

Significant BITS

Newsletter of the
Department of Computer Science

Winning the War on Bugs

Nearly all software ships with known bugs, and unknown ones are just lurking in the code waiting to be discovered. Some bugs are benign; for example, a page might not display correctly in a browser. But more serious bugs cause programs to crash unexpectedly or leave them vulnerable to attack by hackers. These bugs are difficult for programmers to find and fix. Even when the bugs are critical and security-sensitive, it takes an average of one month between initial bug reports and the delivery of a patch.

Rather than waiting for programmers to fix their bugs, or for hackers to find and exploit them, Associate Professor Emery Berger's group is designing systems to make software bug-proof. These systems allow buggy programs to run correctly, make them resistant to attack, and even automatically find and fix certain bugs. This work, developed jointly with Ben Zorn at Microsoft Research, was an important influence on the design of the Fault-Tolerant Heap that today makes Windows 7 more resistant to errors.



Emery Berger

Defending Against Bugs

Berger and Zorn first developed an error-resistant system called **DieHard**, inspired by the film featuring Bruce Willis as an unstoppable cop. DieHard attacks the widespread problem of memory errors. Programs written in the C and C++ programming languages—the vast majority of desktop, mobile, and server applications—are susceptible to memory errors. “These bugs can lead to crashes, erroneous execution, and security vulnerabilities, and are notoriously costly to repair,” says Berger.

Berger uses a real-estate analogy to explain the problem of memory errors. Almost everything done on a computer uses some amount of memory—each graphic on an open Web page, for example—and when a program is running, it is constantly “renting houses” (chunks of memory) to hold each item, and putting them back on the market when they are no longer needed. Each “house” has only enough square footage for a certain number of bytes.

Programmers can make a wide variety of mistakes when managing their memory. They can unwittingly rent out houses that are still occupied (a dangling pointer error). They can ask for less space than they need, so items will spill over into another “house” (a buffer overflow). A program can even place a house up for rent multiple times (a double free), or even try to rent out a house that does not exist (an invalid free), leading to havoc when the renter shows up. These mistakes can make programs suddenly crash, or worse: they can make a computer exploitable by hackers.

The way “addresses” are assigned also makes computers vulnerable. Houses (memory locations) with especially desirable valuables, like passwords, will always be on the same lot on the same street. If hackers can locate a password once, they can easily locate the password’s address on anyone’s version of the same program, adds Berger.

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Andrew McGregor receives NSF CAREER Award

Assistant Professor Andrew McGregor received a five-year National Science Foundation Faculty Early Career Development (CAREER) award for his project “New Directions for Sketching and Stream Computation.”

Various technological trends, such as faster networks, cheaper data storage,

and ubiquitous data logging have given us access to massive amounts of data.

“Traditional theoretical models of computation and notions of efficiency need to be reconsidered when monitoring Gbps network traffic, mining petabytes of search engine data, or processing data that is distributed across multiple low-power sensors,” says McGregor. “Furthermore, the data that is quickest to accumulate is often noisy, plagued by internal inconsistencies, or partially redundant. Exploiting such data poses

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BERGER'S WAR ON BUGS – – – continued from page 1

DieHard attacks these problems in several ways. First, it completely prevents certain memory errors, like double and invalid frees, from having any effect. DieHard keeps important information, like which houses are rented and which are not (heap metadata), out of hackers' reach. Most importantly, DieHard randomly assigns addresses—a password that has a downtown address in one session may be in the suburbs the next time around. "This randomization not only adds security but also increases resilience to errors, reducing the odds that dangling pointer errors or small or moderate overflows will have any effect," says Berger.

Exterminating the Bugs

While Berger is pleased that the DieHard work has influenced the Windows 7 Fault-Tolerant Heap, he hopes that Microsoft will adopt the technology that Zorn, Berger, and his Ph.D. student Gene Novark designed next, called **Exterminator**. Exterminator not only finds errors but also automatically fixes them. Exterminator uses a variant of DieHard (called **DieFast**) that constantly scans memory looking for signs of errors. DieFast places "canaries"—specific random numbers—in unused memory. Just like in a coalmine, a "dead" canary means trouble. When DieFast discovers a dead canary, it generates a report containing the state of memory.

Exterminator next applies forensic analysis to these reports. With information gleaned from several users running a buggy program, Exterminator can pinpoint the source and location of memory errors. From that point on, Exterminator protects the program from that error by "padding" buggy memory requests (or renting more houses) to prevent overflows, and delaying premature relinquishing of memory (delaying putting the house back on the market) to prevent dangling pointer errors.

Berger notes that since Microsoft already gathers information when programs crash, using techniques similar to those in Exterminator would be a natural next step to quickly find and fix memory errors.

Berger is now tackling the problem of concurrency errors—bugs that are becoming more common with the widespread adoption of multicore CPUs. His group recently developed **Grace**, a system that prevents concurrency errors in C and C++ programs, and Berger hopes that some version of it will also gain widespread adoption as part of an arsenal to protect programs from bugs.

Berger joined UMass Amherst in 2002 after receiving a Ph.D. in Computer Science from the University of Texas at Austin. He has spent three summers as a visiting scientist at Microsoft Research and one year as a visiting professor at the Universitat Politècnica de Catalunya / Barcelona Supercomputing Center. Berger's research spans programming languages, runtime systems, and operating systems, with a particular focus on systems that transparently improve reliability and performance. He is the creator of various widely-used software systems including Hoard, a fast and scalable memory manager that accelerates multi-threaded applications.



