

Two New Faculty Join URCS

Engin Ipek's Research to Center on Self-Optimizing Multicore Architectures



Engin Ipek, Ph.D.

Engin Ipek has joined the University and will hold joint appointments as Assistant Professor of Electrical and Computer Engineering and Assistant Professor of Computer Science. Engin comes to us from the Computer Architecture Group of Microsoft Research, where his focus was on multicore architectures, hardware-software interaction, and the application of machine learning to computer systems.

At the University, Prof. Ipek will continue developing flexible, self-optimizing multicore architectures. Basically, what this means is that the architectures are able to adapt to the needs of software running on them. As he explains, "Both the initial adoption and the longevity of multicore systems hinge critically on their ability to embrace a diverse and dynamically changing software eco-system, consisting of software products with very different characteristics and in different stages of development. Unfortunately, this stands in sharp contrast to the rigid nature of existing multicore architectures, which are typically focused on optimizing average or worst-case performance, and are statically tuned to perform well over a relatively narrow application class."

An example is off-chip DRAM memory bandwidth, a key shared resource in multicore chips. Along with the growth in transistor densities comes an increase in off-chip bandwidth requirements. This makes DRAM scheduling even more challenging. Issues involve access scheduling constraints, prioritization requests, and adapting to a dynamically changing memory reference stream. *(Continued on page 3)*

Bigham Creates Tools for Better Web Accessibility



Jeffrey Bigham, Ph.D.

Jeffrey P. Bigham has joined the faculty in Computer Science as an assistant professor. Bigham has recently been featured on the 2009 edition of MIT *Technology Review's* "TR35" list of "35 most exciting Young Innovators Under 35" (see <http://www.technologyreview.com/TR35/>). "We're very proud to have Jeffrey with us," says Henry Kautz, chair of the Department of Computer Science. "His focus on making the web more accessible to the blind is a terrific example of how we can use computer science to make life better for everyone."

Bigham received his B.S.E. degree in Computer Science from Princeton University in 2003. He attended the University of Washington, where he worked with Richard E. Ladner, receiving his Ph.D. in Computer Science and Engineering in 2009. Along the way he has won the Microsoft Imagine Cup Accessible Technology Award, the W4A Accessibility Challenge Delegate's Award, the Andrew W. Mellon Foundation Award for Technology Collaboration, the NCTI Technology in the Works

Award, and the University of Washington College of Engineering Student Innovator Award for Research.

While at UW, Dr. Bigham served as a teaching assistant for a variety of courses, ranging from artificial intelligence and computer vision to a course looking at cyber terrorism taught jointly with the Berkeley Law School. He also taught computer science to blind high schoolers through the Youth Slam, a summer program created *(continued on Page 4)*



HAJIM
SCHOOL OF ENGINEERING
& APPLIED SCIENCES
UNIVERSITY of ROCHESTER



Message from the Chair

by Henry Kautz

Department of Computer Science Joins Hajim School of Engineering and Applied Sciences

On July 1st, 2009, the University of Rochester's Department of Computer Science joined the Edmund A. Hajim School of Engineering and Applied Sciences. Many students, alumni, and faculty in other departments are wondering why we did this, and what it will mean for Computer Science.

As one of six departments in Engineering and Applied Sciences, Computer Science will be able to play a more prominent and direct role in helping shape the future of the university than it did as one of eighteen departments in the School of Arts and Sciences.

The move will help support the Department's need for growth. Dean Robert Clark is leading an energetic development plan for Engineering and Applied Science, which is in addition to the University's overall development effort. Edward Hajim's gift (of \$30 million last fall) is only the first step in the plan. The discipline of computer science is much larger than it was two decades ago. Growth will enable the department to engage with crucial new research areas such as human-computer interaction, while deepening our traditional strength in system, theory, and artificial intelligence.

For example, this past June, the department hired Dr. Jeffrey Bigham, an HCI researcher whose work on making the Internet accessible to the blind has won wide acclaim. In addition, the Department of Computer Science and the Department of Electrical and Computer Engineering jointly hired Dr. Engin Ipek, whose work in computer architecture incorporates algorithms from machine learning. The fact that CS and ECE were united under Engineering and Applied Sciences was an important factor in our ability to hire a computer engineer of Dr. Ipek's caliber.

The move will also help the other departments in Engineering and Applied Sciences by enhancing educational offerings for engineering students. Prof. Christopher

Brown is leading the Department's work with the Hajim School of Engineering's Curriculum Committee on the design of a new introductory programming course for engineering students, which will focus on numeric algorithms and MATLAB.

The impact of the move on the Department's majors will be small, apart from expanded opportunities for undergraduate research projects. The Department is not changing its B.S. degree requirements, nor will it seek ABET accreditation (a professional degree accreditation process which is important in many fields of engineering, but not in computer science). The one change immediately visible to majors is that each graduating class will be assigned two faculty advisors who will follow them throughout their time in the major.

I wish to stress that the move to Engineering and Applied Sciences does not undercut the strong ties Computer Science has with departments in Arts and Science, such as Brain and Cognitive Science, Linguistics, Philosophy, Mathematics, and Biology. For example, starting in Fall 2009, the Department is offering a redesigned Bachelor of Arts degree, which is specifically designed to accommodate students who wish to study computing in the context of other disciplines in the sciences or humanities.

Across universities nationwide, computer science departments are evenly split between those in schools of engineering and those in schools of arts and sciences, with a few located in schools of information science. This mix reflects the fact that there is no one correct home for computer science. Like engineering, computer science includes the design and analysis of human artifacts. Like one of the sciences or humanities, however, it also includes work on principles of human reasoning and perception, and deals with fundamental questions in mathematics. The take away message for our students and alumni is that this change in administrative structure preserves all that is good about the Department, while providing us with a better forum for upward communication and impact.

Faculty News and Awards

The third edition of **Michael L. Scott's** book *Programming Language Pragmatics* was released in March 2009.

Jeffrey Bigham was named one of the Top 35 Researchers under 35 by MIT's *Technology Review Magazine*.

Lane Hemaspaandra spent his summer at the Hebrew University of Jerusalem and at the Universities of Duesseldorf, Munich, and Wuerzburg. These trips are part of Lane's work as a US Associated Partner on the seven-country

European Science Foundation EUROCORES LogICCC project "Computational Foundations of Social Choice."

The URCS synchronization research group released Version 5 of the open-source Rochester Software Transactional Memory (RSTM) library. Previous versions of the library have been downloaded to well over 1000 unique IP addresses, worldwide, and have become a standard resource in the field.

Henry Kautz was elected President of the Association for the Advancement of Artificial Intelligence (AAAI).

(Ipek - continued from Page 1)

Yet most current schedulers do not evolve and adapt to changing workload demands. Instead, fixed scheduling is common, and memory controllers grossly underutilize the available bandwidth.

