

MULTICAST

THE DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF ROCHESTER



Founding Faculty Retires

Brown with Department for 40 Years



HAJIM
SCHOOL OF ENGINEERING
& APPLIED SCIENCES
UNIVERSITY OF ROCHESTER

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*Brown honored by
Dean Robert Clark and
Edmund A. Hajim '58
at the Hajim School
Commencement ceremony
this past May.*

Christopher M. Brown Retires

Chris Brown, “CB” to many of his colleagues, retired on June 30. He was one of the founding members of the Department of Computer Science and is the first to retire since it was started by Jerome Feldman in 1974.

Brown began his academic career at Oberlin College where he earned a BA in philosophy, focusing on linguistics and the new field of artificial intelligence, in 1967. He received his PhD in information sciences from the University of Chicago in 1972 for work on robotics and machine vision and did postdoctoral research at the University of Edinburgh from 1972 to 1975. He joined the new Department of Computer Science at Rochester in 1975.

In his four decades with the University, Brown’s research touched nearly every important area of computer vision, and

many others in robotics as well as in the broader field of artificial intelligence.

With Dana Ballard, Brown founded the Computer Vision Laboratory, which became a seminal institution in the then new field of machine vision. Together they published *Computer Vision* (Prentice Hall, 1982), that was for many years a defining text of the field. The laboratory pioneered the concept of active vision, which is now central to the field, and created the world’s second binocular robot head (and the first fast one) to study how the human ability to saccade (move the high-resolution center of vision rapidly between points of interest) might provide a model for effective use of computer resources for visual tasks.

Early in his career at Rochester, Brown and his colleagues secured a series of multimillion-dollar block grants from the

Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation. These grants were instrumental in building the infrastructure and continuity that allowed the department to become a world-class research institution. He served as chair from 1983 to 1987 and has provided continuous leadership on several core committees with special attention to both graduate and undergraduate curriculum development.

Brown served as primary supervisor for 16 doctoral students, including Rick Rashid, now senior vice president for research at Microsoft, and Yiannis Aloimonos, currently at the University of Maryland and a leader in computer vision. He supervised several postdoctoral fellows, including Kyriakos Kutulakos, now a senior professor at the University of Toronto.

“CB believed in us and then left us alone to do what we wanted. That’s what made us (the Mabel team) win. That’s what made at least three of us earn advanced degrees after we left. Right now, I am an assistant professor at a research institution. And I can tell you, when a group of young students with too little experience and too much enthusiasm come knocking at my door with a crazy idea, I think of my friend and mentor CB and give them a room, a robot, and the freedom the follow a crazy path. It was the best gift that I got from CB and the one that I’m most eager to pass on.”

—Dave Feil-Siefer '03 (member of Mabel, the Mobile Table Team), USC PhD '12, Assistant Professor, University of Nevada–Reno.

Brown has published more than 100 papers in peer-reviewed outlets and 18 book chapters in addition to Computer Vision.

He is a member of the Association for Computing Machinery and the Cognitive Science Society. Throughout 40 years at Rochester, he served on countless program committees, editorial boards, and grant review panels, operating at the center of the international computer vision community.

An enthusiastic teacher, Brown created many graduate and undergraduate courses in machine vision, robotics, and artificial intelligence, as well as the department’s foundational data structures and advanced programming classes. An undergraduate team he supervised built “Mabel the Robot Table,” a mobile service robot that won Association for the Advancement of Artificial Intelligence (AAAI) robot competitions in Edmonton, Alberta, and Acapulco, Mexico. He earns exceptional praise from his students for patience, encouragement, practical advice, and not taking himself or his field too seriously.

Brown is famous (or infamous) for quirky advice and memorable quotes, including

- “You have to be conservative with these bloody computers. I’m growing to hate them cordially as I grow older.”
- “Never use a piece of prose only once.”
- “If anything in life troubles you, roll a Gaussian over it!”
- “You don’t want to see symmetry out there in the jungle. It means someone’s looking at you.”
- “Textbooks are [manure]; they’re written by people like me.”



Brown has a wide range of interests outside of computer science. He plays (or has played) trombone, banjo, classical guitar, and electric bass. As part of the department band, the Algo-Rhythms, he has, for the last several years, serenaded the department’s graduating classes with irreverent lyrics to great acclaim. He was visible on campus daily with his noontime run and annually at Rush Rhees Library’s Halloween Scare Fair, reading Poe’s “The Raven” while dressed as Dracula.

He spent two seasons in summer stock on Cape Cod and continues to be active in community theater, especially with the Gilbert and Sullivan troupe the Off-Monroe Players. He crossed the Atlantic in the USA Bicentennial Tall Ships Race in 1976 and was

third in his age group in the 1981 Rochester Marathon. He retired from the Computer Science Hockey Club early on as a danger to himself and others. Brown is known as a brewer, bicycler, cigar smoker, and stalker of the wily stag.

As a researcher, teacher, and inspirational leader as well as a colleague with wide-ranging interests and knowledge, unexpected talents, and a wry sense of humor, Brown will be sorely missed.

Not quite that fast though—in various roles, CB will likely remain around the department for a good while to come.

Computers Facilitate Conversations



by Ehsan Hoque

In 2011, I attended the Asperger Association of New England (AANE) conference to demonstrate technology that can understand and respond to human emotions. The audience was amazed by how reliably computers could recognize human nonverbal cues. Notably, one gentleman came up to me and asked if we could make this innovation more useful to people. He had been diagnosed with Asperger syndrome, which is a mild form of autism. He said, "I have difficulty making eye contact with people. Sometimes I end up monologuing to people without realizing it. I would love to get some help. But I fear social stigma." He wondered if we could find a way to repurpose our algorithms to help his communication skills in a confidential and respectful way. "It could potentially transform my life and that of many others like me," he said.

There are two key elements in the above scenario: first, a person who desires assistance in improving his or her social skills and, second, the limitations—such as lack of resources, logistical obstacles, and social stigma—that impede their ability to obtain the personalized support and/or training they seek.

It sounds counterintuitive. Yet in 2013, we developed MACH, an autonomous humanoid agent that can respond to and provide feedback on a user's vocal and visual nonverbal behavior at a job interview. At the same time, it could also help a user improve his or her face-to-face conversations beyond the job interview.

Our findings flew in the face of the assumption that computers are incapable of helping with such human skills. We completed a rigorous randomized and controlled study of 90 participants. All of them were tested in face-to-

Figure 1: The MACH system works on a regular laptop, which processes the audio and video inputs in real time. The data is used to generate the behavior of a three-dimensional character that interacts with participants and provides feedback.

face interactions before and after their interaction with the computer to establish our findings. Our work marked a significant scientific advance in perceptual and affective computing by yielding the first scientific evidence that it is possible for humans to improve their interpersonal skills by interacting with a computer.

Within five months of publishing our initial report in July 2013, we received responses from more than 2,500 people, all sharing personal stories about problems they had experienced in social interactions. These responses suggested new ways of thinking about our work and presented possibilities for designing personalized, respectful, and automated

interfaces to help people improve nonverbal communication skills in multiple social scenarios—scenarios that include public speaking, customer service and sales, communication for healthcare professionals, learning a new language, overcoming social difficulties, and more.

ROC Speak: an online platform to practice public speaking

Recently, we have developed an interface that is ubiquitously available through an Internet browser, allowing individuals to practice public speaking in a private, respectful, and standardized manner.

An example scenario:

The following example (figure 2) outlines how a user interacts with our system.

- An Internet user opens a web browser and navigates to our application at www.rocspeak.com.
- Before starting, the user is given the choice to practice in normal mode or private mode. (Private mode allows users to practice without storing any audio or visual data beyond the duration of the session.)
- Once the user chooses to proceed, the system asks for the user’s permission to enable his or her webcam and microphone.
- The user then begins practicing his or her speech, clicking on the “Stop Recording” button to upload and begin analysis of the recording.
- Our sensing framework in the server looks for features like smile intensity, body movement, loudness, pitch, speaking rate, volume modulation, and word prosody.
- With the user’s consent, the framework can create a task on the Amazon Mechanical Turk website, where anonymous “Turkers” can view and rate the video based on various behaviors. It is possible to share the data privately with “trusted circles” if one doesn’t want to share data with Turkers.