McGREGOR'S CAREER AWARD – continued from page 1

new algorithmic challenges and raises fundamental questions about the computational complexity of processing massive data sets."

Over the last few years, the study of sketching (a form of compression based on linear projection) and stream computation (space-bounded computation where the input is processed sequentially) has sought to address aspects of massive data computation. The research goal of McGregor's CAREER project is to initiate and pursue a variety of new directions for these computational models and to champion the cause of algorithmic theory in stream processing. This includes developing a deeper understanding of why certain theoretically-intractable problems can be solved in practice and designing new abstractions that better capture the various ways in which useful information can be hidden in the available data.

Prior to joining the department's faculty in January 2009, McGregor held postdoctoral researcher positions at Microsoft Research (Silicon Valley) and at the University of California, San Diego, Information Theory and Applications Center. He received his Ph.D. and M.Eng. in Computer Science from the University of Pennsylvania in 2007 and 2002, respectively.

The CAREER program offers the NSF's most prestigious awards for new faculty members. It recognizes and supports the early career-development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. In addition to McGregor, seventeen members of the department's faculty have received previous CAREER awards.



Top 20 ranking for UMass Amherst CS

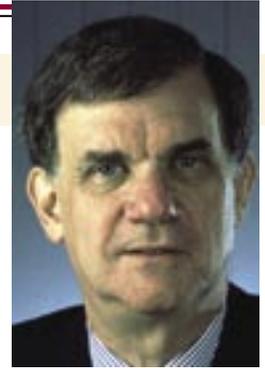
According to the *U.S. News & World Report* rankings of the 2011 America's Best Graduate Schools, the UMass Amherst graduate program in computer science ranked 20th, while its artificial intelligence specialty ranked 8th. The annual rankings are based on the ratings of academic experts, the magazine says.

Osterweil given SIGSOFT Influential Educator Award

The Association for Computing Machinery Special Interest Group on Software Engineering (ACM SIGSOFT) selected Professor Leon J. Osterweil for the 2010 ACM SIGSOFT Influential Educator Award. Osterweil was recognized for pioneering software engineering as an academic discipline, contributions to software engineering scholarship and excellence through graduate education, and mentoring of new software engineering faculty.

The award is presented annually to an educator who has made significant contributions to, and impact on, the field of software engineering with his or her accomplishments as a teacher, mentor, researcher (in education or learning), author, and/or policy maker. Osterweil received the award during the 2010 ACM/IEEE 32nd International Conference on Software Engineering (ICSE) held in Cape Town, South Africa in May. This year marks only the second time this lifetime achievement award has been presented.

During ICSE in South Africa, Professor Osterweil (holding award) is surrounded by some of his many academic descendants.



Osterweil won two other SIGSOFT lifetime achievement awards previously. In 2003, he received the group's top honor, the ACM SIGSOFT Outstanding Research Award, and in 1997 he won the Most Influential Paper Award, a coveted honor given as a 10-year retrospective.

Osterweil's Influential Educator Award nomination states that he has had a profound impact on the field of software engineering as an educator and university administrator. "Many of Osterweil's Ph.D. students have gone on to be pioneering researchers and producers of their own Ph.D.s; his combined Ph.D. descendants now number over 100. Among these Ph.D. descendants are one ACM SIGSOFT Outstanding Research Award winner, the authors of three ICSE Most Influential Paper Awards, one Dean, three Department Chairs, three ACM SIGSOFT Chairs, two ICSE General Chairs, and six ICSE Program Co-Chairs."

Osterweil's research centers on software analysis and testing, software tool integration, and software processes and process programming. Among his many other achievements and activities, Osterweil is a Fellow of the ACM, has been an ACM Lecturer, is director of the International Software Process Association, has served on the editorial board of *IEEE Software* and on the board of *ACM Transactions on Software Engineering and Methodology* since its inception, and has been a member of the Software Engineering Institute's Process Program Advisory Board since its inception.

Adrion receives Distinguished Outreach Award

Professor W. Richards Adrion was honored with the UMass Amherst Distinguished Academic Outreach Research Award presented to him by Chancellor Robert Holub during the Founder's Day ceremonies in April.

The Distinguished Academic Outreach Awards, established in 1997, recognize and encourage superlative individual achievements in outreach as an incentive to further community engagement as part of the academic enterprise.

Adrion received the award for his many leadership contributions over the years to developing, broadening, expanding, and improving computing and information technology (IT) activities in K-12 and in higher education across the Commonwealth. The award recognizes Adrion in particular for his efforts on CITI (the Commonwealth Information Technology Initiative) and CAITE (Commonwealth Alliance for Information Technology Education).

Adrion is the Director of CAITE, an alliance that designs and carries out comprehensive programs that address underrepresentation in IT education and the workforce. CAITE focuses on women and minorities in groups that are underrepresented in the Massachusetts innovation economy; that is, economically, academically, and socially disadvantaged

residents. He is also the Co-Director of CITI which is involved in strengthening, modernizing and invigorating computing and technology programs in Massachusetts public higher education. Adrion is also the Principal Investigator of an NSF Research Experiences for Undergraduates site, and Co-Director of the RIPPLES (Research in Presentation Production for Learning Electronically) multimedia teaching and learning group.

The use of multimedia technology for teaching and learning, both in the classroom and for distance education, is a major focus of Adrion's research. He is also active in the fields of testing, analysis and verification of complex software systems.

Adrion is a fellow of the American Association for the Advancement of Science and of the Association for Computing Machinery. As of 2009, he is the Faculty Delegate to the University of Massachusetts Board of Trustees. Adrion has served several times as a senior manager at the National Science Foundation, where he was instrumental in setting strategic directions for computing research.