With his team, Engin has proposed using machine learning technology to circumvent these problems. A self-optimizing, adaptive memory controller can plan, learn, and adapt to changing workloads. Specifically, he suggests the use of reinforcement learning that enables the hardware designer to focus on the performance targets of a controller and the appropriate system variables for deriving optimal scheduling policies.

In addition, he has proposed coordinated hardware mechanisms to manage other critical shared resources: on-chip last level cache space and the chip's power budget. He proposes to address these issues at run time and without prior knowledge of the workload. At run time, a machine learning-based resource management scheme monitors each application's execution and learns how to predict system performance based on allocation decisions.

Along with more efficient resource management, multi-core systems also require flexibility in their execution substrates. An example, according to Engin, is being able to change the granularity of the architecture at run time, hence accommodating software at different stages of parallelization. He is also exploring ways to enable independent cores to "fuse" into one large CPU on demand. "We call this idea core fusion," he explains. "We envision a core fusion chip as a homogeneous substrate with conventional memory coherence/consistency support, where groups of up to four adjacent cores and their i- and d-caches can be fused at run-time into CPUs that have up to four times the fetch, issue, and commit width, and up to four times the i-cache, d-cache, branch predictor, and BTB size." This method would require no additional programming or special compiler support. It would provide a single execution model across all configurations, and it would leverage mature micro-architecture technologies.

Further, dynamic reconfiguration would allow the cores to verify each other's execution. Requiring no static core binding during the design phase and requiring no dedicated communications hardware, this method would offer a few advantages. Dr. Ipek suggests that it would be possible for on-demand triple modular redundancy to overcome hardware faults, also that hardware would degrade much more slowly than mechanisms relying on static binding.

Ipek plans to extend his machine learning-based DRAM scheduling and multi-resource allocations to additional architectural control problems. Specifically, he intends to find solutions to hardware-assisted thread and task scheduling for parallel applications, adaptive cache insertion/replacement policies, prefetching, thread selection policies in multithreaded cores; dynamic energy, reliability, or quality-of-service optimization; branch or value speculation; and routing in on- and off-chip interconnects.

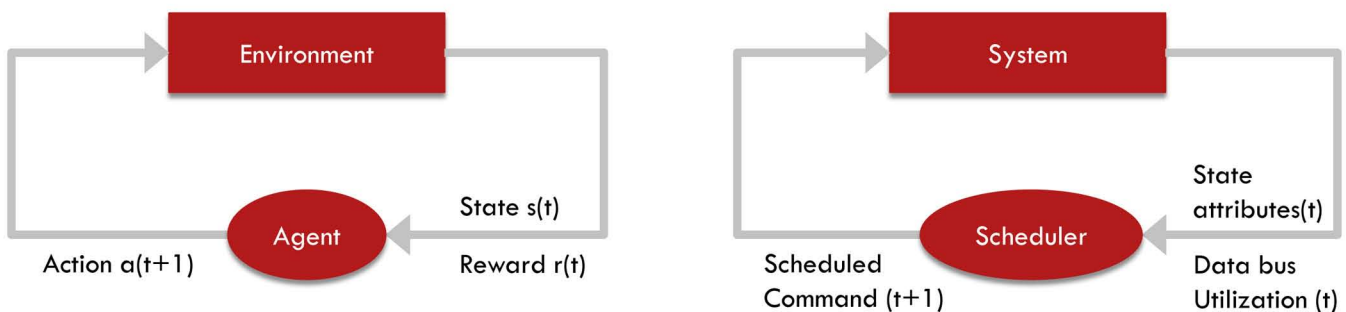
"Ultimately," he says, "if successful, my work and the follow-up work by other researchers may cause a significant leap in the performance and flexibility of microprocessors and computer systems."

We share Professor Ipek's hopes. His credentials prove that he is a capable researcher and valuable teacher.

With numerous publications to his credit, Dr. Ipek received his Ph.D. in Electrical and Computer Engineering from Cornell University in 2008. His doctoral dissertation was nominated by Cornell for the 2008 ACM Doctoral Dissertation Award. He earned his B.S. in 2003 and his M.S. in 2007, both from Cornell in Electrical and Computer Engineering.

Ipek has been a researcher at Microsoft since 2007. He worked as a graduate intern for Intel Corporation in 2005, and before that, served as a graduate intern at Lawrence Livermore National Laboratory.

Professor Ipek has extensive experience supervising both graduate and undergraduate students, and he was a teaching assistant at Cornell for two semesters. The University of Rochester is pleased to have him on board.



$$Q^\pi(s, a) = E_\pi \left\{ \sum_{k=0}^{\infty} \gamma^k r_{t+k+1} \mid s_t = s, a_t = a \right\}$$

*Memory access scheduling formulated as a reinforcement learning problem.
Using Q-learning, the system learns the expected reward for executing an action "a" in each state "s"*

(Bigham, from Page 1)

by the National Federation of the Blind.

The web is an unparalleled source of information, and its role in everything from education to employment, to maintaining personal connections, is making access a necessary prerequisite for success. Jeffrey's work seeks to enable people to get more out of web information, conveniently access the web wherever they happen to be, and easily improve existing web content to make it work better for them.

Most web content is still designed primarily for access on standard monitors, but people are accessing it with a variety of different devices. Assistive technologies require converting content to voice or large print, mobile devices require shrinking content designed for larger displays, and cheap voice phones will provide access in the developing world in the future.

The following two of his projects empower blind people to collaboratively improve accessibility without relying on others, effectively connecting their incentive to improve content with the ability to do so.

1) Trail-Blazer – a browser-based tool that observes the web usage of blind and sighted users in order to suggest trails through existing web content. Trails help make browsing with a screen reader more efficient.

2) Web Anywhere – a web-based screen reader that lets a blind person access the web from any computer, even locked-down public terminals, without installing new software. WebAnywhere is currently being used by nearly 1000 different users each week across the world, many of whom would not otherwise have access.

Prof. Bigham's research explores intelligent interfaces such as these to enable anyone to independently improve web content. These tools are made possible by novel predictive models of web actions, inference over recorded interactions, and careful consideration of the design constraints for creating software that can run anywhere. Solutions created by users of these tools can be shared so that users can collaboratively help one another make sense of the web. In particular, disabled people should not be seen only as access consumers, but also as effective partners in achieving better access for everyone. Better tools can make this happen.

In the Spring 2010 semester, Prof. Bigham will teach

a course at Rochester in web programming that will explain the technology and design principles for creating effective Web 2.0 sites. Since the introduction of the web, it has evolved from a collection of static documents to a platform for dynamic applications. Along with this transformation has come a dizzying array of new programming languages, technologies, and techniques. The unique characteristics of the web mean that to be effective you need to be knowledgeable not only of new programming languages, but also of implications of the web platform stemming from its architecture and security model. This course will teach students the basics of the web that they need to know in order to build the next Web 2.0 application or contribute to a host of research projects that leverage the web platform (including Dr. Bigham's). In future semesters, he plans to teach a course on human computer interaction and a graduate-level seminar on intelligent user interfaces and access technology.

