many other women are going through the same obstacles in the tech world. Every time I go, I’m blown away by having so many technical women in one place. The comradery was so natural because the

early on from attending these women-focused tech events is that a lot of people go through imposter syndrome—and that what holds a person back isn’t their ability to execute, it’s their own lack of confidence in putting themselves out there for fear of failing and looking like an “fraud” who shouldn’t have been there in the first place. Knowing that and recognizing that there are others around me who feel like they don’t deserve the wonderful successes they’ve earned motivates me to help them build up their self-confidence and, as a result, helps me grow my own.



Ed.: You've written some applications for Sesame Street. What are the apps that you've done, and what do they teach children? Are there any problem-solving or subtle programming concepts in the designs? How does writing applications for children differ from other work you have done?

P.V.: Besides Sesame Street, I worked on an app for NASA JPL that teaches kids about Mars and gives updates and pictures on the latest discoveries from the Curiosity rover. I've also built several business and consumer-facing apps, websites, and services for enterprises, nonprofits, start-ups, and government. What I love most is working on educational apps for children. They are the most satisfying products to develop, in my experience, because I know that their use is helping the next generation learn and grow.

Ed.: I see you are a regular contributor to GitHub. What kind of code do you contribute? How is this a useful platform for you?

P.V.: Github is recognized by a lot of developers as the home for open-source projects. It's a great tool for collaborating on technical projects but also for showcasing one's work. Many people use Github to determine if an open-source project is the right tool to use in their own projects by looking at how popular and active its Github repository is. Contributors to Github projects use it to help advance features or fix bugs for projects that they have an interest in, while others contribute to Github projects as a way to show samples of their technical abilities.

For me, I use Github to find the right third-party tool for my own projects, host code samples for tutorials, and also to collaborate on projects for the organizations that I am a part of. Sometimes my contributions go to private repositories for clients, and sometimes they go to public ones for the communities that I volunteer with—like Women Who Code, Women Who Code DC, Tech Ed Spotlight, and Codettes.NET. I usually advise beginners and those who are looking for a new job in tech to contribute to Github projects because it's a great way for recruiters to find samples of their abilities, but I want to emphasize that they do not have to do this in order to be an attractive candidate.

There's been a trend towards thinking that the "best" developers are passionate and are the ones who think about and work on code all the time—after their work hours and on the

weekends. Although I can say this is something I do occasionally (because I do enjoy it), it is an endeavor to make the time for it. This is not something that lends itself to a healthy work-life balance for most people, and if the tech world wants to be known as an industry that cares about such things, I would want to change how much we emphasize "passion" towards working on and talking about code all the time. There are a lot of developers who would be a great fit with many companies but are probably overlooked because they would rather go home to take care of their families or give their time to charity than be evangelizing tech every weekend.

I call attention to this not to discredit the good that comes with contributing to open-source projects or say that "passion" for tech is a bad thing to have but just point out that companies and recruiters shouldn't only be looking for candidates who "check all the boxes" for a "rock star" developer. Doing so has led to the lack of diversity we have in tech today.

Ed.: As director of the DC Chapter of Women Who Code, what positive impact have you seen with this organization on the tech environment in the Washington region? What type of events do you sponsor? What are the best-attended events?

P.V.: The DC Chapter of Women Who Code has been incredibly successful in the region because of its strong community and consistent activities. We have over 3,700 members in our local Meetup group and also have a very active online Slack community—with over 1,000 members discussing topics in tech, careers, commuting, and life with each other every day. We regularly host five events listed on Meetup each week, targeting a specific area of tech—front-end, algorithms, Java/Android, Ruby, and Python—while we also host bigger one-off events at least once a month. The biggest event so far has been our two-year anniversary hackathon, which we held over two days and had almost a hundred women participate in coding and learning from one another.

Ed.: You are listed in so many places as a mentor and role model for women in technology, i.e., DC FemTech, Women Who Code DC, and FabFems. Do these programs offer active outreach events for K–12 grades to encourage them to explore STEM fields? Have you been contacted by young people as a result of being featured on these websites?

FabFems is a program meant to connect K–12 students with real-world professional role models, but I have not been contacted through them yet. A program that I have been engaged with involving sixth through twelfth-grade students is Girls Who Code. I was a volunteer teacher with their DC program for an after-school club at a local DC public charter school. This was one of the most fulfilling experiences in my career because I got to share in the wonder and excitement the kids had when writing their first program and seeing it run.