CS Researchers play critical role in GENI program

UMass Amherst Computer Science researchers are building and deploying a virtual laboratory funded by the National Science Foundation for experimenting with future Internet architectures.

The department's projects account for four of the 60+ academic and industry projects currently being funded to prototype the nationwide network testbed, the Global Environment for Network Innovations (GENI). GENI, being managed by BBN Technologies of Boston, is beginning to take shape by linking research testbeds at different sites throughout the nation through national networks, such as Internet2 and the National Lambda Rail. The Department's four projects cover a diverse array of topics including the ViSE steerable sensor network testbed, the DiCloud cloud computing testbed, the mobile DOME testbed, and a WiMax deployment.

One of the Department's GENI teams, Virtualized Sensing Environment (ViSE), is led by Professor Prashant Shenoy and ECE Assistant Professor and CS Adjunct Professor Michael Zink. As modern systems increasingly rely on networks of specialized computers and sensors to monitor environmental conditions, testing performance and reliability at scale becomes

more important. ViSE will be integrated with the campus' Collaborative Adaptive Sensing of the Atmosphere (CASA) sensor network to "revolutionize the way we observe, understand, and predict hazardous weather."

Together CASA and ViSE have deployed computers at many locations in the Amherst area, including on mountain-top fire towers and buildings on campus. These computers connect to short-range weather radars and communicate wirelessly using long-distance antennas. The sensing testbed allows researchers to experiment using these sensors to improve systems for predicting and detecting dangerous weather such as tornadoes. Shenoy says the project's goal is "to develop an open, accessible, shared public facility that other researchers can use to test out their own ideas." Testbed users are able to request "virtualized" access to each computer and its sensors. Virtualization enables a high degree of multi-user sharing that supports many researchers simultaneously without sacrificing the necessary freedom each researcher requires to develop and experiment with radical new approaches. Because GENI is a nationwide facility, the ViSE testbed coordinates with GENI's nationwide clearinghouse to allow researchers access to experimental testbeds and networks that span the country and cut across multiple technologies beyond sensing systems.

Another GENI project, **DiCloud**, led by Zink and Shenoy, has the immediate goal of connecting ViSE with emerging cloud computing platforms offered by companies such as Amazon. DiCloud's goal is to incorporate virtualized cloud resources into the GENI prototype, notably its storage services, to provide an end-to-end software stack to conduct distributed data-intensive sensor network experiments using ViSE's sensors.

"Our goal, and GENI's, is not to develop the single best sensing system or new Internet architecture, but to develop a shared testbed, where students and researchers from across the country can build and experiment with their own new approaches to improve sensing systems by integrating them with the new Internet technologies GENI enables," says Zink. The DiCloud team recently demonstrated their system at the Seventh GENI Engineering Conference in Durham, North Carolina, as part of a large cluster of GENI projects that includes Duke University, the Renaissance Computing Institute, Ohio State University, Northwestern, Oklahoma State, Columbia, Houston, and North Carolina State. The team demonstrated the dynamic instantiation of a slice of GENI resources, including sensors and virtual machines located at UMass Amherst, Duke University, and Amazon's Elastic Compute Cloud, connected via multiple network providers, including the National Lambda Rail, the Starlight facility in Chicago, and the BEN optical network in Raleigh-Durham, to sense, process, transmit, and archive high-bandwidth radar sensor data.

As the national network begins operation, scientists will be able to run experiments to address a wide variety of problems in communications, networking, distributed systems, cybersecurity, and networked services. "New innovation in sensing systems goes hand-in-hand with new innovation in the Internet and cloud computing, since sensors must send their data

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Fu given Armstrong Award

Assistant Professor Kevin Fu received the campus's Armstrong Fund for Science Award for research innovation. This grant is made possible through a generous gift from John and Elizabeth Armstrong and intended for faculty members with aggressive research visions. The research should represent a new initiative: either a bold, new line of research or the application of prior research to a field that has no precedent for it.

Fu investigates how to ensure the security and privacy of pervasive devices that must withstand attacks from determined, malicious parties. His primary focus is on improving the security and privacy of pervasive healthcare and energy-constrained architectures such as implantable medical devices and computational RFIDs (radio frequency identification).

Fu leads the Security and Privacy Research (SPQR) group at UMass Amherst. He is the director of the RFID Consortium for Security and Privacy (RFID CUSP), and he co-directs the Medical Device Security Center. He was named the 2009 *Technology Review* Innovator of the Year for his cutting-edge research. Fu is an Alfred P. Sloan Research Fellow, and he received an NSF CAREER Award in 2009. His research received best paper awards from USENIX Security and the IEEE Symposium on Security and Privacy.



Moss named IEEE Fellow

The Institute of Electrical and Electronics Engineers (IEEE) has named Professor Eliot Moss a Fellow, one of the Institute's most prestigious honors. Moss was recognized for his contributions to transactional computing and memory management.

According to the IEEE, the Grade of Fellow is conferred by the Board of Directors, following a rigorous evaluation procedure, upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth of one percent of the total voting Institute membership.

Moss's research interests include programming language

design and implementation, database and information retrieval systems, persistent object stores and persistent programming languages, memory management and garbage collection. He received his B.S., M.S., and Ph.D. at the Massachusetts Institute of Technology.

Moss is a Fellow of the ACM. He received the 2009 UMass Amherst Chancellor's Award for Outstanding Accomplishments in Research and Creative Activity. Since 2005, he has also been a priest of the Episcopal Church.