Dr. Bigham

is excited to continue addressing challenging research questions with the potential for positive social impact once at UR. As such, his projects often lead to large-scale deployments with real world users, which not only enable users to immediately benefit from his research but also give the researchers



A visually impaired graduate student at the University of Washington uses WebAnywhere to access his email on a computer at a campus library that would otherwise be inaccessible to him.

important feedback for improvements to the system. Bigham believes that creating tools that impact the lives of people means seeing them through longer into their life cycle than is commonly done, and he tries to design that capability into his projects. Jeff is currently exploring various projects along this theme that stem from the deployed version of WebAnywhere. By mining their collective interactions, he believes he can make more progress on making the web experience for blind web users more usable and intuitive.

Jeffrey Bigham and his wife Jen look forward to finding their niche in the Rochester community. Bigham is a runner and his wife is active with Team in Training, an organization affiliated with the Leukemia and Lymphoma Society. Jeff will bring new and exciting coursework and research to URCS and we enthusiastically welcome both him and his wife to the University of Rochester and the Rochester community!

New Ph.D.s Begin Life in Academia

Piotr Faliszewski graduated from AGH University of Science and Technology in Krakow, Poland in 2004 with a B.S./M.S.'s degree in computer systems. During the last year of his undergraduate studies, Piotr contacted Prof. Lane A. Hemaspaandra of the University of Rochester, and their extended email discussions lead to Piotr joining University of Rochester's Computer Science Department in the fall of 2004.

Piotr's main area of expertise is computational social choice and computational complexity theory. Computational social choice is a new field of study that intersects computer science, artificial intelligence, economics, political science and operations research. Its main purpose is to study computational properties of collective decision-making. In his thesis, Piotr studied such problems as which election systems can be easily manipulated, in which election systems it is easy to find how to optimally bribe people, or how to change the election structure (e.g., by introducing spoiler candidates) in order to achieve some goal (e.g., make someone a winner or preclude someone from winning). The purpose of this work is to find in which elections such cheating behavior is difficult, and thus practically impossible. Piotr is also interested, and actively works on, cooperative game theory. To date, Piotr has published over 20 publications.



Piotr Faliszewski



Michael F. Spear

Michael F. Spear graduated from the US Military Academy at West Point in 1999 and joined the Air Force. While stationed in Anchorage he was responsible for the development of classified and nonclassified decision support software; during this assignment he also earned his MBA from the University of Alaska. In 2002, Mike moved to Little Rock, Arkansas, where he reached the rank of Captain and served as Executive Officer for a 1,300-person aircraft maintenance unit.

Mike entered the University of Rochester Computer Science Ph.D. program in 2004, where his research focused on the implementation of transactional memory, a programming mechanism that dramatically simplifies the synchronization of cooperating program threads (as are found in almost all processors today). Transactional memory has become something of a "hot topic" over the past several years, with active work at dozens of institutions.

Mike's contributions (some 20 refereed publications) address issues of correctness, performance, functionality, and semantics. He is the principal architect of the open-source Rochester Software Transactional Memory (RSTM) system, which has been downloaded more than 1,700 times by groups around the world. He interned at Microsoft (with Galen Hunt, '98) and at IBM (with Maged Michael, '97), and also helped to supervise a dozen undergraduate researchers, five of whom co-authored published papers.

Mike, his wife Emily, and their three children (ages 3, 2, and 2 months) now reside in Bethlehem, PA. This fall, he begins a new career as an assistant professor in the Department of Computer Science and Engineering at Lehigh University. In this capacity, he plans to continue his research in the field of parallel programming, with an emphasis on languages, runtimes, and architectural extensions to support high-performance synchronization, speculative parallelism, and emerging parallel programming models.

Christopher C. Stewart entered our Computer Science Ph.D. program in 2003 as a recipient of the Provost Fellowship. Since then, Chris has focused his work on computer system support for Internet services that power much of today's digital economy and society. These systems often contain a large number of interacting components and they must handle fluctuating levels of user workloads at potentially high concurrency. Chris found himself fascinated by the intricacies of these complex systems and the need to better understand and manage them (in both normal and rare abnormal conditions). He was among the first to study the performance modeling of distributed Internet services with multiple interacting components. He also made contributions in managing the inherent variations of Internet service workloads and characterizing system behaviors under different software/hardware configurations. While working at Rochester, Chris has authored or co-authored more than a dozen peer-reviewed publications, including conference papers at NSDI, USENIX, EuroSys, SIGMETRICS, and ASPLOS. His internship work at HP Labs has contributed to four pending patents.

While a graduate student, Chris demonstrated a strong commitment to teaching and mentoring. At Rochester, he mentored two undergraduate students in research leading to peer-reviewed publications. He also made multiple outreach trips to minority-serving institutions (Morehouse College and Spelman College) and talked to their students about the opportunities for graduate study and research careers.

Chris will join The Ohio State University as a tenure-track faculty member this fall. The next phase of his work will include the investigation of emerging challenges in Internet service management. A particular emphasis will be to support the use of renewable but intermittent energy sources in Internet data centers.



Christopher C. Stewart



Corinna Cortes, Ph.D. '94

Cortes Finds Ways to Put Theory into Practice at Google Research NY

with SVM Machine Learning Algorithm

Corinna Cortes' path to a Ph.D. in Computer Science was quite unconventional. With undergraduate studies in theology and Danish literature, and a master's degree in physics, she didn't have the typical background of most CSC Ph.D. first year students. Then again, Corinna didn't follow the typical pattern of many of our graduate students either. Instead of spending four to six years in Rochester, she spent a good deal of her time completing her research work at AT&T Bell Labs in New Jersey. After Corinna received her Ph.D. in 1994 from URCS, she continued to work at Bell Labs until 2004. Her joint research with Vladimir Vapnik on Support Vector Machines (a highly effective algorithm for classification and related machine learning problems) has been praised as a theory with wide practical application. With many accolades, including the recent ACM Paris Kanellakis Theory and Practice Award for her work on SVMs, Corinna now finds herself as Head of Google Research, NY. Cortes balances a busy work schedule, a marathon runner training schedule, and a family life but still had time to be interviewed for Multicast.

ED: Congratulations on receiving the Paris Kanellakis Theory and Practices Award for your research on Support Vector Machines (SVM). Scientists often work in the theoretical world, without seeing the practical applications of their work. Does it motivate you to even loftier ideas when you see the far-reaching effects of your Support Vector Machines research?