Ed.: You were invited to participate in the White House TechJam during CS Ed Week this past December. How were you selected to participate? What did that gathering accomplish? Do you think there will be any concrete results from this exercise?

P.V.: Because of my involvement on the leadership team of Women Who Code DC, I've had the opportunity to be a part of some really exciting events. In January, I got to attend the opening bell ceremony for Women Who Code at the NYSE. Last December I had the opportunity to participate in the White House Computer Science Tech Jam. There were over 70 developers, students, and educators from all over the country who came together to generate ideas for imaginative and innovative tools to bring CS education to K–6th-grade classrooms. My team came up with a project called Tech Ed Spotlight, which we have continued to work on since then. It is going to be a platform for educators and the community to share their stories related to implementing some level of CS education in the classroom. We've grown the team since then to include a few students from the high school and a few women who joined the project when I brought it to the Women Who Code DC two-year anniversary hackathon.

Ed.: How can our alumni get more involved in STEM outreach? How much time does this take from your personal time?

P.V.: Besides the organizations that I've been a part of (Women Who Code, Girls Who Code, and Rails Girls), there are many others with similar goals that are always looking for volunteers and mentors, such as CODE2040, Black Girls Code, PyLadies, and Girl Develop It. There are many more than this, and more are always popping up, including a new one I've just started. I created a new community to fill a void I've found in my tech career called Codettes.NET—a group to connect women developers who work with C# and the .NET stack—with the



Left: Pamela Vong at her Women Who Code informational display
Right: Attendees and students at the White House Computer Science (CS) Tech Jam

eventual goal of hosting a workshop to teach beginners a crash course on .NET development (similar to what Rails Girls does with their Ruby on Rails workshop). I'm hoping this group will help support the women who currently work in this tech stack and bring more diversity into it by being welcoming and by providing resources and mentoring for beginners.

The time one spends volunteering varies from person to person. If someone asked me if I would be willing to pick up another side project or volunteer opportunity, I really should say "no" even if I wanted to do it. Unfortunately (or fortunately depending on how one looks at it), I have very little free personal time because I keep myself very busy by working towards my goals of changing the tech world for the better. I like to think that if I work extra hard towards these goals now, I won't have regrets about not living up to my full potential to try to make a difference later. I know a lot of people with kids these days, and I hear about and have known for a while about how much time will revolve around one's own children once they are born. Of course, I think about this because I am a woman, just married, and at that age when many people would expect me to have children; so I reflect a lot on how much time it would take to go through such an experience. Many of my coworkers and friends are working parents who are able to stay actively involved in the community. I do not know if I would be capable of keeping up the same level of involvement if I were in their shoes. So, I do not take for granted the time I have available now as a young, educated, healthy, and financially secure woman, because there might not be a better time for me to work towards my goals at full force later.

Ed.: You have two other URCS alumni from 2007 working with you at InfernoRed Technologies: Brian Meeker and Ryan Korsak. Why is this company a good fit for URCS alumni? Do you get together and reminisce about your college days? What part of our curriculum prepared you the most for your current job?

P.V.: InfernoRed Technology is the best company I've ever worked for, and I bet Brian and Ryan would agree with me. As a company, they give me an enormous amount of freedom and respect. I get to work on some of the coolest projects for some really impressive clients while using some very exciting, cutting-edge technologies. They've not only given me the oppor-

tunity to challenge myself and helped me grow in my technical and leadership abilities but have also been incredibly supportive of my involvement with the women in tech community. A lot of us at the company are very involved with the greater tech communities and are constantly learning new things for fun. Everyone is also incredibly smart and pleasant to work with, which is why I can't imagine a better company to be a part of.

I've reminisced with Brian and Ryan a few times about how great Professor Scott's class was on Computer Languages. Getting the exposure to a lot of different languages from different programming paradigms helped me become a very fast learner of any new technology I've had to work with in my career. The best thing I learned from my time at UofR was to not be afraid to try and learn new things. A career in tech means I'm constantly learning and adapting because things change so quickly in this field, so I'm glad UofR prepared me for that.

Ed.: Not everyone gets to hike to Machu Picchu like you did last fall. Was this on your bucket list? What did you learn about yourself on this amazing trip?