GENI PROJECTS - - - - - continued from page 4

over the Internet to the computers that ultimately process the data to accurately predict when and where hazardous weather exists," Zink explains.

Created in 2005, the Diverse Outdoor Mobile Environment (DOME) is a versatile mobile network test bed composed of 35 computer-equipped public transit buses operated by UMass Amherst PVTAs. Each bus has a GPS, WiFi card and access point, 3G cellular modem, and a 900MHz two-way radio. Through cooperation with the Town of Amherst and UMass Amherst Office of Information Technologies, the DOME network also interconnects with the downtown and campus WiFi networks. As part of the GENI program, the DOME team is led by Associate Professors Brian Levine and Mark Corner and staff researcher Brian Lynn. This past September, the team announced that they had achieved their goal of making DOME available to researchers throughout the world. Through DOME's web portal, researchers can schedule access to the DOME test bed and install their experiments on the buses, without ever having to visit Amherst.

"High-quality mobile systems research depends on the deployment and evaluation of systems in a realistic, large-scale heterogeneous environment," says Levine. "DOME allows experimentation to factor in realistic constraints such as movement, propagation, latency and throughput, connection establishment and node discovery." DOME has proven useful to more than just researchers. The DOME team has used the equipment to provide bus tracking services to UMass Amherst Transit, and Internet access to bus riders. This in turn may generate more research opportunities, since researchers are now studying how the bus riders use the Internet in an effort to improve mobile computing.

As GENI enters its second phase, its vision is to create a large-scale virtual laboratory that enables network experimentation at a much larger scale than has previously been available. A critical component of this vision is what GENI refers to as a "meso-scale" computing infrastructure: the interconnection of test beds using high-speed backbone networks, VLANs and programmable routers. As part of the meso-scale computing effort, UMass Amherst joins Columbia, NYU Poly, Rutgers, Stanford, UCLA, University of Colorado, and University of Wisconsin in being selected to build and deploy

high-speed WiMAX-based test beds. The WiMAX project, led by Corner, Levine, and Lynn, will initially deploy a WiMAX (Worldwide Interoperability for Microwave Access) base station on the UMass Amherst campus. WiMAX can support speeds up to 20Mbps, and the base stations will have a range of 3-5 kilometers. The base station will be fully programmable. "In contrast to technologies such as 3G," states Corner, "researchers will be able to control and instrument both the ingress and egress points of the wireless network. Furthermore, the speed of WiMAX will allow us to perform research on services that previously was not feasible."

After deploying the WiMAX base station, the project will integrate WiMAX into the DOME test bed by adding WiMAX clients to the computers on the buses. The project will also connect the UMass Amherst WiMAX network to other GENI campuses, through high-speed networks such as Internet2 and National Lambda Rail. "Because of our WiMAX effort, DOME will become part of a large-scale network test bed," adds Corner. The meso-scale network will encompass wired and wireless networks, contain stationary and mobile nodes, and span from sensors to servers.

NESCAI held on campus

More than 100 graduate students from across New England, eastern Canada, New York, Pennsylvania, and Maryland attended the fourth Northeast Student Colloquium on Artificial Intelligence (NESCAI) held on campus in April. Graduate students David Mimno and Sameer Singh co-chaired the event hosted by the department. This year was the largest NESCAI ever held, with 68 papers and three invited talks. The conference, previously held at Cornell University, includes research presentations on all areas of artificial intelligence, from planning and search to vision and natural language processing.

Invited speakers included Jonathan Chang, a member of the Data Science team at Facebook, Ron Brachman, Vice President of Yahoo! Labs and Research Operations and the creator of Yahoo!'s Academic Relations organization, and Andrew Barto, Professor and Chair of the UMass Amherst Computer Science Department.

Distinguished Lecturer Series

For the 2009-2010 Distinguished Lecturer Series (DLS), the department hosted five prominent speakers.

Jennifer Widom, the Fletcher Jones Professor and Chair of the Computer Science Department at Stanford University, spoke in September on “Principled Research in Database Systems.” She discussed the challenges of developing new data models and query languages that are simultaneously well-defined, understandable, sufficiently expressive, similar to existing models and languages, and implementable.

In October, **Paul Debevec**, Research Associate Professor and Associate Director of the Graphics Laboratory at the University of Southern California’s Institute for Creative Technologies, gave a lecture on “Digital Emily: Achieving a

Photoreal Digital Actor.” During his presentation, he focused on how high-resolution face scanning, advanced character rigging, and performance-driven facial animation were combined to create “Digital Emily,” a believably photorealistic digital actor.

The recipients of the department’s 2009 Outstanding Achievement in Research Awards were invited back to campus to present their work as part of the DLS. **Michael Franklin**, Professor of Computer Science at UC Berkeley, visited in March to discuss “The Alliance vs. The Horde: A Struggle for the Future of Data Analytics.” **Tuomas Sandholm**, Professor of Computer Science at Carnegie Mellon University, spoke in April on “Design and Algorithms for Modern Kidney Exchanges.”

Massachusetts Governor **Deval Patrick** gave the Sidney Topol Distinguished Lecturer Series speech in May (see article below for more details).

Governor is Topol Distinguished Lecturer

Massachusetts Governor Deval Patrick presented a technology-related address on April 22 as part of the Sidney Topol Distinguished Lecturer Series at the UMass Amherst Campus Center Auditorium.