- Soon, the user is provided with synthesized behavioral data that includes machine-sensed nonverbal data coupled with the Turkers’ most constructive interpretations and recommendations.

Technical challenges:

Automated modeling of the full range of human nonverbal behavior remains a challenging endeavor. Solely by using the 43 muscles in our face, we can produce more than 10,000 unique combinations of facial expressions. Modalities like vocal tone, body language, and physiological elements add to the complexity. While further research has allowed us to recognize basic expressions like smiling and frowning, the automated interpretation of human expressions remains an active area of exploration. (For example, a smiling customer does not necessarily indicate that he or she is satisfied.) This demonstrates a current limitation on the utility of technology built to detect human expressions.

In our research, we introduce a

new technique to harness human insights, semi-automating the process of interpreting raw, machine-sensed nonverbal behavior. Our primary motivation is the observation that, while computer algorithms can consistently and objectively sense subtle human behavior, human intelligence is superior at interpreting contextual behavior. Therefore, we see an opportunity to allow computer algorithms to perform the sensing portion while outsourcing the interpretation process to humans. This allows us to develop a semiautomated behavior analysis system. To instantiate our approach, we developed an online framework that can automatically record and analyze videos and later provide data-driven feedback to the users. Our framework allows users to share their data with Turkers or social network connections for subjective interpretation of their nonverbal behavior. Our system automatically prioritizes the Turkers’ comments and presents users with those that are most helpful and constructive.

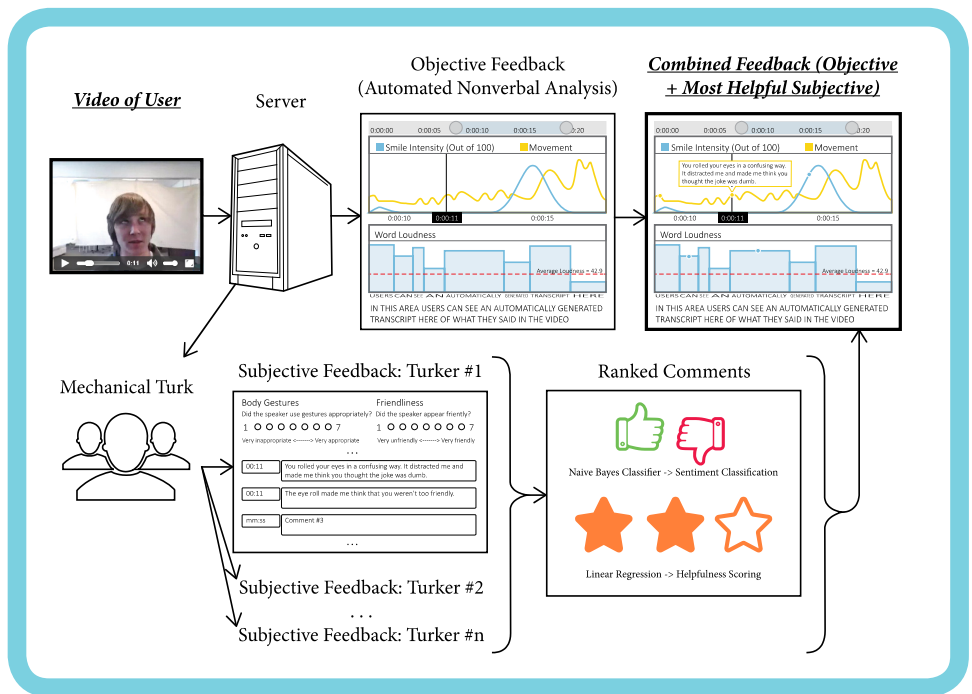


Figure 2: An overview of our system. Once the user finishes recording, the video is analyzed on the server, producing objective feedback, and sent to Mechanical Turk for subjective feedback. The objective feedback is combined with the subjective feedback, which has been scored and classified based on helpfulness.

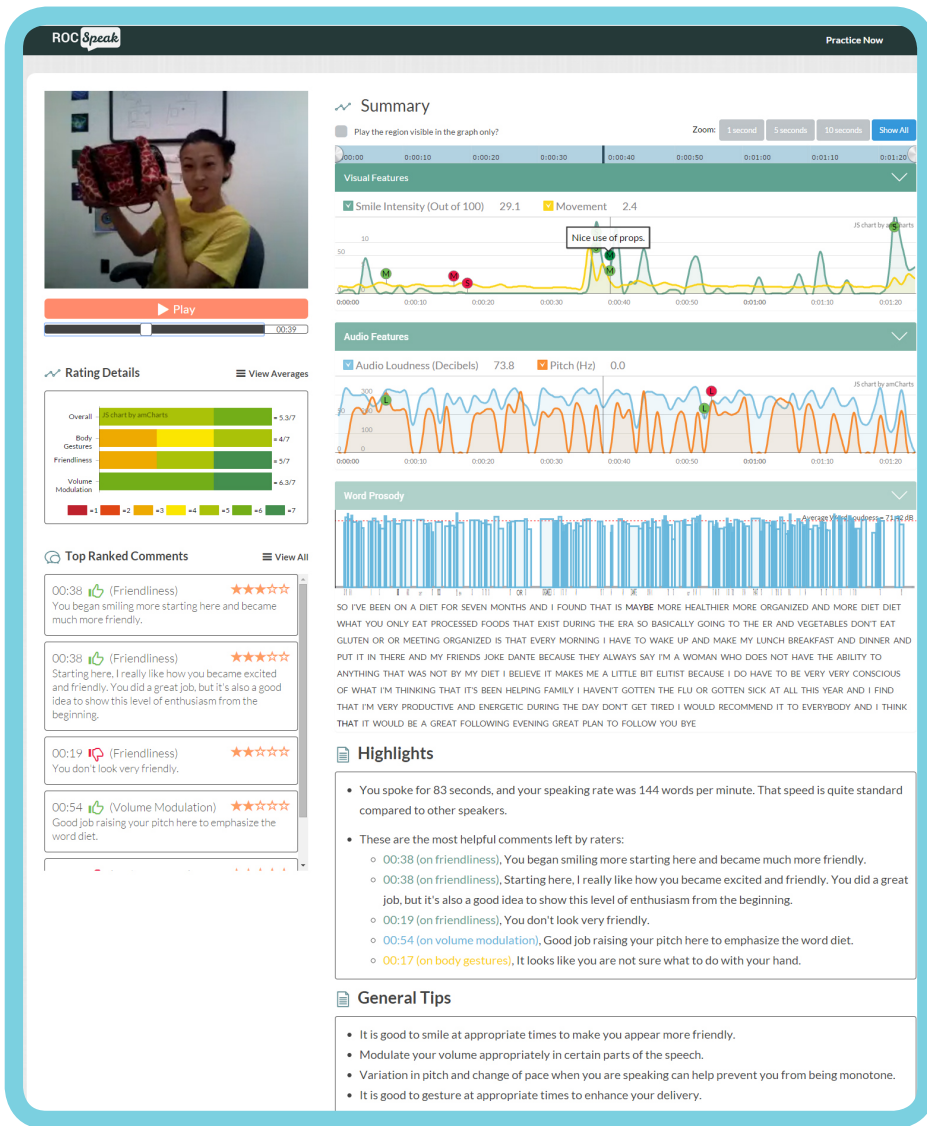


Figure 3: Crowdsourced comments and ratings and machine-generated automated feedback are displayed on the same interface. Users can hover over the color-coded markers on the graphs to see the time-stamped comments and zoom in on the graphs to see the machine-sensed nonverbal behavior in detail. The example feedback page shown here can be seen live at <http://tinyurl.com/feedback-ui>. (Currently, this interface is supported only in Google Chrome.)

Feedback

When the user loads the feedback page for the first time, the visual features, audio features, and word prosody graph panels are collapsed by default to avoid overwhelming the user with information. When the user is ready to explore the graphs, he or she may open them.