P.V.: It was an incredible once-in-a-lifetime trip! It's off my bucket list now, and I would highly recommend the four-day/three-night hike up the Inca Trail as the best way to experience Machu Picchu. I was extremely proud when I made it past "Dead Woman's Pass" because that was the hardest physical challenge I've ever endured, and I'm glad I didn't die!

Ed.: If you could write an app or code that would have a life-changing impact on the world, what would you want it to do?

P.V.: Trying to change the tech world is my focus right now, and I'm hopeful that this will go somewhere, so if I could write an app towards accomplishing this, it would open the door for more women to join the industry and break the stereotypes for computer programmers.

Ed.: As an introverted person, what motivates you to spend so much time helping others discover the wonders of technology? Have you made a commitment to be part of the solution to the lack of diversity in technology?

P.V.: There are many benefits to increasing diversity in tech because studies have shown

that gender-diverse teams make better decisions. This has important social and economic implications because having diversity, which leads to better decisions, means companies can build better products that are designed for more people. And better products that are desirable to more people means that our economy gets better, and we are better situated to compete globally.

Macro reasons aside, what personally motivates me to overcome some of my introverted tendencies is knowing how much others could benefit from a career or education in technology like I did. Growing up in a lower-middle-class family as a first-generation Thai-American has influenced many of the financial decisions I've made early on in my life, including what I pursued in college and in my career. Having my CS degree helped me earn greater than 70 percent* more in salary coming straight out of college than my peers with other undergraduate degrees. Tech has been the fastest-growing industry for years and is expected to continue to grow and provide lots of job opportunities. On average, being in this field earns a person a salary that is 30 percent* higher than any other industry, while the gender wage gap is also smaller than other industries. (The gap is still there of course, which is partly because there aren't as many women who are reaching the top—another issue that motivates me to volunteer my efforts with the Women in Tech communities). In summary, tech is a great industry to be in to change the world, but it's also beneficial for those who want to achieve a higher standard of living.

Ed.: What are your hobbies or fun things to do in your downtime?

P.V.: My spouse and I cook together a lot and also like trying a lot of new/exciting places to eat when we go out. And since our Machu Picchu trip, I've discovered that I prefer active/adventurous vacations, so for our honeymoon, we're traveling to northern Italy on a five-day biking trip. But I also enjoy having some downtime watching sports or streaming shows like Game of Thrones at home with my little family unit, consisting of my spouse (Jason), my rabbit (Boo Radley), and my dog (Casablanca, a.k.a. Cassie).

*Numbers are from similar talk I gave in 2012 at the Rails Girls DC Workshop. The actual percentages may be different today.

Undergraduate ENROLLMENT UPDATE

Growing undergraduate enrollment in computer science is a national trend, and our department has experienced growth at a phenomenal rate. Since our move to the Hajim School of Engineering & Applied Sciences in 2009, enrollments have tripled in our major, making CSC the largest department in HSEAS. This year's graduating class had 73 students, and we project 2017's class to graduate close to 110.

Consequently, the College has provided additional resources to aid with instruction. More faculty and instructor lines have been added, some classes are now offered both fall and spring, new electives are being offered, and multiple sections have helped split some of the largest classes into more manageable sizes. In September 2015 we welcomed back George Ferguson to the department in his new position as associate director of the undergraduate program. Ferguson taught several large classes last year and is creating new systems to assist managing course planning and projection as well as teaching assistant selection and hiring. An additional lecturer, Tamal Biswas, will join our faculty this fall. Several adjunct faculty continue to provide instruction in introductory and advanced courses.

The new Wegmans Hall, which will house the Institute for Data Science, the Department of Computer Science, and the Department of Chemical Engineering, will add additional lab space for our majors and an auditorium-sized classroom that will be well utilized for larger classes.

Wegmans Hall is scheduled to be completed by late 2016 or early 2017. Along with growing enrollment, we are experiencing increased academic diversity in our computing disciplines. In 2010, we created a more flexible bachelor of arts degree that has appealed to a wide range of students. BA students often start their CSC degree later and are simultaneously completing a double major in an area of financial economics, mathematics, digital media studies, linguistics, or studio arts. In addition, our data science degree, though offered through the Institute for Data Science rather than CSC, requires many computer science courses with an area of specialty ranging from statistics to economics, biology, business, and political science, to name a few.