Patrick’s talk was the concluding lecture in the series established in 1997 with a gift from UMass Amherst alum Sidney Topol, widely regarded as a telecommunications pioneer who helped forge the cable-satellite connection that triggered the growth of cable television in the U.S. A Boston native, Topol was president, CEO, chairman of the board and director of Scientific-Atlanta, Inc., a manufacturer of broadband communications systems, satellite-based networks, and instrumentation



Pictured (left to right): Sidney Topol, Governor Deval Patrick, UMass Chancellor Robert Holub, and CS Professor Rick Adrion, who has coordinated the Topol Series since its inception.

for industrial communications and government applications. During his tenure, the company grew in sales from \$16 million to more than \$600 million. He is currently the president of the Topol Group LLC and is a member of several boards in Massachusetts.



National meeting on cyber security held on campus

The Institute for Information Infrastructure Protection (I3P), a consortium of leading universities, national laboratories, and nonprofit institutions dedicated to strengthening the cyber infrastructure of the United States, selected UMass Amherst to hold its national meeting for member institutions this past fall. Forty researchers from leading universities, national laboratories, and the Department of Homeland Security converged on the department to discuss how to protect the nation’s information infrastructure against catastrophic failures. The I3P invited several of the

campus’ faculty to speak about on-going cyber security activities at UMass Amherst. These included CS Professors Kevin Fu, Gerome Miklau, and Jim Kurose, along with ECE Prof. Wayne Burleson, Civil & Environmental Engineering Prof. John Collura, and ISOM Finance and Operations Management Prof. Anna Nagurney.

Successful shirt campaign

The UMass Amherst ACM student chapter organized a successful sale of CS t-shirts and hoodies. The group sold over 450 t-shirts and hoodies, and shipped 130 shirts to alums from throughout the U.S. to as far as Canada, England, and Norway. David McGavern, a senior BDIC major, created the binary tree CS logo design displayed on the shirts. In the fall, the ACM chapter is planning a new logo design contest and future shirt sales. Details are at umass.acm.org.



CAITE outreach efforts making statewide impact

Since it began in 2007, the Commonwealth Alliance for Information Technology Education (CAITE), directed by Professor Rick Adrion, has reached more than 8,000 students and some 500 educators at more than 100 events and activities across Massachusetts aimed at broadening participation in computing. Based at UMass Amherst and funded by the National Science Foundation's Broadening Participation in Computing program, CAITE involves 15 public higher education institutions across the state to diversify the innovation economy.

Community colleges (9 of CAITE's 15 partners) enroll large and increasing numbers of students, including under-represented minorities, females, working students, and first-generation college attendees. CAITE's college and technology fairs, contests, and middle- and high-school camps aim to interest a broader range of students in computing fields and support them through the high-school-to-community-college-to-four-year-college educational pathway.

Already, CAITE is making an impact at its partner campuses:

- Since 2006, community college (CC) IT program enrollment has grown 56%;
- Numbers of female students majoring in these programs grew by 60%;
- Enrollment by under-represented minorities in IT majors at CCs grew by 88%;
- Female enrollment in 4-year IT programs increased by 19%;
- Minority enrollment in IT majors is up 60% overall in CAITE campuses.

Locally, the department's 2010 undergraduate outstanding student awards are evidence of community college transfer students' success in the field: of 8 awardees, 2 had transferred from community colleges. In addition, 50% of the CS

seniors on the fall 2009 dean's list were CC transfers, and 75% of the department's Baystate Scholars had also studied at community colleges.

CAITE is developing online resources, articulation agreements, advising structures, and curricula across partner campuses designed to ease transfer and support and retain students. One example is the support of peer-led supplemental instruction sessions in challenging courses. CAITE and the CS Department also partnered this year with the UMass Amherst College of Engineering to integrate computer science into two large events: Women in Engineering Career Day, which brings 200 high school girls to campus, and Community College Day, which encourages transfer to four-year schools.

A highlight of this spring was CAITE's partnership with FIRST and LEGO Education to bring 35 middle-school girls to campus for "Girls Connect," a Saturday introduction to building and programming LEGO robots. UMass Amherst graduate and undergraduate students helped mentor the girls who came from Greenfield, Northampton, and Holyoke. Grad students Megan Olsen and Borislava Simidchieva are pictured helping the girls (in red) program their LEGO Mindstorms robot. The program helped the the girls overcome their fear of programming and robotics and developed teamwork skills. For more about CAITE's work, see www.caite.info.



Adrion leads computing workshops

Professor W. Richards Adrion was one of the organizers of the "Workshop on Educational Opportunities Associated with a Green High Performance Computing Facility," held at Holyoke Community College (HCC), and the "CloudCamp Western Massachusetts" Workshop, held at Springfield Technical Community College (STCC) this spring.

Renowned speaker Dr. Francine Berman, Vice President for Research and Professor of Computer Science at Rensselaer Polytechnic Institute, gave the keynote address at the HCC Workshop. Over 70 attendees from the Massachusetts Institute of Technology, Boston University, UMass Amherst, STCC, HCC, local economic development organizations, and K-12 and educational non-profit representatives gathered to discuss the educational and economic potential of the high-performance computing center to be built in Holyoke. Recommendations from workshop attendees will be published in a report to be released this summer. The workshop was

sponsored by the Commonwealth Information Technology Initiative (CITI), which Adrion directs.

The department also sponsored the Workshop held at STCC. Department speakers included Postdoctoral Research Associate David Irwin and Distinguished Professor and Executive Associate Dean of the College of Natural Sciences Jim Kurose. CloudCamp is an "unconference" focused on the introduction and adoption of cloud computing, providing a chance for attendees to meet, discuss, share ideas, and advance knowledge and understanding of cloud computing. Business people, students, faculty, system administrators and others interested in or responsible for information technology attended the event. The National Center for Information and Communications Technologies (ICT Center) streamed live video of the event to colleges around the nation. Local organizers included TNR Global and the ICT Center at STCC.