Embedded comments in graphs

The graphs of audio and visual features are annotated with markers, color-coded by classified sentiment. (Red indicates negative sentiment, and green indicates positive sentiment.) The markers are placed at the original time that the rater

commented. When the user hovers over the marker, the comments appear. This allows users to explore comments in the graph as the video is playing.

Human ratings

The subjective ratings for the four categories—overall, bodily gestures, friendliness, and volume modulation—are shown on the left using two different representational styles. One view shows only the averages in a simple radar chart, while the other shows a detailed, color-coded distribution of ratings. In the latter representation, green indicates better performance.

Ranked comments

The most helpful comments for each category are featured in the highlights box. On the left, users can toggle between viewing all comments and viewing only the top-ranked, most helpful comments. Our linear regression model determines the comment helpfulness score by looking at both the textual features and the audio-visual features that are extracted from the recorded video. This helpfulness score is expressed to the user on a five-star rating scale. Comment sentiment is indicated with a colored thumbs-up or thumbs-down image. Users can click on the comment time to go to the corresponding time in the video and graphs.

Though we have validated our prototype in the context of public speaking, there are other areas in which our system could be used. As an automated sensing platform that can generate social cues and record fine-grained continuous measurement autonomously, this system can be deployed outside of the lab or school. This will increase both the quantity and quality of data inexpensively and unobtrusively impact areas like mental health and behavioral assessment. The most exciting part of this technology is that it gives users control, affording them an opportunity to improve their interaction skills.

. . . user responses suggested new ways of thinking about our work and presented possibilities for designing personalized, respectful, and automated interfaces to help people improve nonverbal communication skills in multiple social scenarios—scenarios that include public speaking, customer service and sales, communication for healthcare professionals, learning a new language, overcoming social difficulties, and more.

2014–15 IN RETROSPECT



Sandhya Dwarkadas
Chair of Computer Science

This 40th anniversary year for the computer science department has been truly eventful and memorable, heralding many changes, including several new faculty hires, our first faculty retirement, a new staff recruit, a staff retirement, a burgeoning undergraduate enrollment, an increasing graduate (master's and

PhD) enrollment, new interdisciplinary programs, and the announcement of a new building to house the new institute for data science as well as the computer science department.

Four faculty members have joined our ranks this last year, broadening our research coverage in several areas. John Criswell earned his PhD from the University of Illinois at Urbana–Champaign and focuses on software security in his research. Philip Guo did his PhD at Stanford University and joined us after spending a year on sabbatical at MIT. His research is in the area of online cooperative learning. Ji Liu joins us from the University of Wisconsin–Madison and works on core machine learning with a focus on asynchronous algorithms. Tom Howard did his PhD at Carnegie Mellon in the area of robotics and joined us after his postdoctoral stint at MIT. As you can see, each of the new hires adds unique strengths to our department. They have already received affirmation on the quality and direction of their research: our department was one of only two nationwide to receive three National Science Foundation (NSF) CISE Research Initiation Initiative (CRII) awards. The CRII program was initiated for the first time last year, offering awards to faculty in their first two years of an academic position. John Criswell also received the 2015 David J. Kuck outstanding dissertation award at UIUC, as well as an honorable mention for both the 2014 ACM doctoral dissertation award and the ACM SIGOPS Dennis M. Ritchie doctoral dissertation award.

This year, 2015, also saw our first faculty retirement: Chris “CB” Brown. CB was a founding member of the department and has a long and dedicated history of service to the University. We expect to continue to be able to draw from his wit and wisdom, as he plans to remain in Rochester. A retirement party in his honor is planned for Meliora Weekend.

Our bachelor's program continues to grow in popularity, with 100 students in the entering Class of 2019 declaring computer science as their interest. Driven by the belief that diversity drives innovation, we are also participating in what is called the BRAID initiative. Our goal is to broaden participation in our program by groups typically underrepresented in computer science through both curricular reform and community building via peer networking opportunities. The BRAID initiative is spearheaded by Maria Klawe, president of Harvey Mudd College, who put it well when she said, “I want computer science and technology to be a world that embraces everyone who has passion, ability, and interest, whether they look like the dominant group or not.”

Our first year of tracking our cohort of women students has been encouraging, with numbers for the 2017 graduating class crossing 30 percent.

We introduced new interdisciplinary programs in data science, computational biology, and computational linguistics this last year, with another potentially focused on biomedical data science in the wings. We also welcomed Niki Pizzutelli last November as our new graduate coordinator. She replaces JoMarie Carpenter, who retired on July 31, 2015. Niki will be coordinating both our growing MS and PhD programs.

Among our alumni, Rick Rashid and Avie Tevanian received the ACM Software System Award in recognition of their work on the Mach operating system. Rick also received an honorary degree from the University of Rochester.

Last but not least, we were in the throes of working with the architects of the new Wegmans Hall, which will house the newly created Goergen Institute for Data Science as well as the Department of Computer Science. My office is a great vantage point for watching the construction.

We hope to see many of you here over Meliora Weekend to witness all this activity first hand and to participate in Chris Brown's retirement party!

Graduate Alumni NEWS

Altman, Art MS '87—Art has retired from his management position at the Electric Power Research Institute (EPRI) in Palo Alto, California, where he was responsible for research in financial analytics for energy companies. He has moved to New York City and is engaged full time in his lifelong hobby of portrait photography! Check Facebook for samples of his portfolio.

Bianchini, Ricardo PhD '95—was named a Fellow of the IEEE.

Luciw, William MS '89—I recently accepted the position of Principal Product Manager at Amazon Lab126. Previously, I was Senior Technical Product Manager at LG Electronics, Silicon Valley Lab. Prior to LG, I ran a Silicon Valley consultancy developing mobile applications primarily for startups. For example, I developed the MVP iPhone app for fitmob, which was used to secure their initial funding. I've also developed fundamental IP (U.S. Patent issued) for the Internet of Things (IoT) in the area of semantic caching for device and service composition. After UR, I worked for the

Apple's Advanced Technology Group and ultimately shipped the Intelligent Assistant for the Apple Newton, a forerunner of Siri (among others).

Mayer, Jim MS '83—I retired in 2015 and spend my time either rowing or eating sushi.

Michael, Maged PhD '97—At PLDI '14 (Programming Language Design and Implementation) held in Edinburgh, Scotland, in June, Maged Michael received the “Most Influential Paper Award” for his work from 2004 at IBM TJ Watson Research Center. Michael Scott, who supervised Maged's PhD while at Rochester, had the pleasure of being in Edinburgh to watch him receive the award.

Ringger, Eric PhD '00—Has moved from BYU in Utah and will be a research scientist at Facebook in Seattle.

Shriraman, Arrvindh PhD '11—married Medha Satish Kumar on July 6th in Chennai, India.

Stent, Amanda PhD '01—I'm managing an NLP group in the New York Lab at Yahoo Labs, just off Times Square. Visitors welcome!

Thakur, Mayur PhD '04—After spending almost 8 years at Google, I recently moved to Goldman Sachs in New York. Anu and I also became parents for the second time—Avi was born last year and is now a naughty one-year-old.



Mayur Thakur's children

Van Durme, Benjamin PhD '09—Starting next year I will be an Assistant Professor at Johns Hopkins University in CS. Both a big and a small move.

JoMarie Carpenter Retires after more than 20 years

JoMarie Carpenter retired in July after more than 20 years at the University and 19 years working in the Department of Computer Science, most recently as the graduate coordinator. When JoMarie joined the computer science staff, she was the chair's secretary, first for Michael Scott and then for Mitsu Ogihara. Upon the retirement of Peggy Meeker in 2007, JoMarie assumed the role of graduate coordinator, where she has worked on graduate recruitment, admissions, and graduate curriculum committees. She has

seen many classes of graduate students complete their master's degrees and their PhD degrees.

JoMarie says she'll most miss the students after she retires, but she plans to be busy with many activities on her bucket list. Highest on the list is some travel and spending time with her family.

We welcomed Nicole Pizzutelli (Niki) as the new graduate coordinator in November. Niki comes with a background in student services, has traveled and studied abroad, and brings her boundless

energy to the position. Our expanding master's program and our Women in Computer Science initiative are keeping her quite busy. She hopes to recruit and retain more female students into our PhD and master's degree programs.

