University of Massachusetts Amherst

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Significant BITS

Newsletter of the
Department of Computer Science

Professor Eliot Moss

Making the world safe for concurrency

Moore's Law predicts that CPUs will double in speed approximately every 18 months. It has been true for many years, but may not continue because of the increased power needed to drive chips faster without shifting to rather different technology. At the same time, however, manufacturers can fabricate more and more transistors in a single device with acceptable yield. The problem then is how to *use* those transistors to improve the overall speed of computations in practice. The hardware designers' solution is to put more CPUs (cores) on a chip and into the unit purchased by the consumer. "Some people have been saying for a long time that we were running out of single CPU speed and that we must shift to higher concurrency; that time has finally arrived," says Professor Eliot Moss whose research is addressing this issue.

Except in specialized sub-communities, little has been done to address the problems of *programming* in this concurrent world. Many languages have no explicit support for concurrency, and whatever the available libraries and hardware offer often is far from intuitive. Even in languages with defined semantics for threads and locks (e.g., Java), the situation is complex and the models are difficult to understand, even by the experts who generate them. The available programming concepts, primarily threads and locks, are not far from programming in assembly language. The level of abstraction is low; it is easy to make errors. Professional programmers already suffer from mental overload in dealing with the complexity of modern software systems; concurrency pushes matters over the edge.

What is wrong with locks? First, threads can deadlock. Suppose some object X has a corresponding piece of cross-indexed information in object Y. Depending on how you get to the object, you may arrive first at X or at Y. But if you need to update both X and Y consistently, you need to lock them both. One path locks X first, then Y, and another Y then X, which can deadlock. To fix this, you have to be aware, and also find some way to acquire locks in a standard order. Tools help, but do not entirely alleviate the problem, especially if the locking is off in library routines, hidden from the programmer.

Second, it is hard to determine the best granularity for locking. Using one "big fat" lock on a data structure is safe, but may prevent useful concurrency. Using many fine-grained locks is more complex, and thus is prone

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Towsley receives ACM SIGMETRICS Achievement Award

Distinguished Professor Don Towsley is the recipient of the 2007 Association for Computing Machinery (ACM) Special Interest Group on Measurement and Evaluation (SIGMETRICS) Achievement Award in recognition of his sustained and continuous record of truly outstanding research achievements over a career of nearly three decades. ACM SIGMETRICS called Towsley a pioneer and a leading scholar in the area of computer modeling and analysis, with applications to networking and computer systems.

Recent research by Towsley includes pioneering work in developing techniques for analyzing the propagation of Internet viruses and worms. He is also responsible for some of the most notable results obtained in networking research in the last few years, including the analytical evaluation of Transmission Control Protocol (TCP) throughput. TCP allows computers on a network

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CONCURRENCY – – – – – – – *continued from page 1*

to more errors. Also, fine-grained locks are more likely to deadlock and may have more locking overhead. If you need to adjust granularity, you face a difficult re-programming problem.

Third, while the association of locks with objects in Java helps, a lock is just a representative for some set of data that the lock protects. Exactly what data a lock protects is only in the programmer's mind. It is not known and enforced by the system. Fourth, locking usually provides only one mode: mutual exclusion. This unnecessarily slows many read-only operations and also some updates. Lastly, if a low priority thread acquires a lock and goes to sleep for a long time (perhaps a page fault), high priority threads can back up behind it. This is called priority inversion.

Transactional Memory to the Rescue

What can we do? Since their seminal work in the 1990s, Maurice Herlihy and Moss developed *transactional memory* to address these problems. A *transaction* is a series of memory reads and writes by one thread which wants those reads and writes to be executed atomically. This atomicity is similar to that of database systems, comprising most of the *ACID properties: Atomicity,* the steps of a transaction either all happen, or none of them do; *Consistency*, all threads see the same ordering of transactions, where it matters; *Isolation*, no transaction can perceive a state in the middle of another one; and *Durability*, the transaction's effects are guaranteed not to go away. Transactional memory guarantees ACI but not D.

There are many ways to build a system with these semantics. Consider the following simple one described by Moss. Extend the computer's cache, adding some transaction information to each cache line. Lines can be marked as read or written (or both) by the current transaction. We arrange the cache so that, for written lines, we have both the old (before the transaction) value and the new value. If a transaction commits (completes successfully), we discard the old value; if it aborts (fails, either on request, termination by the operating system, or because of conflict), we discard the new value. When reading, a transaction always sees a new value in preference to an old one.

We detect conflicts between transactions by extending the usual cache coherency protocols between multiple CPUs. If a CPU tries to read an item written by another CPU in a running transaction, there is a conflict, and likewise there is a conflict when a CPU writes an item read or written by a CPU in a running transaction. One can manage conflicts in many ways, which are not elaborated here. Also, one probably wants to virtualize transactional memory (TM) so that transactions can span thread switches and overflow the cache when needed.