Fast predicts NFL coaching success



In an article titled “You want winners? Here’s a formula,” ESPN.com recently featured work by Andrew Fast (PhD ’10) analyzing the social network among professional football coaches. The work originally appeared at the AAAI Fall Symposium in 2006.

In the NFL, organizations look to hire head coaches who will consistently produce winning teams, says Fast, a New England Patriots fan. Hiring decisions are based, in part, on the “coaching trees” of the candidates.

A coaching tree captures the lineage of a particular coach; a “protégé” coach who has worked under successful “mentor” coaches is likely to be successful also.

Fast examined every head and assistant coach in the NFL from 1920 through 2007 to identify characteristics of successful coaches. One conclusion he reached is that championship coaches tend to have fewer mentor coaches than non-championship coaches. This implies that talented coaching candidates either quickly rise to head coaching positions or work under successful head coaches for long periods of time. In addition, Fast uses Relational Probability Tree (RPT) models developed in the Knowledge Discovery Laboratory to predict future playoff success using the coaching tree of a head coach. These models show that the experiences of both the head and assistant coaches are valuable for predicting playoff teams, and the coaching network alone can be used to make accurate preseason predictions for which teams will make the playoffs.

“After the 2005 season, there were a lot of articles in the press about how teams used the coaching network to make hiring decisions,” says Fast. “I wanted to test whether or not

John Cavazos (Ph.D. ’05), Assistant Professor in the Department of Computer and Information Sciences at the University of Delaware, was selected a recipient of the prestigious National Science Foundation Faculty Early Career Development Award. With his CAREER project, he will develop adaptive compilers for multi-core computer environments, freeing software developers from laborious and time-consuming hand-tuning of compilers and helping machines make fuller use of their performance capabilities.

Matthew Cornell (M.S.’91), published his time management guide to daily planning, “Where the !@#% did my day go? The ultimate guide to making every day a great workday.” This is his second publication, and joins his popular “You Did WHAT? 99 Playful experiments to live a healthier and happier life.” More at matthewcornell.org.

Adam Williams (M.S. ’09) is the creator of the *Christmas Gifts List* application for the iPhone and iPod Touch that helps holiday shoppers create shopping lists and budgets. His App has been ranked 15th on the Top Paid Apps list at the iTunes App Store. Williams is President of Adamcode.com, a company founded in 2008 in Amherst, MA. Another of Williams’ Apps, *Spend*, a personal budget manager, was one of the 500 applications available in the iTunes App Store on its opening day and became one of the Top 20 finance apps.

that was a good idea. I already had access to the tools, so I started gathering data, doing the analysis, and everything started to snowball from there.”

Fast, advised by Associate Professor David Jensen while at UMass Amherst, is now a Research Scientist at Elder Research Inc., a data mining consulting firm.

CS alum social held in Boston

On March 4, 2010, the department hosted a social gathering for UMass Amherst CS alums at Google’s Cambridge, MA facility. With over 100 people registered, the night was a great opportunity for our guests to talk with CS faculty, to reminisce with old friends, and to make new connections. CS Assistant Professor Kevin Fu, *Technology Review*’s 2009 Innovator of the Year, gave a captivating presentation on his work, “Security and Privacy for Pervasive, Wireless Healthcare.” The department hopes that the alum social will be an annual event in the Boston area, with additional events held on the west coast. More photos at www.cs.umass.edu/alumsocial2010.



(clockwise): Steve Vinter welcomes alums; Mike Cialowicz and Karolina Dobrowolska chat; David Hildum and Jack Wileden; Oliver Chong with raffle prize; Alums mingle; CNS Dean Steve Goodwin touts CS.



Alums and students feted at awards ceremony

On Friday evening, April 30, 2010, alums, students, faculty, friends, and family filled the campus' Marriott Center for the department's Second Annual Outstanding Achievement and Advocacy (OAA) Awards Banquet. Earlier that day, the department hosted a poster session showcasing the research activities within the department and a round-table discussion at which the OAA recipients discussed their careers and reflected on their time at UMass Amherst.

The OAA event was established in 2009 to recognize the outstanding accomplishments of students and graduates of the department's degree programs, and to acknowledge the support of important friends of the department.

Department Chair Andrew Barto and Steve Goodwin, Dean of the College of Natural Sciences, welcomed the attendees and gave overviews of the department and the college."

Professor Leon J. Osterweil, chair of the OAA awards committee, presented awards to these 2010 OAA recipients:



Outstanding Achievement in Education:
Carla E. Brodley (Ph.D. '94), Professor, Department of Computer Science, Tufts University



Outstanding Achievement in Public Service:
Jody J. Daniels (Ph.D. '97), Director of Advanced Programs for Lockheed Martin's Advanced Technology Laboratories and a Colonel in the U.S. Army Reserves



Outstanding Achievement in Entrepreneurship:
Andrew J. Singer (Ph.D. '79), Chief Scientist of Edison Labs LLC; previously CEO and CTO of Rapport Incorporated



Outstanding Achievement by a Young Alum:
Sanjay Tandon (B.S. '01), founder and CEO of Paramount Defenses Inc.



Outstanding Support for the Department:
Sidney Topol (Physics B.S. '47), President of The Topol Group, and founder of the Massachusetts Telecommunications Council



Outstanding Achievement in Management:
Steve Vinter (Ph.D. '85), Engineering Director at Google, Inc.