One advantage of larger graduating classes is an increase in on-campus recruiting. Small classes discouraged some employers from sending representatives. Our students have now benefited from a larger presence of employers on campus and have secured jobs at major tech companies such as Google, Microsoft, Amazon, Apple, Facebook, IBM, and Intel, with Epic, Factset Research, and Cimpres (Vistaprint) also actively recruiting on campus. As our alumni branch out to new companies, we hope to see *them* return to campus to fulfill their hiring demands.

The sudden growth in enrollment has challenged the existing infrastructure and our ability to keep up with advising and providing instruction, but we acknowledge those challenges and are listening to students and working with administration to make changes as needed.



Congratulations to the Class of 2016!

Front row L-R: Christian Djoe, Ryan Lee, John Donner, Gabriel Issa, Fan Jiang, Jinze An

2nd row: Emy Lin, Bram Adams, Isabelle Schmit, Sarah Harari, Yuan Liang, Aleksandra Shanina, Christopher Wong

3rd row: Philip Meyers, Dmitri Ostapenko, Alyson Grealish, Victor Liu, Elias Davis, Rebecca Everson, Luisa Neves, Dan Hassin

Back row: Yibo Zhou, Daniel Harris, Kezhen Chen, Yukun Liu, Binley Yang, Charles Kelman, Wolf Honore, Steve Gattuso

Not pictured: Jamie Alexander, Celine Anand, Jin Chul Ann, Christian Baker, Karina Banda, Edward Barthelemy, Thomas Craw, Lindsey Curtis, Ian Davison, Ian Delbridge, Mitchell Gordon, Matthew Graichen, Catherine Hart, Michael Holupka, Yiping Liang, Thomas Lindstrom-Vautrin, Evan McLaughlin, Bilal Moiz, Zanga Ben Ouattara, Lauren Pien, Tergel Purevdorj, Xuanmei Quan, Feroz Rauf, Katarzyna Ruszowska, Adam Scrivener, Morgan Sinko, Thaddeus Spencer, Peter Stoeckl, Aaron Swerdlow-Freed, Frank Tamburrino, Jack Teitel, Anna Thornton, Jenny Wang, Jeffrey Weeks, Daniel Weiner, Gabriel Werman, Alex Wong, Geyang Yu, Yifan Zhang, Yu Zheng, Lan Zhou

MAKING CONNECTIONS AT THE GRACE HOPPER CONFERENCE



Above: Busy URCS booth at Grace Hopper

Our fall trip to the Grace Hopper Conference in Houston was an incredible networking and community-building experience for all 20 female URCS students, two staff members, and one faculty member—our chair, Sandhya Dwarkadas.

Excitement started building for the students as soon as they were selected in April 2015 to attend GHC. This was a diverse group of CSC women spanning different class years and double majors. Initial meetings were held to get acquainted with other attendees. Later, conference preparation included a résumé workshop, a buddy-up list, and roomie selection. One could see the dynamic evolving, with leaders surfacing to organize the group. But until the actual journey to Houston began, the connections were tentative. With airport layovers, sharing four-person hotel rooms, eating meals together, attending workshops and talks, and sharing both positive and negative career fair experiences during the conference, the students began making positive connections and gaining confidence.

The focus of the networking changed once the students reached the enormous career fair. It was more centered around employers and organizations. One student, Mikayla Konst, made it a high priority to visit the Girls Who Code information booth to learn what she needed to know to introduce a program in Rochester this fall as part of our BRAID outreach. Others navigated through aisle after aisle, booth after booth, to find opportunities to network with recruiters from a range of technical companies. Many of our students were invited to corporate parties in the evenings, where they continued their conversations, hoping to connect with job interviews for internships and full-time



Back row: Mikayla Korst '17, Isabelle Schmit '16, Maria Janczak '17, Joyce Zhu '17, Sarah Harari
Front: Sarah Kingsley '17, Emy Lin '16

“I got to know more about the alumni and actually got enough time to talk to them and listen to their experiences in their companies.”

—Yuan (Aries) Liang '16

employment. Group meet-ups for special interests like Women of Color, Latina Women, LGBTQ, and others helped the ladies interact with those with similar backgrounds and life experiences.

The networking dinner with alumni was perhaps the ultimate opportunity for our students to mingle on a more individual level with people who best understood their journey through URCS. Conversations about River Campus, the department, coursework and especially professors demonstrated that these alumni had walked the same path to graduation and on to successful careers in the high-tech industry.

Upon the students' return to campus, the GHC attendees shared their stories at an event sponsored by UR Women in Computing. They recounted their successes and challenges and their overwhelming enthusiasm for the event.