CC: I was lucky working in machine learning when there was still a lot to be discovered. SVMs were indeed not developed with any specific practical applications in mind and it has been amazing to see how popular they have become. I have a lot to thank the machine learning community for adapting this algorithm and extending the ideas of learning with kernels to many other algorithms.

When working on a problem it is hard to predict how influential it will be. Of course the loftier the goal, the more potential it has, but it also carries a higher risk for not succeeding. It is important to think bold thoughts, but it is even more important to do good work. Clear and clean work with theoretical guarantees is much more likely to persist than hacks and heuristics.

ED: How do you think machine learning and data mining will be utilized in the future? What's the most revolutionary use you can envision?

CC: Medical records is probably one of the areas that currently is trailing the most when it comes to data mining. It is a tricky business because one, of course, has to protect the privacy of the patients. But if that issue can somehow be solved, there is an enormous amount to be learned from aggregating and correlating medical records. The simplest example is how Google is able to predict the outbreak of flu in real time by exploiting the close relationship between how many people search for flu-related topics and how many people actually have flu symptoms, <http://www.google.org/flutrends/>. This is really the very simplest one can do. Then just think about how much could be learned from aggregating symptoms, test results and diagnoses and treatments across millions of patients. This is just one area where I think data mining and machine learning will prove invaluable. There are many more in robotics and automation in general.

ED: You have been successful doing research in the corporate world, first at AT&T (Bell Labs) and now at Google Research, NY. How does corporate research work so well for you? Have you ever considered a move to academia?

CC: Corporate research is fun because we have the real problems and the data to get inspiration from. And if you solve a problem, you may be able to impact a lot of people by getting a better solution distributed to the public. Academia is more isolated. You have to figure out what the interesting problem is and somehow try to get data to work with. Of course, aca-

Corinna was the first student I advised as a new professor, and I'm afraid I ended up with rather inflated expectations for my future students.

Prof. Randal Nelson

demia gives one a bit more freedom to choose what to work on, but if the company is big enough like Google, basically any part of CS is relevant.

Some people would say that it is too hard to get a company to deploy a new technique so too often, corporate research projects are orphaned. That can be true if there is a poor connection between the research group and the business units. Fortunately that is not the case at Google and most often it is the best solution that gets implemented. Other companies may be different. But, yes, we have to argue to the production part of the company that our work is worth using. That might still be much more straightforward than arguing to NSF or any other grant offering institution that the work is worth supporting.

ED: What is the most creative part of your job at Google research? How do you keep the creativity alive?

CC: I am managing a fairly large and very diverse group of researchers at Google at the same time as carrying out my own research. To keep the creativity for my own research alive, all I have to do is to go out and make a cup of coffee and ask the other Googlers in the kitchen what they are working on. They all have fascinating problems to solve that I would love to spend hours thinking about.

I also have to be creative about getting the group to work together and make progress on their problems. Creativity comes at many levels.

ED: I see that you are a marathon runner. Do you do some of your best problem solving while running?

CC: I hardly ever manage to actually solve a problem running, but it is important to have a good problem to think about while running. Otherwise, it can get a bit boring out there.

ED: You have mentored high school students to help them see how relevant, useful and cool computer science can be. How hard is it to dispel the geeky image of a computer scientist, especially to young women? What is the best advice you would give to a young person?

CC: I usually try to give examples of how computer science is used to advance areas that we find important, like health care, medical research and computational biology. And I try to make them proud of what they do. I also joke about the nerdy boys and how CS is not considered sexy. It is important to say it explicitly instead of denying it.

As for what career to choose, I believe in studying what you really like, independently of whether the area has a future or what other people think of the area. One has to live with that decision for so long that it is important to follow ones dreams.

Women's Cohort Develops Mentoring Plan



April 4 Ladies Tea at AAUW House

Though the number of women at all levels in Computer Science at Rochester isn't record-breaking, the current cohort is active and strong. This was evident at this year's 2nd annual Women in URCS D tea, held Saturday April 4 at the American Association for University Women (AAUW) House in Rochester. Undergraduates, graduates, faculty and local alumnae joined together to get to know each other, establish a network and talk about future plans. Students like Sara Melnick '11 enjoyed the opportunity to get to know other women in computer science. Sara said, "Seeing women in the field, including grad students, professors, and alumnae, who have already gone through the undergraduate experience and made it through, shows that we're not alone, and that we really can have a future in the field." After some time to get to know each other, we began our discussion session in small groups.

The discussion session focused on three main topics: recruitment, mentoring and retention. We also talked about the myths surrounding women in computer science. The women decided they would like to meet regularly throughout the year with a mixture of social and academic activities. This will help develop a network and a sense of community. A strong mentoring plan for freshmen and sophomore undergrads and first year grads will be one of the main activities of the group. A 'meet and greet' party will be held early in the fall semester for new students, and a regularly-scheduled study group will be held for female students of all levels.

In an effort to raise the visibility of women in the department, we have created a bulletin board to showcase research, profiles of alumnae, upcoming events and topics of interest. The women also plan to widely advertise their events to reach all students in the college. As time permits, they would like to do some community outreach in Rochester to make sure young girls find out how cool CSC can be for a woman. Also, as part of Computer Science's merger into the Hajim School of Engineering and Applied Science, our students will have the opportunity to be more active in both the Society of Women Engineers and UR WISE (Women in Science and Engineering) groups. In the end, the group hoped that the number of women in CSC will increase, the opportunities will continue to grow and there will be no need to focus on gender in the future.

Graduate Alumni Report from Near and Far

Ambastha, Madhur (M.S. '05) - "Just wanted to let you know that I have changed companies and also got promoted. I am Vice President at Barclays Capital, situated in New York City. Some personal details - I am married and have a two year old son called Rohan."

Blaylock, Nathan (Ph.D. '05) - "I am now at the Institute for Human and Machine Cognition in Pensacola, FL and still collaborating with James Allen."

Boutell, Matt (Ph.D. '05) - "Annastasya Jeanne was born on September 27, 2007. Her name means "resurrection". To say that her three brothers and sister all adore her is an understatement!" Matt finished his fourth year teaching at Rose-Hulman Institute of Technology in Terre Haute, IN. He is also serving a term as Director of the Imaging Systems Group, and is looking to grow the Imaging program at Rose. He is looking for prospective undergrads to groom and send back to URCS as grad students.

Cottrell, Garrison (Ph.D. '85) - "I am still the Director of the Temporal Dynamics of Learning Center, an NSF-sponsored Science of Learning Center. We are doing well, as can be gleaned from perusing our web pages: <http://tdlc.ucsd.edu>. I also just got promoted to "Step VI", which in UC parlance refers to a "Stuffed Professor" (comes after "Full Professor"). However, I will only be able to enjoy my raise for about a month before they will take it away with a forced salary reduction due to the state budget crisis..."