Outstanding Achievement in Research:
Alexander L. Wolf (Ph.D. '85), Professor, Department of Computing, Imperial College London

The award citations and more details on the careers of the OAA award recipients, along with photos of the event, are posted at www.cs.umass.edu/oa2010.

During the evening's celebration, current students and recent alums were also recognized. The undergraduate and graduate awards were generously sponsored by Yahoo!, a member of the Department's Industrial Affiliates Program. Professor Robbie Moll, Department Associate Chair, presented the following Outstanding Undergraduate Awards to students in this year's graduating class:

- Overall Achievement in Computer Science:

Daniel Amirault

- Achievement in Artificial Intelligence:

Carlton Henderson

- Achievement in Interdisciplinary Study: **Marisa Pacifico**
- Achievement in Multimedia: **Eric Ssebanakitta**
- Achievement in Security: **Norman Provost**
- Achievement in Software Engineering: **Meagan Day**
- Achievement in Systems: **James Gummeson**
- Achievement in Theory: **John Brattin**

Professor James Allan, Graduate Program Director, presented the following Outstanding Graduate Student Awards for 2009:

- Outstanding Doctoral Dissertation Award: **Nilanjan Banerjee**

- Outstanding Doctoral Dissertation Award: **Ting Yang**
- Outstanding Synthesis Project Award: **Devesh Agrawal**
- Outstanding Synthesis Project Award: **Daniel Menasche**
- Outstanding Teaching Assistant Award: **Phillip Kirlin**
- Outstanding Teaching Assistant Award: **James Partan**

"The department was delighted to, once again this year, recognize the outstanding achievements both of alums and friends who have gone on to great distinction, and of graduating students who are positioned to follow their footsteps in the future," says Osterweil. "The events of the day, climaxed by the Awards Banquet, served to remind us yet again of the importance of our education and research mission and to strengthen our commitment to it."

The department would like to thank all those who participated in these successful events. We look forward to seeing more alums at next year's event.

Nominate a fellow alum

Nominations are now being accepted for the 2011 Outstanding Achievement and Advocacy Awards.

Nominations should be sent by email to Leanne Leclerc (leclerc@cs.umass.edu) and should consist of:

- The name, title, email, phone number and organizational affiliation of the nominee,
- The name(s), email(s), and phone number(s) of the nominator(s),
- A brief biography summarizing the nominee's career (no more than one page),
- A statement of the nominee's outstanding achievements in the award category,
- A very brief (no more than 25 word) suggested citation to be written on the OAA winner's award plaque.

Faculty News

In April, **Mohan Kamath** (Ph.D. '98), Adjunct Professor (and former Professor in the department) **Krithi Ramamritham**,



and Distinguished Professor **Don Towsley** received the 10+ year Best Paper Award at the 2010 Distributed Systems and Advanced Applications Conference (DASFAA) for their 1995 paper "Continuous Media Sharing in Multimedia Database Systems."



Towsley, along with co-authors **S. Xiao** and **W. Gong**, were finalists for the INFOCOM 2010 Best Paper Award for their paper "Secure Wireless Communication with Dynamic Secrets." In March, **Towsley** gave a Distinguished Lecture at Florida International University.



Distinguished Professor **Jim Kurose** presented Distinguished Lectures this year at the College of William and Mary and at Texas A&M.



Professor **Andrew Barto** gave an invited plenary address at the Third International Conference on Pattern Recognition and Machine Intelligence, Indian Institute of Technology, New Delhi, India. He also gave invited talks at the Indian Institute of Technology Madras in Chennai, Microsoft Research in Bangalore, and the Indian Institute of Science in Bangalore.



Professor **Andrew McCallum** is spending his sabbatical year as a Visiting Scientist at Xerox Research Centre Europe in Grenoble France. He is collaborating with scientists on natural language processing, machine learning, and computer vision. **McCallum** gave invited presentations at the "Journees CRF" Workshop in

Paris and at the Valencia International Meetings on Bayesian Statistics.

Streinu receives Robbins Prize



Adjunct Professor **Ileana Streinu** was awarded the prestigious David P. Robbins Prize from the American Mathematical Society. The AMS prizes are among the world's most important honors given for outstanding contributions to mathematics. **Streinu**, the Charles N. Clark Professor of Computer Science and Mathematics at Smith College and a Five Colleges 40th Anniversary Professor, accepted the accolade at the Joint Mathematics Meetings in San Francisco. The Robbins Prize is awarded every three years for a paper that reports on novel research in algebra, combinatorics, or discrete mathematics. **Streinu** was honored for her algorithmic solution of the "carpenter's rule problem," which asks whether any polygonal chain – a connected series of line segments – can be continuously straightened out in a way that avoids self-intersections.



In January, Professor **Eliot Moss** joined a team that visited Ghana to deploy some One-Laptop-Per-Child computers in a rural village middle school.



Distinguished Professor Emeritus **Arnold Rosenberg** was the Algorithms Keynote Speaker at the 24th IEEE International Parallel and Distributed Processing Symposium held in Atlanta in April. **Rosenberg's** book, *The Pillars of Computaton Theory*, was released this winter.



Professor **Shlomo Zilberstein** was one of three keynote speakers at the 17th French Conference on Pattern Recognition and Artificial Intelligence (RFIA 2010). His talk was titled "Decentralized Decision Making: Challenges and New Directions."

Graduate student **Siddharth Srivastava**, along with Professors **Neil Immerman** and **Shlomo Zilberstein**, received the 2010 International Conference on Automated Planning and Scheduling (ICAPS) Best Paper Award for "Computing Applicability Conditions for Plans with Loops." ICAPS is the leading international venue in this field.