This October we will be sending 22 students, three staff, and faculty member Michael Scott to the Grace Hopper Conference in Houston. We will once again have a booth for recruiting future graduate students and faculty members. In addition to recruitment, the booth will provide a familiar point of contact and a swag storage oasis amid the chaos and excitement that 15,000 women in computing generate. We hope to make even more life-changing connections once again this year.

Networking with alumni

Of all the memorable moments at the Grace Hopper Conference 2015, our students most often commented that the dinner with our alumni was the highlight. We were lucky to have several local Houston alumni (Bill Scherer [Hewlett Packard], John Mellor-Crummey and Alan Cox [both at Rice University] as well as alumna, both graduate and undergraduate, who were attending the conference, including Robin Miller [Microsoft], Diane Panagiotopoulos [Amazon], Pamela Vong [InfernoRed Technologies], and Adina Rubinoff [Factset]).

In order to maximize the opportunity to spend time with each of the alumni, we rotated them from table to table like a speed-dating event. Though this confused the waiters a bit, students got more time to network with each of them. Violeta Lopez '17 said, "I really liked the alumni dinner because it was intimate, and we got to speak to many of them because there was a rotation." This small group conversation was certainly something that had an impact on our students. Yuan (Aries) Liang '16 commented, "I got to know more about the alumni and actually got enough time to talk to them and listen to their experiences in their companies. That was something we didn't get directly from the conference."

These types of interactions are valuable. We encourage anyone who plans to attend GHC this year to let us know so that we can include you in our 2016 GHC alumni dinner.



Alumni and attendees at GHC 2015:

Back row L–R: Diane Panagiotopoulos '09, Sandhya Dwarkadas, Emily Uhde, John Mellor-Crummey PhD '89, Zahara Razavi, Sarah Kingsley '17, Adina Rubinoff '12, Robin Miller '11, Marty Guenther

Front row: Isabelle Schmit '16, Pamela Vong '08, Alax Cox PhD '92, Yina Jin MS '16, Jean Brownell '16, Nikki Pizzutelli
Not pictured: Bill Scherer PhD '06, Amal Fahah PhD '14

BRAID UPDATE



Attendees at the Braid Summit, Harvey Mudd College, July 2015

As we enter the third year of our three-year commitment to the BRAID Initiative, our efforts to increase our numbers of women and underrepresented minorities in computing have shown significant progress. Chair Sandhya Dwarkadas and Marty Guenther attended the BRAID summit at Harvey Mudd College in July 2015. At the summit, members of the 15 core institutions shared ideas, best practices, challenges, successes, and future plans to increase diversity in technology.

Some of these initiatives are already yielding results for URCS. Our graduating class of 2016 finished with 29.6 percent women. According to this year's CRA Taulbee Survey (<http://cra.org/wp-content/uploads/2016/05/2015-Taulbee-Survey.pdf>), the national average of women graduating with bachelor's degrees from PhD-granting institutions is 15.7 percent. We are on target to graduate 34 percent female in 2017. Through community building, outreach, curricular changes, and recruitment, we hope to see this trend continue so that we may reach our goal of 40 percent female by

2018. We are very grateful to have been one of the 15 universities that have benefited from the support BRAID has provided us and look forward to making a diverse population in computer science ever better. *Meliora!*

“Our efforts to increase our numbers of women in computing have shown significant progress. Our graduating class of 2016 finished with 29.6 percent women.”

LEARN MORE AT

<http://anitaborg.org/braid-building-recruiting-and-inclusion-for-diversity/>

Undergraduate Alumni NEWS



Andy Burke



Ross Camara



Brian Immerman



Jonathan Chen



Jonathan Tomer

Andrews, Peter '09: I moved to Boston to start work at Modo Labs doing backend work for their flagship Kurogo product. It's pretty great! Then this year I got engaged to my long-time girlfriend Heather Manly.

Bernier, John '13: I am no longer working for Lockheed Martin, I am working for Gust, which is a platform for helping start-ups find investors and for investors to find start-ups; you can check it out at Gust.com.

Bhopale Plaisier, Seema '04: I just completed a gig as a course developer for a new bioinformatics course at Bellevue College, a nearby college that will be offering 4-year science degrees for the first time this Fall. A paper that I was a part of is now published in the journal *Oncotarget*. I have also been part of various presentations promoting science to young children.