Crowl, Lawrence (Ph.D. '91) - "I have been heavily involved in developing the next C++ standard. <http://en.wikipedia.org/wiki/C%2B%2B0x>
<http://www.open-std.org/JTC1/SC22/WG21/>
My contributions have mostly been in the areas of abstraction and concurrency."

Dominguez, Melissa (Ph.D. '03) - has moved to Ontario, Canada recently with her husband Jeff Bondy and daughter Trella. She will be working as a senior developer at Primal Fusion in Waterloo.

Du, Harry (M.S. '02)
- Yutao Zhong (Ph.D. '05) and Harry welcomed their first child, a son named Patrick in October 2008.

Goldowsky, Boris (Ph.D. PSY/CSC '95) - "I am working at CAST, Inc - www.cast.org - a non-profit that does educational R&D. I'm the Director of Technology there."

He, Bijun (M.S. '04) - has moved from Google Boston

to Google Mountain View, CA.

He, Shan (Ph.D. '07) - "I moved to a new job as a software engineer at Google in Mountain View, CA in January 2008."

Hitzeman, Janet (Ph.D. LIN/CSC '93) - died May 18, 2009 in Boston, at the age of 46.

Homan, Christopher (Ph.D. '03) - has been promoted to Associate Professor of Computer Science at Rochester Institute of Technology.

Lachter, Joel (Ph.D. CSC/PSY) - "In 2002 I married Jill Ludwig. We have two boys, Ben 4 1/2 and Isaac, 2. I'm still at NASA."

Light, Marc (Ph.D. '96) - "I'm working at the Research & Development Department for Thomson Reuters and I was promoted to Lead Researcher this year. I was involved in adding natural language processing smarts to a pair of products, Reuters Insider and West KM. I also managed to stay active in the academic community by co-organizing two workshops: the NAACL Workshop on Software Engineering, Testing, and Quality Assurance for natural language processing and DESI III Global E-Discovery/E-Disclosure Workshop. More importantly, myself, my wife, and two daughters are healthy and happy here in Saint Paul, MN."

Loui, Ron (Ph.D. '88) - "After a sabbatical of knocking outdoors for a presidential campaign, I have parted company with Washington University in St. Louis. I have many good things to say about the students and several of my colleagues. Based on a decade of actual outcomes, I have been challenging the practice of using Java in CS1 these days, calling it the "single greatest mistake in the history of computing curricula" (IEEE Computer) and a threat to our national competitiveness. The company based on our FPGA deep packet inspection boxes was named Missouri Technology Company of the Year. If you want to squash viruses at ISP's, or do `grep/sed/awk` on network data streams, we currently hold the key patent. I am consulting for Cycorp on a contract at the Cleveland Clinic, doing natural language querying of medical outcomes databases and improving medical records ontologies. I am always looking for interesting new things to do. I am looking to establish a network of urban centers for Unix excellence, and I consider the offshoring of Unix excellence to be a long term threat to our national security."

McInerny, Michael (M.S. '88) - "I joined Amazon.com in the summer of 2004, and have been recently promoted to Sr. Development Manager where I have the privilege of leading a team of world-class software engineers developing the software/service that manages Amazon's global e-commerce product catalog. It uses distributed processing to address the scale, and NLP and AI techniques to improve the quality of our catalog data. (by the way: we're hiring!)"



Patrick Du

Recent Ph.D. Theses

*Manipulations of Elections:
Algorithms and Infeasibility Results*

Piotr Faliszewski

(now at AGH University of Science
and Technology, Krakow, Poland)

*Operating System Enhancements for
Data-Intensive Server Systems*

Chuanpeng Li

(now at Bloomberg L.P.)

Fast Software Transactions

Michael F. Spear

(now at Lehigh University)

*Reliable System Management for
Component-Based Server Systems*

Christopher Stewart

(now at The Ohio State University)

My family enjoys living on Mercer Island in Lake Washington, and exploring the pacific northwest (<http://www.mcinerny.org/michael>). We're sending our eldest to attend Western Washington University in the autumn, and our other three children are starting 11th, 9th, and 8th grades. My wife Diane is a paraprofessional with the local school district's special needs preschool program."

Mellor-Crummey, John (Ph.D. '89) - "I was promoted to Professor of Computer Science in the Department of Computer Science at Rice University. On June 18, 2009, my group received the PLDI'09 Distinguished Paper Award for the paper:

Tallent, N. R., Mellor-Crummey, J. M., and Fagan, M. W. 2009. Binary analysis for measurement and attribution of program performance. In Proceedings of the 2009 ACM SIGPLAN Conference on Programming Language Design and Implementation (Dublin, Ireland, June 15 - 21, 2009)."

Mukherji, Proshanto (Ph.D. '07) - "I married Rachel Sussman (U of R, Ph.D. (LIN & BCS) 2006) in December '08. We honeymooned in Mexico. I graduated magna cum laude from Harvard Law School in June. In September, I started as an Intellectual Property attorney at Fish & Richardson, a Boston law firm."

Parker, Clinton (M.S., '79) - is employed at Parker-

Hannefin, Inc as a project manager/senior software engineer. He is married to Deborah and has 4 daughters, ages 9-14.

Pelavin, Rich (Ph.D. '88) - "I moved out to the Bay Area in 1990 for a job at the Lockheed AI Center that Jay Weber helped me get. After that, I did a startup in network management area that was acquired by Cisco in the mid 1990s. I stayed at Cisco for 8 years and then left to do another startup in the area of networking and server virtualization; that is what I am doing now although the economic downturn has made closing customers and getting venture funding challenging. I've been leveraging my AI background in building a system that uses an SQL database to effectively do deductive inference. I have also been doing a fair amount of travel with the family and over the last few years have gone to Morocco, Japan, Australia, and Israel."

Pook, Polly (Ph.D. '96) - "I have just moved temporarily from Boston to Bangladesh to help start a liberal arts university for women. The Asian University for Women (<http://www.asian-university.org/>) has as its mission to "prepare women of high ability and potential to meet society's challenges and effect positive change through an innovative rigorous curriculum that encompasses the liberal arts, sciences, and professional training, and develops thoughtful and ethical leaders." Muhammad Yunus, Nobel prize winner of the Grameen Bank, sits on our Board of Directors and exemplifies the drive behind educating women to positions of leadership within their communities, in their countries, or in the world at large. We are in Chittagong, Bangladesh but the students come from many countries throughout South and Southeast Asia. I am now helping to design the full curriculum and will stay for the first year of its operation to teach and help prepare a future capstone program on innovation and entrepreneurship. I met a few of the students this week and they are AMAZING: bright, eager, confident, funny and so very much better at draping an orna (muslim scarf for women) than I'll ever be. The university faculty and staff hail from all over the world and seem just fantastic. If any of you are ever in the neighborhood, do stop by!"