Professors **Prashant Shenoy** and **Yanlei Diao** received a Google Research Award for their work on "Streamlining Large-Scale Data Analysis: Exact Answers Fast, Approximate Answers Faster."



Assistant Professor **Andrew McGregor** was one of the four organizers of the IITK Workshop on Algorithms for Processing Massive Data Sets that was held in Kanpur, India in December.



A new ACM award, the SIGPLAN Programming Languages Software Award, was initially proposed to the organization by Associate Professor **Emery Berger**. "This award will provide much-needed recognition to the hard work that goes into software infrastructure," says **Berger**. The award will recognize software that has had a significant impact on the programming languages community (or commercial / industrial impact), including compiler infrastructures, runtime systems, development and debugging environments, and related tools.



In June, Research Professor **Beverly Woolf** will give an invited talk at the Tenth International Conference on Intelligent Tutoring Systems: Bridges to Learning. **Woolf's** and **Ivon Arroyo's** emotion sensitive tutoring software research was highlighted in the *Boston Globe*, *Education Week*, *Communications of the ACM*, *Behavioral Health Central*, *Springfield Newspapers*, and a number of other media outlets. **Woolf** also welcomed her latest grandchild, **Maia Mikaela**, born on March 29 to parents **Matt Haimovitz** and **Luna Woolf**.





Associate Professor **Mark Corner** and his wife Sarah McMullen welcomed the birth of their first child, Ada Vivienne, on New Year's Day: a binary birthday 01/01/10.



Deepak Ganesan and his wife Kalyani announced the arrival of their daughter, Mahima, on February 4th.

Researcher News

Christoph Reichenbach joined the department as a Postdoctoral Research Associate.

Graduate students **Roman Klinger**, **Arthur Milchior**, and **Tamsin Maxwell**, and undergraduate **Sanjeev Sharma** joined the department as Visiting Scholars this semester.

Bruno Ribeiro joined the Networks Lab as a Postdoctoral Research Associate.

Working with the Multi-Agent Systems Lab, **Zhiqi Shen** is a Visiting Professor from Nanyang Technological University in Singapore.

Student News

Graduate student **Marwan Mattar** is the leader of team "Mosaic" which received one of the four top prizes in the 2009 UMass Amherst Innovation Challenge for the group's business venture concept. Mosaic's entry was an image analysis web application for researchers in the life sciences.

Yi Ding was selected for Honorable Mention in the Computing Research Association's 2010 Outstanding Undergraduate Research Award Competition.

At the New England Undergraduate Computing Symposium: Celebrating Excellence and Diversity in Computer Science, undergraduate **Mario Barrenechea** presented a poster on his research undertaken in the LASER lab, "Little-JIL: Analyzing and Defining Complex Processes in Diverse Application Domains." The symposium was held in April at Boston University.

Graduate student **Dubi Katz** and his wife Gili are the proud parents of their daughter, Maayan, born on January 3rd.

Graduate students **Bobby Simidchieva**, **Stefan Christov**, **Andrew Sout**, **Ibrahim Uysal**, and **Jeff Johns**, along with teammates from around the campus, won the UMass Amherst Co-Recreational Fall 2009 Intramural Volleyball championship for the second semester in a row.

Undergrad **Vladislav Yazhbin** (a triple major in computer science, mathematics, and individualized major in human computer interaction) was a member of the Filmix team that was awarded seed capital from the UMass Amherst Entrepreneurship Initiative through its seventh Executive Summary Competition. Filmix is a company that enables independent filmmakers to post their work online, and where customers may sample and download the films.

Two CS undergrads received UMass Amherst Alumni Association Scholarships & Awards. **Daniel Amirault** received the 2010 Senior Leadership Award and **Sean Dooley** received the William F. Field Alumni Scholar Award. Incoming grad student **Peter Krafft** was chosen as a recipient of the 2010 UMass Amherst 21st Century Leaders Award.

Graduate fellowships and awards

Graduate students **John Bowers**, **Shane Clark**, and **Joshua Glatt** received prestigious 2010 National Science Foundation Graduate Research Fellowships (GRFP). **Sean Barker**, **Charles Curtsinger**, and **Jeff Dalton** received Honorable Mention in the competition. The Graduate Research Fellowship provides three years of support for graduate study leading to research-based master's or doctoral degrees and is intended for students who are at the early stages of their graduate study.

IESL graduate students **Sameer Singh** and **Michael Wick** are recipients of Yahoo!'s 2010 Key Scientific Challenge (KSC) Program Awards. Singh and Wick are two of twenty-two students honored nationwide with this competitive award created to support a limited number of outstanding PhD students who Yahoo! believes are doing research in very important and challenging areas.

Graduate students **Akshat Kumar** and **Sameer Singh** were chosen for 2010-2011 University Fellowships, two of 15 graduate students chosen from across the campus.

Graduate students **Van Dang** and **Sameer Singh** are the recipients of this year's Accomplishments in Search & Mining Awards, sponsored by Yahoo!



Third annual foosball tournament

The ACM Student Chapter hosted the department's 3rd Annual CS Foosball Tournament on May 5th. Students, faculty, and staff participated in the event.

Yahoo! sponsored the tournament by providing food, prizes, and the foosball table. Assistant Professor Erik Learned-Miller and undergrad Lindsay Van Dyke (right) were the winners of this year's tournament. Graduate students Jeff Dalton and Van Dang came in second place, and Xiaozheng Tie and Abhigyan took third.



Significant Bits

**Newsletter of the
Department of Computer Science
College of Natural Sciences
at the University of Massachusetts Amherst**

140 Governors Drive
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