If you are an alumnus/alumna, please update your contact information (current home address, employer, and email) so we can keep our database current. Email URCSDALum@cs.rochester.edu.

JACK VEENSTRA

The department notes with great sadness the passing of Jack Veenstra, who died January 7, 2015, at the much-too-young age of 53.



Jack received his bachelor's degree in math and computer science from Calvin College in 1983 and his MS in computer science with a concentration in computer vision from UIUC in 1986. After two and a half years at AT&T, he joined the department at Rochester in the fall of 1989, where he pursued his PhD in parallel computing under the guidance of Rob Fowler. Among other things, Jack's thesis included a detailed evaluation of the update-then-invalidate cache coherence protocol of the first-generation DEC Alpha multiprocessors.

After completing his doctorate in 1994, Jack worked at a succession of leading-edge Bay Area companies, including SGI, SandCraft, Sun, Google, and Ooyala. A survivor of Hodgkin's disease as an undergraduate, Jack succumbed to leukemia this year. A devoted family man, he is survived by his wife, Laura, and their children, Brianna, 13, and Jason, 10.

He will be greatly missed.

Rick Rashid's

Ever Expanding Horizons



RICK RASHID '77 (MA), '80 (PHD)

Rick Rashid was in the first PhD class in the University of Rochester's Department of Computer Science, having

been intrigued by an offer from the founding chair, Jerry Feldman. Rashid had just graduated with honors in mathematics and comparative literature from Stanford University and had a good offer in hand for PhD studies at Berkeley.

At Rochester, Rashid worked on artificial intelligence, operating systems, networking and multiprocessors, and networked computer games, taking advantage of URCS's then unique ownership of powerful networked computers. As a professor at Carnegie Mellon University, he directed and developed influential systems for distributed personal computing, including Mach, an operating system that survives today underneath many commercial computer and mobile-device operating systems.

Rashid was recruited to create Microsoft Research in 1991, and he directed it and its various global operations from 1991 to 2013.

He has an impressive collection

of highly placed professional responsibilities, awards, and honors. He is a trustee for the Anita Borg Institute for Women and Technology. In 2015, he received an Honorary Doctorate from the University of Rochester and participated in Commencement activities throughout the weekend in May. Our editor recently interviewed Rashid.

Ed.: You joined the board of the Anita Borg Institute in 2004 and became involved in the effort to increase the number of women in computer science. URCS is part of the BRAID program to increase diversity in the tech industry thanks to generous corporate backing. In the event the diversity numbers increase in the enrollments in undergraduate and graduate programs, what needs to happen to make the industry environment more suitable to retain them?

RR: Actually, I joined ABI in 2003, and I'm just finishing up my 12th year on the board! Achieving gender diversity in the technology industry has been a frustrating problem at each level of the pipeline. The BRAID program holds promise, I believe, in bringing more young women into the field, but we also need to do a better job keeping technical women in the workforce both in industry and academia. There

are many efforts ongoing within the field to address the reasons women leave the workplace, and those are extremely important, but, frankly, just the act of getting more women into technical disciplines will have a huge positive effect on its own. We know that women are more likely to stay in a workplace that has significant female representation and that groups managed by women hire more women and retain them better. If programs like BRAID are successful, they will go a long way toward addressing the problem of diversity.

Ed.: You received the 2014 ACM Software System Award with fellow Rochester alumnus Avie Tevanian. This award was 30-plus years in the making, as the technology was developed while you were at CMU. Is it unusual in this ever-changing technology world that a 30-year-old development like your Mach system would still be so widely used in commercial applications like iOS mobile devices and in personal computers such as OSX? What about Mach makes it timeless?

RR: If you told me 30 years ago that the code I was writing would eventually be running in over 100 million cell phones, I would have had to inquire what a "cell phone" was! I think there were two key properties of Mach that led to its success

Featured Graduate Alumnus



*Rick Rashid enjoys a hike
near Big Sky, Montana*



Rick Rashid '77 (MA), '80 (PhD) and Avie Tevanian '83 (BA) and spouses receiving the ACM Software Systems Award.

and longevity. First, it was an operating system “kernel” which we envisioned could emulate the “personalities” of many other operating systems. While at CMU we built implementations of DOS/Windows, Unix, and MacOS on top of Mach. This flexibility meant that it could adapt itself to many environments. In fact, Mach ultimately became the first 64-bit implementation of Unix (in the form of OSF/1, Digital Unix, and Tru64 Unix) and the basis for MacOS X. Second, Mach was built to be very hardware “agnostic.” We supported many different kinds of uniprocessor and multiprocessor systems and pioneered the idea of machine-independent virtual memory management. That allowed Mach to be ported to an enormous variety of machines and, ultimately, to be adaptable to even very small devices like the first iPod Touch.

Ed.: In your recent visit to Rochester during Commencement weekend 2015, you reminisced about your experiences as one of the first PhD students in URCS D in the mid-1970s. The department was just getting started, with no computing equipment, only five young faculty—like your advisor, Chris Brown—and a newly established PhD curriculum. Was the free form of this environment a creative catalyst for you? Is the current structured curricular approach in computer science education producing the same kind of

results as the collaborative young department circa the 1970s?

RR: I think I thrive in “startup” environments. At the University of Rochester we were starting a new department. When I went to CMU I had to establish a whole new area around networking and distributed computing. Microsoft Research was another “start from the ground up” opportunity for me. I do think you have a lot of creative freedom in those kinds of

situations. That said, you also have unique challenges. We literally had to build some of our own computer equipment back in my University of Rochester days. For example, I designed and wire-wrapped the memory management board for our Data General Eclipse computer. We built our own software and tools from the ground up. I can’t say there was a lot of time for socializing!

Ed.: What has been your biggest challenge as director of Microsoft Research?

RR: The biggest challenge I faced starting Microsoft Research was finding and hiring the right people. Research is a human-powered enterprise, and, if you don’t have the right people to start, you will not be able to build a great lab. In those days Microsoft was small and not well known in the academic community. It was located in the Pacific Northwest, which was not seen as a great place for a research lab back in those days. I had to sell an idea without anything to show for it. I still feel extremely lucky in finding the right group of entrepreneurial researchers who were willing to take a bet on me and the future. Once we had the right starting team and showed the world what we could do (we had more than 25 percent of all papers in the 1996 SIGGRAPH conference), recruiting got a lot easier!

Ed.: Since you were one of the first trained computer scientists and have been an important part of this tech boom for more than four decades, can you pinpoint any events or products that surprised you with their success or failures?

RR: I’m constantly surprised—not so much by technology itself, as it is not that hard to see at least a few years into the future if you work in a research environment—but by what people do with technology. We did a great video for a conference back in the mid-1990s where we talked about the “information superhighway,” and it’s fun to watch today to see how much of it became true. That said, the impact of social media on society could be hinted at perhaps but not predicted. I often say that scientists and engineers create the raw material for the future, but people and society use that raw material and shape it to create the future.

Ed.: What sort of personalities will drive the next big wave in technology?

RR: People with optimism, energy, drive, and an ability to fail without becoming failures are the ones who seem to succeed.

Ed.: With all the travel and work commitments you have, where do you choose to put your energy and time when you take a relaxation break?

RR: My wife and I do a huge amount of trail running. She’s an endurance runner, and the best I can do competitively is a marathon, but we love getting out together in the mountains running on trails that go well up into passes and mountain basins where you are unlikely to encounter anything that can talk. I also enjoy learning new skills when I have the time. A couple of years ago my wife and I learned to fly airplanes, and that was a lot of fun. My general feeling is that it **is** important to keep expanding your horizons no matter what your age or position in life.

NAAACL

UR Language Contingent Reunites



The University of Rochester has a long history of computational linguistics, with professors James Allen, Len Schubert, and Dan Gildea advising numerous graduate students. Each year, at annual conferences for the North American Association for Computational Linguistics (NAAACL), a contingent of past and present students and faculty gather for the yearly photo. This year's conference in Human Language Translation (HLT) met in Denver, Colorado, in early June.