Selinger Salgian, Andrea (Ph.D. '01) has received tenure in the Department of Computer Science at The College of New Jersey.

Slayden Mitchell, April (M.S. '02) - "I had a baby girl in November '08. Her name is Harper Wynne Mitchell. She is almost crawling and we are having so much fun with her! I saw Melissa Dominquez (Bondy) right before Christmas when she & her husband Jeff & baby girl, Trella, were in California visiting family. She is doing great as well!"

Stewart, Chris (Ph.D. '09) - "I started a tenure track faculty position at The Ohio State University in September."

Tetreault, Joel (Ph.D. '05) - "I have been at Educational Testing Service (Princeton, NJ) since February 2007 working as a research scientist."

Turner, Paul (M.S. '88) - "I'm at Yodlee, Inc. based in Redwood Shores, CA, since December 2008."

Zhong, Yutao (Ph.D. '05) - "Harry Du (M.S. '02) and I welcomed our first baby in October 2008. His name is Patrick." (see picture on page 8).



Problem Solving Takes McCauley to Africa

Henry (Mac) W. McCauley graduated in 2000 with degrees in both Computer Science and Electrical and Computer Engineering. While at Rochester, Mac worked with Professors Chris Brown and Randal Nelson on the Mobile Wheelchair Project. He and Craig Harman '00 (now a staff member in our department) developed systems and applications code for the original wheelchair robots, and Mac went on to create and analyze images for Randal Nelson's object recognition system. Chris Brown said, "Mac was a fearless problem-solver who seemed to thrive in the unstructured and uncertain world of robotics, where buggy hardware and software meet an unpredictable world and somehow reliable results are supposed to emerge." Mac continues to be a problem solver now, though his work is more focused on water treatment than software. Recently, Mac was interviewed for Multicast.

ED: You graduated with degrees in both Computer Science and Electrical and Computer Engineering. How has the combination of those two degrees been significant in your career so far?

HM: Both degrees were very significant when I worked at ALSTOM Signaling, Inc. in Rochester after graduation, until 2006. I was involved in product design of railroad signaling systems. I worked on software development, from assembly language to C++, including algorithm design, and on hardware development, from I/O modules to the CPU board itself. Now that I have completed my masters degree in water and wastewater engineering with the goal of missions and development work in Africa, those degrees have provided a great background and understanding of the power and control

systems at treatment facilities. More importantly, though, I appreciate how similar and interconnected the different fields of engineering are, and the excellent education provided at the University of Rochester not only taught me about algorithms and circuits, but also how to think critically, search for answers, and design within constraints.

ED: What do you see as benefits for the Department of Computer Science as it joins the Hajim School of Engineering and Applied Science?

HM: There are many connections between computer science and the engineering disciplines, and those connections will likely be more easily tapped. I originally combined the two to pursue a career in robotics research, and there are many other burgeoning fields and developments that will require the collaboration of these fields. I see that the Industry Practicum program that I took part in through Electrical Engineering (now Electrical and Computer Engineering) is also available to CSC students.

ED: During your valedictory speech at our 2000 departmental diploma ceremony, you talked about using your skills and talents for the good of others. Have you been able to make the kind of impact you were hoping to so far?

HM: We can always hope for greater impact, but I have been blessed with opportunities to benefit others using my professional skills. I enjoyed working on railroad signaling systems to improve safety and reliability. I have enjoyed working with municipalities here in Ohio to improve their drinking

water quality or their water pollution control efforts. And I have enjoyed my two trips to Cameroon in West Africa, where I was able to help with water and sanitation projects. I look forward eagerly to full-time missions work in Africa. I hope that we all continue to look beyond ourselves and seek what is most valuable in life.

ED: What were some of the most important skills you learned while studying computer science at Rochester? Why have they been important in your work and life?

HM: Most importantly, I learned problem-solving skills - how to frame the problem, how to do research, how to brainstorm solutions, how to evaluate options, and how to work with a team to complete the task. These skills translate into any field and into all of life.

ED: What advice would you give a young person about a career in computer science?

“Mac was a fearless problem-solver who seemed to thrive in the unstructured and uncertain world of robotics, where buggy hardware and software meet an unpredictable world and somehow reliable results are supposed to emerge.”

Prof. Chris Brown

HM: Look beyond the specifics to the big picture. Don't focus on the particular languages or systems. Learn the theory and how to apply it to many situations and problems, including possible integrations with other fields. And consider how your career could improve the lives of others.

ED: How do you spend your time outside of work? Any hobbies, activities, or organizations?

HM: My main activity outside of work is the joy of being a husband to my wife Leesa and now a father to my ten-month old Seth.

Our favorite activities include hiking and camping with our dog and enjoying time with family and friends. We are also involved in serving the junior high and senior high youth groups at our church. I also enjoy reading, writing fiction, woodworking, and basketball when I get some time.

URCS Introduces New Customizable B.A. Degree

URCS's Bachelor of Science degree has a well-deserved reputation for rigor and intensity. The B.S. provides a thorough grounding in all areas of core computer science, and includes coursework equivalent to the first year of graduate study at most universities. Graduates are well prepared for work at leading R&D laboratories or the best Ph.D. graduate programs.

The B.S. degree is, however, not optimal for many students who are more interested in applications of computing to other disciplines in the sciences or humanities than in computing as an intellectual pursuit for its own sake. The number of courses required to complete the B.S. is also a challenge for many students who wish to double major.

In response to these issues, the department has developed a new Bachelor of Arts degree for 2009, which complements the current (and continuing) B.S. degree. The B.A. in Computer Science provides a flexible and customizable curriculum based on the notions of foundational courses and a choice of

tracks of advanced courses that address a computing related topic in depth.

Along with the new B.A. requirements, the department is introducing two new introductory courses targeted at potential B.A. students and non-majors in 2009-2010. CSC 161, The Art of Programming, and CSC 162, The Art of Data Structures, will parallel the traditional sequence CSC 171, The Science of Programming, and CSC 172, The Science of Data Structures. The new sequence uses the language Python, which provides a more direct entry into programming than more structured languages such as Java or C++.

Students entering the B.A. major will choose from an existing set of tracks, or, along with their departmental advisor, will design a new track. Currently approved tracks include Artificial Intelligence and Vision, Natural Language Understanding, Graphics and Human-Computer Interaction, Theory of Computation, Computer Systems, Computer Security, and Scientific Computing.

Undergraduate Alumni Make Their Mark on the World

Acharya, Athul '06 - Graduated from Purdue with a master's degree in computer science and has taken a position with Intel in Portland, Oregon as a Software Engineer.

Anderson, Darrell '96 - "After 6 years I left Google last year to join the Board of Directors for Agilewaves, developing energy monitoring and conservation tools."