Bijlani, Rahul '02: I moved from Marcus & Millichap to CBRE: <http://www.cbre.us/o/sanantonio/real-estate-news/Pages/Industry-Leading-Hospitality-Team-Joins-CBRE-Hotels-in-Texas.aspx>

Burke, Andy '03: CTO, Float—<https://hellofloat.com>. We are hoping to close our funding round soon and may be hiring in the near future. If there are alumni in the Los Angeles area who might be interested, please let me know. And lastly, our son Kieran recently turned 1.

Camara, Ross '04: In July of 2015 I left BAH to join Capital One as a senior developer. At Capital One I'm leveraging my UI skills to help lead a team building an internal metadata management product for our big data infrastructure. My wife and I continue to watch our kids M(4) and K(2) grow up faster than ever.

Chen, Jonathan '07: Our daughter Katherine Tianru Chen was born on 7/5/2016.

Dias, Carlos '14: I work for the Pomona Unified School District as a programmer analyst.

Eisenstat, David '06: I graduated with my PhD in May 2014, took a job at Google NYC as a software engineer starting January 2015, and am leaving shortly for Cockroach Labs (NYC start-up making a new open-source database).

Frank, Eric '13: I do machine learning research/engineering for a company called Geometric Intelligence in NYC.

Frankel-Goldwater, Lee '06: I'm starting my PhD in Environmental Studies and Design at University of Colorado, Boulder in the fall!

Undergraduate Alumni NEWS, Continued

Fredrickson, Chris '14: I'm still working at Mathworks, but I was accepted to the Georgia Tech OMSCS program (many thanks to my recommendation-writers!). I'll be starting classes in August and will be following the Computing Systems track.

Frueh, Andrew '03: New job at Health Catalyst. My title is Director of User Experience.

Gondarenko, Alexander '04: I am a Sr. Photonics Scientist in 4Catalyzer.com; it is an incubator for a biotech start-ups.

Horowitz, Daniel '05: I have a 2-yr-old boy named Leo and newborn son Oskar born in June. 1010data was acquired by Advance Publications in Aug 2015 and I'm now SVP Engineering.

Immerman, Brian '04: I can share the exciting news that I got married to Jennifer Topolosky Immerman on 2/6/16.

Hyman, Erica '12: I've been in NYC for two years now, and I work for Two-N, a data visualization agency in Manhattan. Two-N is always on the lookout for talented developers. Check out www.two-n.com if you're interested or want to see some of what I've worked on.

Kayastha, Christina '14: I'm working at Cimpres, Inc. I'm going to be presenting at the Grace Hopper Conference this year; my talk title is "Hack It Till You Make It."

Keesom, Jeff '08: I currently work for Lockheed Martin as a Data Analytics Project Lead in the Analytics Center of Excellence. I

lead data analytics efforts for senior leaders in the Mission Systems & Training (MST) business area of the company. I am very excited to see Rochester investing so heavily in data science.

Kim, Brian '04: I am working at Google in Mountain View, CA.

Laird, Edward '08: I'm currently employed by Randstad Technologies, contracting for Vanteon Corporation as an embedded software engineer.

Lander, Sean '08: No announcements, but change of employer to Self-employed, Co-Founder Phinlander LLC. Expecting some cool good news in the coming year but for now just getting along.

Linsky, Kenny '05: I'm now working at Work Market as a Senior Software Engineer.

Lu, David '07: After I finished up a year and half of teaching at Washington University in St. Louis and doing robotics contract work, I moved to Pittsburgh and started work as a Robotics Scientist at Bossa Nova Robotics, programming robots that scan retail stores to find products that are out of stock. I've attached a picture from the play I helped put on last year with the WashU Performing Arts Department, which included a PR2 robot I programmed as one of the four main actors.

Luis, Cristina '01: In November I started working as a systems developer for MKonline, my first job as a programmer since graduating fifteen years ago. :-). Marriage: Melissa and I were married at Clara Barton Camp in North Oxford, MA, on October 10, 2015. Baby: Melissa gave birth to our son Lukas Haakon Trout Luis in Norway on August 1.

McCarthy, Eric '03: I'm still working for DesertNet in Tucson, Arizona. In my spare time the past year or so I've been co-organizing TucsonJS, a Meetup for local JavaScript developers. I also just got engaged to my girlfriend, Rebecca!