Pictured in this year's photos are

Front row: Karl Lee Stratos (BS '11, now PhD candidate at Columbia; Iftekhar Naim, current PhD student; Jason

Eisner (former Rochester faculty, now at Johns Hopkins); Mayur Thakur PhD '04 (now at Goldman Sachs); current PhD students Nasrin Mostafazadeh and Omid Bakhshandeh; Joel Tetrault (PhD '05 now at Yahoo); Charley Beller (BA LIN '06).

Back row: Daniel Gildea (faculty); Tagyoung Chung (PhD '13 now at Nuance Communications); Jonathan Gordon (PhD '14 USC Information Sciences Institute); Ben VanDurme (BS '01, PhD '09, now at Johns Hopkins); Matt Post (PhD '11, now at Johns Hopkins); Frank Ferraro (BS '11, PhD candidate at Johns Hopkins); Eric Ringger (PhD '00, now at Facebook in Seattle).

RECENT PHDS

Erin Brady

Social Microvolunteering: Quick, Free Answers to Visual Questions from Blind People

Indiana University-Purdue University, Indianapolis IUPUI

Amal Fahad

System and Application Level Techniques for Limited Resources Environments

Microsoft, Redmond, Washington

Walter Lasecki

Crowd Agents: Interactive Intelligent Systems Powered by the Crowd

University of Michigan Computer Science and Engineering Faculty

Li Lu

Designing for the Simple Case in a Parallel Scripting Language

Hortonworks

Konstantinos Menychtas

Fair, Protected OS-level Scheduling for Fast Computational Accelerators

Google

Yu Zhong

Enhancing Visual Information Access Techniques for Blind Users on Mobile Platforms

Google

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"URCSD Alumni"
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and Facebook**





UR Women in Computing

They say timing is everything in life. Last summer at the CRA's biennial meeting for computer science chairs at Snowbird, Utah, our recently appointed chair, Sandhya Dwarkadas, responded to Maria Klawe's (president of Harvey Mudd College) offer to help any department interested in improving diversity in its student body. This effort would tackle the problem of the low numbers from underrepresented groups (women and minorities) both within the tech industry and in academia. Klawe promptly arranged for corporate sponsorships from Google, Microsoft, Facebook, and Intel for a limited number of member schools. Within days, the new BRAID (Building Recruiting and Inclusion for Diversity) initiative was born, and the University of Rochester was fortunate to be one of a handful of early participating institutions.

This initiative coordinated well with University and Hajim initiatives including recruitment and retention of women and underrepresented minorities. The BRAID initiative gives us not only additional funding but also motivation, resources, and inspiration to achieve these goals.

Four main target areas have been identified for improving the gender and minority balance within BRAID and at URCS. Curricular improvements, innovative recruiting efforts,

outreach to K–12 for students and teachers, and creation of a welcoming culture. At Rochester, we have focused on two of the four target areas in 2014–15. First, we have made many curricular changes in the past decade, including the design of a more flexible BA and use of collaborative workshops. More recently, we have added or redesigned courses in human-computer interaction, web development and design, mobile app development, and data science. We will continue to look at other innovations that make courses appealing to a broader group of students.

Our second focus this year has been to connect our women within CS. To help with confidence and culture, the funding from BRAID enabled us to send 14 women to the Grace Hopper Conference in Phoenix in fall 2014. This was a huge success! Our young women attended inspiring talks, found internships, and made new friends among their fellow URCSers. More than 60 percent of our women are working toward double majors while on campus. For this reason, their paths don't always cross in CSC classes. Having the opportunity to go to GHC allowed them to meet and connect as women of computer science. Upon their return to campus, they shared their enthusiasm with nearly 60 faculty, graduates students,



At Grace Hopper 2014 in Phoenix, Az (left to right) Ana Bealo '15, Becky Everson '16, Minfeng Lu '17, Becky Galasso '15, April Uzzle '17, Marjorie Cuerdo '17, Michaela Kerem '15, and Zoe Tiet '17.

and undergraduates who attended a debriefing meeting for the women's group in November.

The momentum subsequent to the group's return from GHC last year helped us identify leaders, establish our new UR Women in Computing group, and set some important goals. One such goal was to have a group identity and communicate it to the campus and beyond. A team of artistic and tech-savvy undergraduate women, Tergel Purevdorj '16, Violeta Lopez-Aldaco '17, and Lauren Pien '16, designed our new UR WIC web pages and logo (www.csug.rochester.edu/URWIC/). Elections for four officers (executive manager, event coordinator, web content manager, and outreach coordinator) also will be held soon after classes start.

This year we plan to send 20 students to GHC in Houston, as well as have staff manage a booth at the career fair to recruit graduate students and faculty. We will also have a dinner for our attendees and alumnae at GHC to network. We hope they return to campus with the same energy and

commitment this year and encourage other young women to try computer science.

Future goals are to increase our outreach and recruitment into local K-12 programs, Girl Scouts, National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), and the STEM club on campus and to continue to

innovate in our curriculum and environment to improve our diversity within computer science.

Our efforts are working, albeit slowly. Our percentage of women in computer science at Rochester has been slowly growing since the early 1990s, when it dipped to around 6 percent per graduating class. Our current numbers are approaching 25 percent women, with the Class of 2017 at 31 percent. We have set a goal of 40 percent female by 2018.

This would be well above the national average of 18 percent across computer science bachelor's degrees. With curricular changes, a welcoming culture, and outreach and recruitment efforts, we hope to meet this lofty goal.

“I want computer science and technology to be a world that embraces everyone who has passion, ability, and interest, whether they look like the dominant group or not.”

—*Maria Klawe, president of Harvey Mudd College and former dean of engineering and professor of computer science at Princeton*

www.newsweek.com/how-can-we-encourage-more-women-study-computer-science-341652

is only one trading opportunity available, which produces a “winner take all” event where the fastest firm wins the trade. This gives rise to what we call “the arms race” or the “race to zero latency.” The trading system designs you encounter generally reflect the goal of winning the arms race. Oftentimes, these designs run counter to best practices for software architectures seen in other industries.

There are many internal and external systems in the inner loop for the round trip from order (an outgoing instruction to execute a trade) to tick (evidence of trade processed by an exchange on the price feed). HFT firms will often precalculate and cache as much as possible to minimize latency. The algorithms and data structures are highly tuned to the exchange and products traded and tend to look “hard-coded.” However, more often than not, the emphasis is on the network layer. HFTs were early adopters of FPGAs (field programmable gate arrays) and kernel bypass networking technologies (i.e., Myricom).

Ed.: This case has been dragged out for more than four years and is only now finally coming to a favorable conclusion for you. What kind of roller coaster ride have you been on since this began?

HB: The time it took to be vindicated came as a surprise to me, but, in hindsight, that should have been expected. In 2012, senior executives in the industry were confiding to me that the industry as a whole knew I was right about the technical detail of the abuses I had discovered. The question that really had to be answered was whether the abuses were illegal or simply unethical. If the regulators had determined it was the latter, my findings would have been regarded as a market reform issue. Thankfully, the regulators determined that my findings were indeed an enforcement issue.

Ed.: You stated that there were only a few people in the world with the technical sophistication to solve this problem. What kind of high-tech brainpower is there at the SEC that could understand the scope of your whistleblower claim? Has that had any impact on the speed with which this case is being handled?

HB: It isn't only technical know-how that is required but also regulatory understanding. The National Market System in the equities space is composed of 11 exchanges, more than 40 dark pools, and hundreds of broker-dealer internalizers. Very sophisticated regulations govern how the entire apparatus is knitted together functionally and technologically. It may come as a surprise that some of the most senior executives at the top high-frequency trading firms have previously worked as regulators, and their opinions are extremely well respected. You can imagine what sort of industry resistance this creates with respect to my allegations. Many industry insiders thought the order type controversy, as it was called, would go away. Instead, the regulators pressed ahead with one of the most sophisticated cases yet undertaken with regard to electronic trading. As it stands, the order type expertise the regulators have developed is definitely ahead of electronic trading desks at top-tier banks. I like to think I've had some influence, but the credit goes to very bright people inside the agency.

Ed.: How long did it take you to pinpoint the cause of the unfair use of order types? How many other dead ends did you take before you finally had your “Aha moment,” when you narrowed it down to this? Once you solved the mystery, what was your emotional reaction?