Baird, Tyrone '01 and Diana Calarese Baird '03 announce the birth of their daughter Sonya in January, 2009.

Beyreis, Rob '96 - "After college I bounced around through a couple small startups and then ended up taking a job at Microsoft five years ago. I am currently a Sr. Systems Engineer working on the Windows Experience team supporting large scale web services. I've been married four years to Miina S. ('97) with one daughter Sophia (2)."

Blumberg, Josh '97 - "I am doing well. Recently we moved to Vermont from Cambridge, Massachusetts and I am working as the Director of Technology for the Addison Central Supervisory Union, the school system near Middlebury, Vermont. I married a wonderful woman, Mieko Ozeki, who I met eight years ago while an intern at Eagle Rock School & Professional Development Center in Estes Park, Colorado. Josh Pincus '99 was the best man at the wedding this August."



Josh Blumberg '97 & bride Meiko, with best man Josh Pincus '99

Canton, Jeff '08 - "I'm working at Amazon.com in Seattle, Washington as a Software Development Engineer."



Kazuo Hirakami

Chang Hiramami, Allison '01 - "My husband and I had a baby boy on April 10th; his name is Kazuo."

Clubb, David '06 - "I have been working as a software developer for LimeLeap--a green IT company in Washington, D.C. since March 2009."

Coimbra, Hilario '08 - "I am still working at

Vlingo (www.vlingo.com) in Harvard Square as a Software Engineer for the Server Development Team."

Csapo, Istvan '05 - "I'm doing an M.S. at Boston University in BioImaging and working at Massachusetts General Hospital and Brigham and Women's Hospital in the same field."

Deaett, Louis '02 - defended his thesis at University of Wisconsin, Madison on July 15th and accepted a job at the University of Victoria, British Columbia.

Easwaran, David '04 - "I'm working as a patent examiner with the U.S. Patent Trade Office."

Forney, Zebulen '02 - "I have been in Indiana and working for Simulex. However, I got married to Aditi Mukherjee the first week of August and we moved to Florida shortly thereafter."

Frankel-Goldwater, Lee '06 - "I will be attending graduate school at N.Y.U. in the fall studying Environmental Conservation Education. My hope is to direct my studies toward the application of traditional medicine and native cultural resources in an effort to maintain cultures, aid public health, and protect the environment."

Frueh, Andrew '03 - "I moved to Salt Lake City, Utah last October to begin working as Senior 3D Animator for Interact Medical, a company focusing on medical animation."

Goldstein, Greg '01 - "I moved to the D.C. area in '05, first to Arlington, then to Bethesda last year. I work for SAIC, and currently I'm working on sonar simulation software for a submarine trainer."

Hilton, Rod '04 - and Julia Sando (MTH '04) were married August 8th at the Interfaith Chapel. URCS family in attendance was best man Dennis Lambe, as well as Sam Hathaway '03, Tori Sweetser '03 and Ted Pawlicki.

Hughes, Eric '07 - "I do have one significant change to report; I've recently begun a new job with FGM, Inc., in Reston, Virginia. I'm a software developer on the Net-Centric Enterprise Services program, which aims to provide a service-oriented support to Dept. of Defense interoperability and data sharing. More information can be gleaned from the website at www.fgm.com."

Inamdar, Peenak '00 - "I spent time as a casualty of the recent economic troubles, but have found my self working at Wireless Generation in the role of a Software Architect in Dumbo, Brooklyn, New York. I have been living happily with my fiancée in Alphabet City (Brooklyn)."

Isman, Mike '04 - "I'm now a senior software engineer at Lead Karma, an insurance focused lead generation company, and still running the Life Expectancy Calculator at <http://www.livingto100.com>."

Keesom, Jeff '08 - "I have completed my master's degree in Software Engineering at RIT and I will be starting law school this fall at Syracuse University."



Kim, Beom-Jin '02 - "Currently I am working for a company called Data Management Corporation in Hong Kong as business development manager. This company provides litigation/arbitration support service, called e-Discovery and hardcopy discovery."

Lambe, Jr, Dennis - "I have had a job change this year. I went from Embedded Software Engineer at Preferred Manufacturing in Danbury Connecticut to freelancing as an Embedded Software Engineer in Brookfield Connecticut (the good kind of freelance, with clients, not the kind where it's like being unemployed but sounds better at cocktail parties)."

Lu, David '07 - In the past year David Lu, a grad student at Washington University in St. Louis, was a first author on a paper published in Bioinformatics, directed a musical, and in August, married his college sweetheart Elise Peterson.

Luis, Cristina '01 - "I am on the US World Orienteering Championships team this year. The 2009 World Orienteering Championships were in August in Miskolc, Hungary, and I represented the United States in two races. You can see results for the team at <http://usa-orienteering.blogspot.com/>"

McCann, Brian '03 - "All's going well here. I'm finishing up my second year of doctoral work in sensory neuroscience at the University of Texas. I study the retina."

McCusker, Jim '99 - "I will be starting the R.P.I. Computer Science Ph.D. program in the fall, as part of the McGuinness Lab."

Meeker, Brian '07 - married Stephanie Boley on May 17, 2009. The newlyweds live in Cincinnati, Ohio.

Panagiotopoulos, Diane '09 - has moved to San Diego, California to join fellow alum Macy Abbey '07 at FanBox.

Prithviraj, Preethum '05 - "I'm one year into marriage and my job as EMS Supervisor. Nothing but continuous excitement between the EMS Command and the additional roles I've taken on with the organization in implementing the newest in high-tech medical, communication, and reporting technology for our squads and hospitals. I hope everyone is doing well and still having fun!"

Reisfeld, Daryl '03 - "My girlfriend of three years, Jennifer, and I became engaged in Central Park, NYC

on January 1st, 2009. The wedding will be in June, 2010, in Westchester, New York. I'm currently pursuing an MBA from Columbia Business School and will graduate in May 2010. I was awarded the James D. McQuaid Graduate Fellowship from the Delta Upsilon Fraternity Educational Foundation and have just completed the summer as an associate with the management consulting firm, Booz & Co. in New York."

Rogers, Jennifer '02 - "I recently graduated from UNC-Chapel Hill with a master's degree in city and regional planning. I am currently on the job search for positions in transportation planning, focusing on transit, bicycling, or walking."

Ross, Kiana '01 - "I'm still in Seattle in the math program here at University of Washington, just trying to finish my thesis and move on with life already! :) I was lucky enough to study in some pretty cool places this last year though...spent about half the year at Berkeley and even some time in London. In other news, I'm getting married this fall! My fiance's name is Tom and he's also a computer geek, so I didn't stray too far from my roots. We're getting married in Playa Del Carmen, Mexico this September."