How does TM solve the problems with locks? First, by detecting conflicts, and by supporting abort and restart, TM avoids deadlocks. Second, TM offers the finest granularity supported by the hardware (cache line, etc.), avoiding the reduction in concurrency of coarse grained locks. Third, TM manages conflicts on exactly the data that the program manipulates, as opposed to the unspecified and unchecked association of data to locks in locking schemes. Fourth, TM naturally distinguishes reads from writes, further increasing concurrency. Finally, TM solves the problems with locks by giving transactions priorities and aborting the low priority transaction in case of conflict, thus guaranteeing that higher priority thread will progress.

Moss's Current Research

The transactional memory idea is appealing and is generating considerable interest. Sun Microsystems announced that TM will be included in upcoming Sun processors, and other manufacturers are actively interested. There is a significant community with regular workshops, and researchers are looking into hardware, programming language extensions, run-time systems, etc. Moss's research at UMass Amherst is further extending the flexibility and concurrency of transactional memory, looking at *nested transactions,* and in particular at *open nesting*. This allows short transactions to be composed into larger ones while managing their conflicts and their rollback at a logical rather than physical level. Open nesting is complex and depends on correct implementation of transactional parts of applications, but it greatly increases possible concurrency. "We are developing a reference implementation of open nesting in Java that we will offer to the community as a semantic standard," says Moss. "We are working on proving logical concurrency control and logical rollback operations correct, and even deriving them automatically or semi-automatically. Finally, we are working on applying transactional programming to grid computations, improving their resiliency to hardware failure and resource reallocation. While transactions do not solve all of the problems of concurrent programming, they address this difficult problem."

Professor Moss performed his undergraduate and graduate studies at the Massachusetts Institute of Technology (B.S. 1975, M.S. 1978, Ph.D. 1981). After completing a military obligation, he joined the department faculty in 1985 and was promoted to full professor in Fall 2007. He has studied and built systems in the areas of virtual machines (Smalltalk, Java), persistent object stores and languages, garbage collection, analysis and compiler optimization, application of machine learning to compilers, and transactional programming. In addition to the work described in this article, he is currently researching automatic code generator generation and automatic simulator generation from machine descriptions, resilient grid programming with Java, schedulers and virtual memory managers that react better under high load, and the chaotic (non-linear) behavior of garbage collectors. Since 2005 he has also been a priest of the Episcopal church. Moss is married with two school-age children. He enjoys books on tape (the only way he has time for pleasure reading!) and movies.

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Top quality research at UMass Amherst CS

In keeping with its strength in producing quality research publications, the department received a number of best paper awards this year and top publication rankings.

UMass Amherst was ranked 12th in list of top U.S. computing graduate programs based on publication data from 1995 to 2003 ("Automatic and versatile publications ranking for research institutions and scholars," authors J. Ren and R. Taylor, *Communications of the ACM,* June 2007). UMass Amherst is also ranked 12th in the list of top software engineering institutions, based on data from 2000 to 2004. In the list of top software engineering scholars, UMass Amherst Computer Science Professor Lori Clarke is ranked 20th.

Autonomous Learning Laboratory graduate student Chris Vigorito and Professors Deepak Ganesan and Andrew Barto received the Best Paper Award at the Fourth Annual IEEE Communications Society Conference on Sensor, Mesh, and Ad Hoc Communications and Networks (SECON 2007) for their paper "Adaptive Control of Duty-Cycling in Energy-Harvesting Wireless Sensor Networks."

Graduate students Audrey Lee and Louis Theran of the Laboratory in Kine(ma)tics and Geometry won the Best Poster/Multimedia Award for their poster and demo "Analyzing Rigidity with Pebble Games" presented at the 17th Fall Workshop on Computational Geometry (FWCG'07).

In addition to the publications above, the department's faculty and students have won awards at three of the major conferences of USENIX, the Advanced

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Corner and Jensen appointed to DARPA study groups

The Defense Advanced Research Projects Agency (DARPA) appointed Professors Mark Corner and David Jensen to two of its highly selective research study groups this fall.

Assistant Professor Mark Corner was selected to be a member of the next class of the DARPA/Institute for Defense Analyses (IDA) Computer Science Study Group (CSSG). The CSSG is a program that supports university research in computer science and related fields, while aligning a new generation of researchers with Department of Defense (DoD) information technology needs and priorities. The CSSG is a multi-year program, consisting of a one-year funded education experience to familiarize the participants with DoD practices, challenges, and risks, followed by up to three additional years of funded research to explore and develop technologies that have the potential to transition material computer science and technology advances to the government. Resulting from his participation in this group, Corner could receive up to $1 million in research funding over 2 to 4 years.

Associate Professor David Jensen continues to serve on the DARPA Defense Science Study Group (DSSG), a program to introduce outstanding young professors of science and engineering to the challenges facing national security. He was also recently named to a three-year term on the DARPA Information Science and Technology Study Group (ISAT). The ISAT advisory group was established by DARPA in 1987 to support its technology offices, providing continuing and independent assessment of the state of advanced information science and technology and their relationship to DoD issues.