HB: It took me six months to find out about the unfair usage of order types, and it would have taken longer if I hadn't been told about the abuses explicitly.

During that six-month period, I was on a perpetual bug hunt, oblivious to the fact that the bug was in the market itself. After I was finally let in on the game, it felt like a punch in the stomach. As I did more research into each exchange, it became clear to me that you weren't going to figure out the order types unless you got assistance from insiders. At that time, the exchanges were releasing order types into the market with deficient (or nonexistent) regulatory filings and with minimum technical disclosure. I analogized this situation to receiving a chess game without any instructions and a few missing pieces, which clearly puts the player at a disadvantage at any reasonable play unless he already knows chess! My main contribution was mapping out the order type abuses across the bulk of exchanges.

Ed.: How have you recovered from being ostracized by your peers several years ago?

HB: I can't say it has been an easy path to follow, but I have managed to keep many good relationships in place and my reputation intact. Currently, I advise very sophisticated clients on how to avoid order type abuses. I am also working on a new trading system based on Erlang, which I am piloting with a sizeable proprietary trading firm in Chicago in the options space. I also continue to do a lot of work on market reform and have spent the last two years assembling whistleblower teams to address market structure abuses. The work I am doing with these teams will probably have greater impact than the work I have done with order type abuses.

Ed.: At one point you mentioned you had been invited to enter the inner circle that would benefit from this HFT scheme. Were you ever tempted to just join the group and remain silent?

HB: I spent a year getting up to speed with the order type game and was able to become a pseudo insider. Presently,

my advice to clients is that they have no choice but to use the order type advantages or use a broker with such knowledge; otherwise, they will “bleed” on the losing side of the trade. It took quite awhile for me to understand that the main abuse was really the selective disclosure of order type features and not the order type features themselves (in most cases). As for being an insider, I have been told a few times that the HFTs think of me as “one of them that has gone astray.” More recently, I have been collaborating with a few leaders in the HFT space on market reform proposals. I guess I am still an HFT at heart.

Ed.: How difficult was it to contact the SEC, and did they believe you? Did you seek legal counsel before you approached them?

HB: I worked with Shayne Stevenson at Hagens Berman to bring my complaint to regulators in 2011. I never felt like I had a credibility issue, but I came overly prepared, having put the work in beforehand to support my claims with evidence and analysis. I can’t emphasize how important it is for anyone seeking to engage regulators to be represented by counsel. It really is the road not traveled, and there are lots of potential pitfalls, especially if your whistleblower status is made public.

Ed.: The time-consuming investigative work to find the necessary proof as well as the subsequent industry backlash has to have been difficult on home and family. What has the most difficult part of this been for you personally?

HB: I like to tell people that “being right” isn’t enough. I spent so much time trying to defend my reputation through technical arguments. Although it provided me industry goodwill and respect, it wasn’t reflected in business opportunities. Probably the most difficult part was coming to terms with the fact that the victims of the order type abuses were not very happy I had blown

the whistle. Many firms that I thought would be natural allies saw me as an inconvenience that increased their legal risk. Meantime, many HFTs actually were quite friendly to me over the period. It was disorienting. It really made me question what I was doing it all for and why I had subjected my family to the risks in the first place.

“It was difficult to see that even the organizations that lost money (i.e., pension funds) were not supportive [of Haim] because the fund managers did not want to be held liable for investor losses. Both the perpetrators of the crimes that make a lot of money and the organizations that lost money would have preferred that none of this was made public, which is a case of placing self-interest first.”

—Haim’s father, Arie Bodek, the George E. Pake Professor of Physics University of Rochester

Ed.: With the amount of potential profit from these transactions, did you ever think your life was in danger after you brought these exchanges under the scrutiny of the SEC?

HB: I am asked that question quite frequently. Sure there were times when I felt uncomfortable with certain communications. My natural response was to build a stronger complaint against my targets. I tend to get focused and very strategic under pressure, which is a good trait to have as a high-frequency trader or a whistleblower.

Ed.: Were there specific courses or projects at Rochester that prepared you for the methodical process you used to discover the algorithm that was being used to gain the unfair trading advantage by these exchanges?

HB: The independent studies I did at UR in mathematics and sociology had

a significant influence on me, both of which focused on interdisciplinary topics that intersected with my cognitive science major. UR’s acceptance and support of interdisciplinary research probably made me more confident in tying together disparate disciplines, a confidence I demonstrate in my role identifying structural relationships in securities markets, which include technological, quantitative, trading, and regulatory elements. For me, the order types weren’t just a technology feature of the exchange APIs but a design element that was introduced to create deliberate asymmetries in the marketplace between classes of participants by circumventing regulation. That kind of assessment is really an interdisciplinary view of the market microstructure involved and market structure overall.

Ed.: Financial economics is currently a common double major among our undergraduates. Any advice to help them avoid the same quagmire you found yourself in?

HB: The regulatory environment is changing rapidly, and many common industry practices are now under scrutiny. At some point, you will be exposed to the “edge” associated with your the business unit. If that “edge” doesn’t sit right with you ethically, you really should consider leaving the firm or transferring to another unit. Relying on your manager’s view of the permissibility of certain practices is no longer something you can count on. I expect to see a lot of change as regulators make progress sorting out the more complex areas of finance.

Ed.: If readers are interested in more information about this, could you provide some links to articles or books?

HB: Scott Patterson’s book *Dark Pools* tells the story about the creation of the modern electronic marketplace as well as my experience with order type abuses

Haim Bodek con't on page 22

Undergraduate Alumni NEWS

Ahluwalia, Vedant '14—I interned at Tudor Investment Corporation this summer while working on my MS at Stanford.

Bakken, Luke '98—I climbed Mt. Athabasca in Alberta, Canada.

Borrello, Donato '12—My current Employer is JWPlayer: www.jwplayer.com/.

Brown, Cole '11—I've recently cofounded a company (Concord Systems, Inc.) with some friends. The product is called Concord. We're building a distributed stream-processing framework, comparable to apache storm. Our goal is to deliver the best solutions and tooling for the emerging stream processing market and guess what — we're hiring!

Burke, Andrew '03—I just started as the



Andrew Burke's new baby, Kieran

CTO at Float, Inc. (<https://hellofloat.com/>) I also had a baby boy, Kieran Burke, in April. I'm pretty sure between the new baby and working at startups, I'd be dead if it weren't for my wife.

Chen, Jonathan '07—Due to sale of the Motorola Solutions Inc. enterprise business, my current employer is now Zebra Technologies, Inc.

Coimbra, Hilario '08—I am now working at Dunwello. www.dunwello.com



Luke Bakken '98, climbed Mt. Athabasca in Alberta, Canada

Crumiller, Marshall '06—I've just accepted an offer at Barron Associates for a position of Research Engineer in statistical signal processing in Charlottesville, VA; they do R&D in the aerospace and biomedical industries. Their website is located at www.barron-associates.com. I received my PhD in neuroscience from The Icahn School of Medicine at Mount Sinai in Manhattan in May 2014.

Danchik, Emily '13—In August 2014, I graduated from the Carnegie Mellon Master's of Human-Computer Interaction program. I then moved to Seattle, and now work on Microsoft Azure as an interaction designer.



Ross D'Eredita's second child, Ava Terese with brother Rosco

D'Eredita, Ross '04—My wife and I welcomed our second child in March—Ava Terese. Her big brother, Rosco, adores her.

Eisenstat, David '06—I graduated in May '14 with my PhD from Brown University and started working at Google NY in January. My thesis was titled "Toward Practical Planar Graph Algorithms."

Frankel-Goldwater, Lee '06—I'm currently teaching environmental studies at Pace University and developing educational technology tools for The Sustainability Laboratory, a NYC and globally oriented non-profit.

Freidman, Jason '07—I'm churning out awesome software (at Periscope) with a few other folks you may remember (Harry Glaser, David Ganzhorn, and Tom O'Neill) here in SF :). We tried to get Aaron (Rolett), but he just joined Twitter, so it's a hard sell.



Gregory Goldstein and daughter, Kala

Frueh, Andrew '03—I did switch jobs this year, my current employer is “Heizenrader Digital.” My title there is “Partner/Creative Director.”