Sankel, David '02 - "Hi friends and classmates! My wife Carlana and I have a new addition to our family, Peter James Sankel. He was born in our living room in a breathtaking chain of events (see davidcarlana.com). My business, Sankel Software, continues to truck along with exciting new projects and developments, the most important being pure functional programming. For those who don't know, pure functional programming is a discipline and there are many

languages out there that explicitly support it, like Haskell. I've been delving deeper into the topic and it has truly revolutionized my personal software development and the way I approach projects (see denotational semantics). I encourage anyone who is still writing software to jump into this topic. It's the way of the future."

Sarkis, Richard '05 - "I'll be starting a masters program in computer science at RIT this fall."

Schmid, Jonathan '03 - "I expect to graduate with an M.S.E. in Robotics from University of Pennsylvania (GRASP Robotics Lab) at the end of December. I still work in Media, Pennsylvania doing GIS work. I'm working to create a new product, offering custom designed posters showcasing environmental education GIS work for environmentally affiliated groups and municipalities."

Class of 2009

Zachary Alexander
 Peter Andrews
 Andrew Blanchette
 Eric Bluestein
 Christopher Clingerman
 Stephan Delmer
 Gregory Hartman
 Jeremiah Hemphill
 Tyler Kieft
 Marin Kobin
 Christopher Norine
 Diane Panagiotopoulos
 Kyle Sabo
 Jacob Scheiber
 Ryan Schmitt
 Devin Snyder
 Justin Steinberg
 Dennis Wheeler

Silverman, Mike '08 - "I'm proud to pass along that I put a small team together to win a Student Showcase Award at last year's Independent Games Festival (Think Sundance for games). Now I'm working as the creative lead on a game project to motivate breathing exercises in post-op surgical patients funded by the Institute for Creative Technology and one of my professors, Mark Bolas. It's a summer gig. We have two games for health conference papers about the project already and are planning to have the complete game experience done by the end of the summer. Here's the award page for my game: <http://www.igf.com/02studentfinalists.html#Kid>.

The team got to go into the awards on the red carpet and sit at our own private table and everything. We were right across from people like Will Wright. All in all, very cool."

Tilton, Michael '08 - "After dating for five years Kara and I got married on June 13th, 2009 in Ithaca, New York. In attendance at the wedding were fellow CS classmates Matt Wagner, Dan Quirk, Nick Wrem, and Nick Sedney. Otherwise, I just completed my first year as a Software Developer at Paychex."

Turner, Jenine '03 - "I am working as a program-

mer at athenahealth in Boston, and I got married at the end of August."

Uzilov, Andrew '05 - "I am now in my second year of the bioinformatics Ph.D. program at University of California - Santa Cruz (go Banana Slugs!), juggling several interesting projects. I'm almost done with the class work, so now it is time to work on advancing to candidacy! I earned the prestigious three-year Graduate Research Fellowship from the National Science Foundation, which starts funding me in Fall 2009. Prior to entering UCSC, I spent two years hanging around UC Berkeley working for a bioinformatics lab. I have three journal papers under my belt and more coming - watch out! Fellow UR alum (and eternal love) Kathleen Hutchison and I are still happily together and both progressing through graduate school nicely."

Vong, Pam '08 - "I am back in school, getting a master's in web design & development from the University of Denver's University College."

Weingarten, Tom '06 - "I am still working on my Ph.D. at NYU. I did an internship at Merck this summer in the chemical modeling and informatics department. If you want to tell people that I found work in modeling that's okay with me."



A blast from the past
Spring 2006 Undergraduate Picnic

UR Robotics: Alive & Kickin'

by T. F. Pawlicki

Robotics is an inherently multi-disciplinary area of study, drawing heavily on computer science as well as mechanical and electrical engineering. Robotics spans multiple levels of abstraction in Computer Science. On a single project, one student can be working on low-level protocols for radio frequency communication while others can be working on computer vision or artificial intelligence planning algorithms. From theory to systems and everything in between, robotics projects represent a microcosm of the sweeping breadth across all of computer science.

Over the past year, a group of our undergraduate Computer Science students has been leading the University of Rochester's first entry into the RoboCup international robotics soccer competition. RoboCup is one of the most prestigious international robotics competitions. Established in 1993, the aim of the RoboCup competition is to develop autonomous soccer robots with the intention of promoting research and education in the field of artificial intelligence. The official goal of the project is: "By mid-21st century, a team of fully autonomous humanoid robot soccer players shall win the soccer game, complying with the official rule of the FIFA, against the winner of the most recent World Cup".

The University of Rochester's undergraduate team has chosen to enter the "Small Size Robot League" of the RoboCup competition. In the Small Size League, each team consists of five robots on wheels. The players have only a few sensors on board; most of the information is provided by cameras that are fitted above the playing field. This information is then sent to an external computer which sends commands back to the robots through a wireless link. In this league, the research teams can decide freely how they wish to design their robots. There are no restrictions

"Robotics can energize and revolutionize computer science education. Robotics contextualizes learning in the real world, makes programming a social activity, and provides an unparalleled platform for creative problem solving."

Henry Kautz

concerning the choice of materials, shape and software - only the size (diameter and height) of the robots is restricted. The robots are controlled by external computers, therefore the players in this league are regarded as semi-autonomous.

The undergraduate computer science RoboCup team has been working during the summer of 2009 under the direction of Dr. George Ferguson on the overarching system architecture for the robot team

control and coordination. According to Ferguson, "Robot soccer and intelligent agents research in general are terrific motivators for computer science. Many of the hardest problems in CS occur nat-



Dr. George Ferguson and Ben Hopkins '11 work together on the RoboCup robot

urally in AI, and many of the most promising techniques for solving these problems have come out of AI. On a personal note, I can well remember being beaten by a simple checkers program that I wrote in an undergrad AI class. Seeing your code do something intelligent on a real problem is a wonderful experience."

Undergraduate computer science major and University of Rochester RoboCup team leader Ben Hopkins '11, is looking forward to increasing student interest in robotics. "Working on the robotics project has been a great opportunity to apply lots of computer knowledge to a real world problem.", Hopkins says. "Hopefully, we will be able to demo our system this fall and recruit more students to the team."

In response to the student interest and enthusiasm generated by the RoboCup team effort, the University of Rochester's Department of Computer Science has instituted new courses to support undergraduate study and research in the area of robotics. According to URCS Chairman, Dr. Henry Kautz "Robotics can energize and revolutionize computer science education. Robotics contextualizes learning in the real world, makes programming a social activity, and provides an unparalleled platform for creative problem solving." In support of these efforts, a new course for freshman called "Explorations in Robotics" is slated for the fall semester. Professor Chris Brown will be offering an upper level undergraduate course "Advanced Robotics" for the Spring '10 semester. These activities are expected to grow and expand in coming years as more and more University of Rochester students are exposed to the intellectual challenge and stimulation of robotics research.

Multicast

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