McClosky, David '04: I joined Google NYC in February and (as a result) am moving to NYC.

Meeker, Brian '07: I had another daughter on April 3, Olivia Elizabeth Meeker. She joins her sister Emily (3).

Meisner, Eric '03: I've moved to CA to work at Google in the Geo/Maps division. I'm hoping to move to the NYC office in the not too distant future.

Melnick, Sara '11: I'm currently finishing up a Masters degree in Deaf Education at Teachers College, Columbia and student teaching (middle school science) at The Learning Center for the Deaf in Framingham, MA.

Moldover, Jonathan '99: I work at Smule in San Francisco (www.smule.com) as a senior programmer making music apps (Karaoke!).

Pawlicki, Josh and Edith Hanson Pawlicki '12: welcomed twin boys, Gil and Caelum, July 2, 2016. Edie is teaching at Redmond High School, and Josh is at Google, Kirkland, WA. Marty adds that Ted Pawlicki couldn't be a prouder grandpa.

Pershing, John (Jake) '10: My employer, 1010data was acquired last August, which was very exciting. We are now part of Advance Publications. The acquisition went really well; very little has changed on the ground, but we're growing even faster than before! My team has doubled in size recently!

Cristina Luis



David Lu programmed the "actor" at right



Pincus, Joshua '99: My current employer is Wind River Systems, though it will soon be Intel Corp.

Ramsay, Robert '10: I am now working at Turn 10 Studios (Microsoft). My wife and I made the move to the Seattle area back in August, and I'm finally achieving my dream of working in the game industry. It's some of the most fulfilling work I've ever done and I absolutely love it. The culture here at Turn 10 is just wonderful—I'm finally able to ditch the suit and wear jeans and a t-shirt to work every day! It's a lot of work, but it sure as heck beats making websites for the government!

Richardson, Andrew Keenan '11: I am now a contractor working multiple jobs. I am a founder at Mob Made Games and a contractor at Disney Imagineering R&D. I also do NLP research at Ozora Research.

Riffle, Mike '07: I got married in May to Mary Fegreus. I am now working for Stashimi, Inc as Lead Cloud Services Engineer. I'm up to 8 audiobooks on the Audible store, and my band The Alarmed released our second EP this summer.

Ross, Andrew (Dru) '04: I am still in NYC but left Barclays earlier this year, and now I work for the National Futures Association (NFA). It is an industry regulator. I am a currently a compliance examiner for Swap Dealers that trade over-the-counter (OTC) derivatives. It's a pretty young division so it should be interesting.

Sankel, David '02: I got a new job at Bloomberg and my wife, myself, and our five children are moving to NYC this summer. Also, since my last update, I've gotten involved in the C++ Standardization Committee and have been working hard to push that language forward to the future!

Senator, Ethan '15: I'm working as a software engineer at Leidos.

Steinberg, Justin '09: I'm now an Assistant Professor of Dentistry at Touro College of Dental Medicine at New York Medical College.

Stratos, Karl (Jang Sun Lee) '11: I defended my PhD thesis titled "Spectral Methods for Natural Language Processing" at Columbia University on June 8. I'll be research scientist at a new NLP and machine learning team at Bloomberg L.P., starting in August.

Tilton, Michael '08: I got engaged at the top of Machu Picchu in March during a weeklong vacation in Peru.



Michael Tilton



Karl Stratos



Brian Meeker



Mike Riffle

Tomer, Jonathan Klabunde '04: Arden Felix Tomer was born August 5, 2015, and has been brightening our lives ever since.

Weingarten, Tom '06: I'm now leading the DNS team at Google, part of the Google Cloud Platform (and we also do Google Public DNS). We're hiring rapidly :)

Williams, Jonathan '05: I'm working as the director of engineering for Bandwagon. www.bandwagon.io.

Wong, Chi '99: For 2016 I started the year by doing my own thing. I am focusing on providing cyber security services to businesses. My website: <https://nforcesolutions.com>. I'm taking this year to reflect and build my brand.

Wood, Lauren '03: I have a new job, effective August 2015: IBM, Littleton, MA.



HAJIM

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MELIORA WEEKEND
• 2016 •

DON'T MISS OUT!

If you graduated in a year that ends in 1 or 6, please join us Meliora Weekend, **October 6, 3:30–5:30 p.m.**, for the **Computer Science Undergraduate and Graduate Reunion Open House** in room 601 of the Computer Studies Building.