Glaser, Harry '07—Jason Freidman '07, David Ganzhorn '06, Tom O'Neill '07, and Harry Glaser '07—have spent the year slaving away in the salt mines at their SF-based data analysis startup, Periscope. Over the last year, their revenue has grown 12X and their headcount has doubled, and they're hiring! Enterprising CS grads should email harry@periscope.io to learn more.

Goldstein, Gregory '01—I just finished a Master of Science degree in Computational Science and Engineering at Harvard. My daughter Kaia is nearly a year old.

He, Jason '12—Two years ago, I was selected from a group of engineers to be part of a select team to help rewrite our CMS (ColdFusion at the time) in Ruby on Rails. Since then, I've had two major promotions and am currently going down a more devops oriented path

[infrastructure development as well as app development] to further my career.

Hill, (Robin) Christopher '11—is transgender and living as a woman. Robin is working now at Animoto in NYC doing mobile development.

Huo, Dennis '10—Nothing too new, same old work, Google, Big Data, Cloud, etc. I got to do a nice developer advocate video for my team's products as part of the Google I/O videos series last June: <https://www.youtube.com/watch?v=wkOUqswPyQ> and there were some nice photos of me running a sandbox at Google IO last year as well (we didn't do anything for this year's Google I/O).

Isman, Michael '04—In the past year Ubersense was acquired by Hudl, so that's where I work now. We make sports video software, and UR Football is an active user of Hudl, using it to do advanced breakdown and analysis of game and scout film. My wife and I also welcomed our first child on December 27: Henry Jacob Isman.

Jonsson, Justin '03—I'm getting married in October!

Karkoska, Jennifer '13—I just received my Masters in Applied Mathematics from RPI. I will be moving to Baltimore in a month to start a new job with the Department of Defense.

Keesom, Jeff '08—I joined Lockheed Martin in February, as a Senior Data Analytics Engineer. I lead the development of business intelligence / data analytics solutions that support the needs of senior leadership in various Lockheed Martin business areas.

Kobin, Marin '09—I was awarded a patent earlier this year for Inert and Pressure-actuated Submunitions Dispensing Projectile. I expect to graduate with my Masters of Engineering in Systems Engineering from Old Dominion University in Norfolk, VA, in August.

Koch, Matthew '06—I'm no longer working for Rafferty Commodities Group. While I was there, I was also working at Saints Trading in Juno Beach, FL, where I'm a co-founder building a proprietary stock and commodities trading system, and I am continuing my role there.

Korsak, Ryan '07—I have just recently started working at InfernoRed Technology alongside fellow Rochester alums Brian Meeker and Pam Vong. I am getting married this September, as well!

Kumar, Vivek '98—My employer is Five Arrows Principal Investments (Rothschilds) in London.

Lander, Sean '08—I'm currently working on a PhD in Medical Informatics at the University of Missouri. I just started up a company, Phinlander LLC, with a fellow PhD and am involved in a couple other entrepreneurial ventures as well, one being BadArtAuction.com which hosted its first charity auction in June. I have

one publication with my name on it to date and one more currently in review. The published article is: "Identifying key variables in African American adherence to colorectal cancer screening: the application of data mining."

Ledley, Harry '12—I have a new job! ActionIQ (actioniq.co): it's a 7-person startup looking to build a next-generation data platform for marketing and consumer data.

Lehr, Michael '01—My current employer is my company—MayStreet LLC www.maystreet.com/.

Lewis, Steven '00—In August '14, I left The College at Brockport to begin formation as a Catholic priest for the Diocese of Rochester. I completed their Becket Hall program this May and expect to begin pre-theology studies at St. John's Seminary in Boston this fall.

Lu, David '07—I've moved to Pittsburgh and I'm self-employed at MetroRobots.

Luis, Cristina '01—Melissa and I had our first child, Lukas Haakon on August 3 and are getting married (finally ;-)) in October at Clara Barton Camp in Massachusetts.

Mincieli, Michael '02—I'm currently working for Etsy, Inc., and based here in Brooklyn, NY.

Norwood, Jonathan '04—Last year, I was promoted to Director of Software Development leading the teams that build the software that runs Amazon's warehouses (some of the cool custom stuff we were working on: <https://www.youtube.com/watch?v=tMpsMt7ETi8>). Six months ago, I transferred to another department within Amazon operations, this time leading the development of Amazon's Last Mile Delivery platform in the transportation department. We've been working on cool new transportation features like, 1-hour PrimeNow delivery

and building out a parcel carrier to deliver the bulk of Amazon's packages.

Orego, Brad '11—I'm now working at MobileIgniter in Madison, WI.

Osborn, Jeffrey '09—I left Akamai in 2014. Now I work at a small-ish startup called Cohealo, helping to share medical devices between hospital facilities.

Ramsay, Robert '10—Since June of 2013 I've been working at Deloitte in DC. This is likely to change in the next month or so since my wife and I are trying to move out to the Seattle area after she graduates next Friday. Oh, and on April 18th of this year I got married!

Regan, Andrew '05—I left EMC in December and am now at a startup . . . Plexxi Inc.

Richardson, Andrew '11—Current employer: Mob Made Games, a video game company that I founded. Currently working on: www.voidborne.com.

Riffle, Michael '07—I'm still at Nero, but I'm now the "Senior Cloud Services Engineer" because now I'm writing in 4 languages instead of just one. Wheel!

—I got engaged to a Boston girl named Mary who is living out here in LA with me and will be getting married in 2016.

—I'm currently recording my 7th audiobook. The other six are available on Audible.

—My band The Alarmed for which I play drums is working on its second EP.

Riley, Darcey '12—I'm still in grad school at Johns Hopkins.

Rogers Green, Jennifer '02—I had a baby last July! His name is Calvin Green, and his birthday is July 31, 2014. He is such a joy! I work as a Transit Service Planner for GoTriangle in Durham, NC. I work to improve the bus routes in Durham and the Triangle region.

Schmid, Jonathan '03—I'm about to move to State College, PA, where I've been working for Raytheon as a developer.

Seid, Michael '10—Currently I am working at Naytev, a company I founded and now up to 10 employees. It has been a wild year, but things are looking up.

Silverman, Michael '08—I've moved to Boston. In terms of my company, Silverware Games, I recently got a game, "Don't Shoot Yourself!" to release on the very popular "Steam" video game platform. I can get you free download codes if you or anyone is interested.



Michael Silverman

Slater, Jay '11—I got married on June 5th.

Skarlatos, Nikolas '14—I'm working at NCC Group.

Snyder, Devin '09—I switched jobs again! I am now working as a Software Engineer for a startup called ItsOn, Inc.

Stratos, Karl (Jang Sun Lee) '11—I just finished my fourth year in the PhD program (at Columbia). So I'll have to start thinking about graduating, perhaps next year.



Andrew Uzilov's baby daughter, Julia

Uzilov, Andrew '05—I do still work for Mount Sinai as a bioinformatics scientist specializing in cancer genomics and technology development. Also, my wife, Kathleen, and I welcomed our baby daughter Julia in Dec of 2014, so now we have two wonderful children (our son Alex is turning 3 this summer).

Vandegriff, Evan '011—Nomi, the tech startup I work at, was acquired last year by a larger company called Brickstream, which means we are international now and have a fair bit more money to play with. Nomi does some cool data crunching of data collected from cameras, wifi, and beacons in order to give brick and mortar stores analytics on customer movement trends inside and directly outside the store.

Wang, Alex '07—I'm working at Ecovent now. We're building a system that provides homes with room-by-room temperature control using a series of vents, sensors, a control hub, and mobile apps.

Wang, Chunpai '14—I just got admitted by SUNY-Albany to pursue my PhD degree of Computer Science. And I will work with Prof. Feng Chen at UAlbany in data mining and machine learning.

Ward, Justin '03—I am at AppNexus now. AppNexus is one of the largest pre-IPO startups in NYC and likes to consider itself one of the true homegrown success stories of Silicon Alley. We're still hiring at a pretty solid clip, as well. I am a Technical Services Consultant there. We hire lots of engineers, as well as product, sales, support, you name it. I'm also recently engaged, to Katherine Palmiter. Katie and I have known each other since our undergraduate days and are planning our wedding for October of this year.

Yang, Chuq '99—I now am working at I.M. Systems Group in College Park, MD, as Senior Research Engineer. I am building a computing cluster (based on HTCondor from U. Wisc.) for NOAA's NESDIS/STAR group to help process incoming weather satellite data so we can all enjoy better forecasting up to about a week out. Right now, it's pretty accurate up to about 3 to 4 days.

Haim Bodek con't from pg. 18

at my firm Trading Machines. Marije Meerman's documentary The Wall Street Code (on YouTube) sheds some light on my whistleblower experience. My own book, The Problem of HFT, gives detail on the order type controversy. Also worth checking out is the Wall Street Journal article by Scott Patterson and Jenny Strasburg, "For Super Fast Stock Traders, a Way to Jump Ahead in Line," which disclosed my whistleblower status. For a discussion of the impact of my contributions on securities regulation, you may take a look at the article "High-Frequency, Trading, Order Types, and the Evolution of the Securities Market Structure" by Stanislav Dolgoplov. The SEC settlement with Direct Edge for order types gives the inside story on the case. If you want more detail on market structure and order types, there are many of my research papers and commentary on <http://haimbodek.com> and <https://decimuscapitalmarkets.com/dcm>.

Ed.: What do you do for fun and relaxation? How do you find a work-life balance?

HB: For better or worse, a career on Wall Street doesn't give you the best work-life balance proposition, especially as you go up the ranks. As a whistleblower, I have probably worked harder than I did at my startup or at the investment banks. Still, I am managing to be more of my eccentric self these days. I recently took my 13-year-old to a Slayer concert. I also excavated a 1920s bottle cache with my sister that I found near my house. This has been one of the better summers in awhile.

Meliora Weekend

If you graduated in a year that ends in 0 or 5, please join us Meliora Weekend, **October 9, 3:30–5:30 p.m.**, for the **Computer Science Undergraduate and Graduate Reunion Open House** in room 601 of the Computer Studies Building.

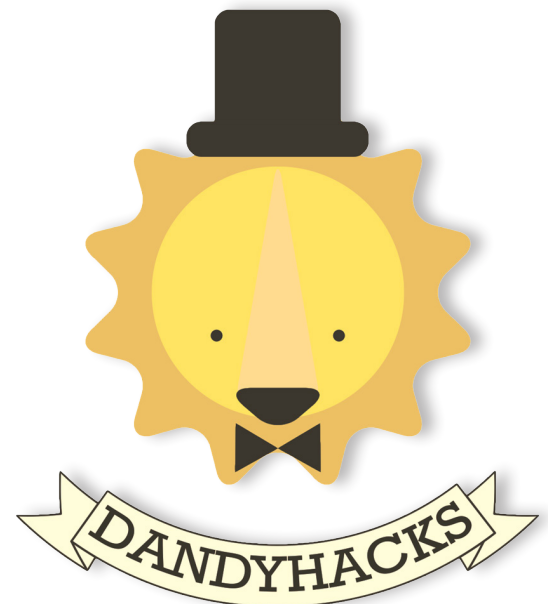


RocHack's Second Annual Spring Hackathon

RocHack's second annual spring hackathon, now known as DandyHacks, was held the first weekend in April in Rettner Hall with about 94 participants—double last year's attendance—including teams from Cornell, RIT, and from as far away as Concordia University in Montreal. Freshmen Dylan Wadler of MechE and Thomas Pinella of Computer Science took first place for their MIB (Message in a Bottle) Note, a web/phone app for leaving notes for others to find based on GPS location. Pebble smart watches and Myo armbands were available for participants to use for their projects; the UR Swing Club livened things up with a dance workshop. The Executive Board of the undergraduate council (CSUG), especially Jack Valinsky, was the main organizer, with administrative support from Marty Guenther and Ted Pawlicki. Organizers said their goal was to “make people feel connected to the larger computer science/engineering community and collaborate on cool projects,” and it appears they did just that.

DandyHacks was successful in getting sponsorship from Google, Wegman's, Periscope ('07 alumni Tom O'Neill and Harry Glaser's company), Jimmy Johns, Thalmic Labs, Pebble, and Moe's.

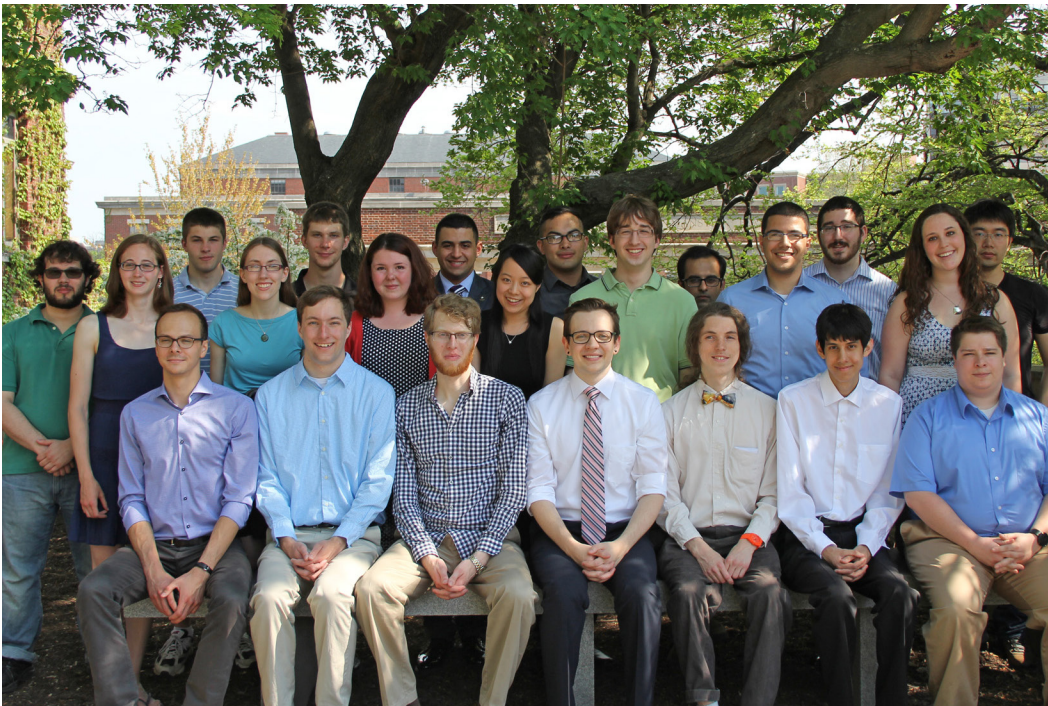
To see a list of project submissions, go to <http://dandyhacks.challengepost.com/submissions>. RocHack plans to hold more hackathons in the future. Alumni are welcome to participate.



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Hajim School of Engineering & Applied Sciences

Return Service Requested



Front row seated: Nikita Miroshnichenko, Ryan Puffer, Tait Madsen, Christopher Bell, Charles Lehner, Frank Dinoff, TJ Stein, **Middle row:** Becky Galasso, Kiera Crist, Ana Bealo, Louise Lu, Tyler Hannan, Yaron Shahverdi, Cara Kessler, **Back row:** Sean Esterkin, Mark Mullock, Nick Van Swol, Mike Urciuoli, Manuel Navarro, Samay Kapadia, Ethan Senator, Kuan Wang, **Not pictured:** Adam Cushmaro, Kate Godzicki, Michaela Kerem, Luke Kortepeter, Jonathan Liao, Sara Lickers, Mochen Liu, Raghav Mehta, Tyler Meyer, Douglas Miller, Bryan Ngadamin, Nicholas Rochwerger, David Sekora, Zhongwu Shi, Catherine Stevens, Jennifer Uvina, Daniel Van Twisk, Alex Wilson, Jonathan Wong, Xing Yan, Yang Yu, Shiqing Zhang.

Thank you to all donors who have contributed to the University of Rochester in the last year. If you are interested in donating to the department or the University, please go to the alumni website and look for "Online Giving."

www.rochester.edu/college/giving/

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