In addition to Corner and Jensen's participation in the DARPA study groups, two UMass Amherst Computer Science Ph.D. alums have also participated. Carla Brodley (Ph.D. '94) was in the DSSG 2004-2005 class, and Jennifer Neville (Ph.D. '06) is in the CSSG 2007 class.

McCallum selected to Computing Community Consortium Council

Associate Professor Andrew McCallum has received a two-year appointment to the first Council for the Computing Community Consortium (CCC), a group dedicated to identifying major research opportunities and goals for the computing field.

"The council will gather consensus on large, forward-looking computer science research projects that would not be possible through traditional means," says McCallum. "The impact of computing in science and our everyday lives continues to grow, and the demand for computer scientists is also rising. The vision produced by the council should not only drive forward a broad-based research agenda, but also attract new students to study computer science."

McCallum is one of 16 researchers from academia, government, and industry chosen for the council by the Computing Research Association in consultation with the National Science Foundation.

"One of my goals in the council will be to focus on the uses of computing and how it reaches out into the rest of the world," says McCallum. He cites two examples: colleagues who are developing machine learning methods to guide the search for an AIDS vaccine and developing new hardware and software for monitoring endangered animals.

The CCC was created by the Computing Research Association under a three-year, six million dollar agreement with the National Science Foundation to identify major research opportunities and grand challenges for the computer sciences. The council will direct and oversee the operations of the CCC while it provides academic leadership and vision to computing research and large-scale research projects.

McCallum receives faculty awards

For his research contributions to the field of machine learning (ML), Associate Professor Andrew McCallum received the College Outstanding Faculty Research Award at the College of Natural Sciences and Mathematics (NSM) fall convocation.

He also received a highly competitive IBM Faculty Award in recognition of his achievements and work on "High Accuracy Co-reference with Weighted First-order Logic, Resource-bounded Information Gathering, and Social Network Analysis." According to IBM, the faculty awards foster collaboration between researchers at leading universities worldwide and those at IBM research, development and services organizations; they also promote courseware and curriculum development that stimulates growth in disciplines and geographical areas that are strategic to IBM and the world.

The NSM outstanding faculty research award was established in 2000 to honor faculty members for their research contributions. Departments make nominations for the faculty awards and the selections are made by the college-wide committee appointed by the NSM Dean. McCallum was selected for this award for his leading research in the field of ML and information extraction (IE).

McCallum specializes in the area of statistical ML. He was among the first researchers to recognize the emerging challenges and opportunities for applying the technology of ML to the processing of textual information. His work on IE has been at the forefront of this important area and has established him as one of the world's leading artificial intelligence (AI) researchers.

McCallum's research concerns mining the vast amounts of unstructured text and scientific data found in newswire articles, Web pages, government reports, and scientific papers, and turning that data into knowledge. He creates probabilistic models that allow computers to search through data and identify patterns based on language.

McCallum has analyzed 16 years of Senate voting records to track how coalitions form based on issues like energy and Social Security, using the language of the legislation. He also analyzed corporate emails from Enron to characterize the roles played by various employees and determine how collaboration and communication work.

Mining the vast amount of biological data available to researchers is another area of focus for McCallum. In collaboration with colleagues from the University of Pennsylvania, his team recently placed highly in a competition aimed at extracting the names of genes and proteins from bioinformatics articles.

In other activities this year, McCallum traveled to China to give a keynote address at a machine learning conference at Peking University, Beijing, China. He also gave an invited talk at the National Academies of Science "Kavli Frontiers of Science Symposium Series," and he co-organized the Workshop on Web Mining and Social Network Analysis held in conjunction with the 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD 2007). McCallum was appointed to the founding editorial board of *Foundations and Trends in Machine Learning* (Michael Jordan is editor-in-chief).

McCallum joined the department in 2002 and was awarded tenure in 2007.

Levine named Outstanding Teacher

At the UMass Amherst College of Natural Science and Mathematics (NSM) fall convocation ceremony, Associate Professor Brian Levine accepted the NSM Outstanding Teacher Award for his distinguished graduate and undergraduate teaching and mentoring.

"Brian's excellence as a classroom teacher is exceeded only by his success as an educator outside the classroom," says Department Chair Andrew Barto. "He has been an incredibly effective mentor for both graduate and undergraduate students, introducing students with a broad range of abilities and skills to self-education via research, and inculcating many of them with a thirst for continued education."

Levine has an ongoing active program where undergraduate students are exposed to research. Many of his undergraduate researchers have stayed on at UMass Amherst for a Master's degree, just in order to work with him.

Levine is always eager to offer new courses that expose students to emerging technologies, relating to topics as diverse as mobile computing, security and related topics (e.g., privacy), ubiquitous computing, and gaming. As one example, Levine is teaching a new course this fall on Digital Forensics.

The NSM Outstanding Teacher Award is coordinated by the campus' Center for Teaching. The purpose of the award is to honor individual faculty members for their teaching accomplishments.

Corner named a Lilly Fellow

The UMass Amherst Center for Teaching (CFT) named Assistant Professor Mark Corner as a Lilly Teaching Fellow for the 2007-2008 academic year. Lilly Fellows are selected for this competitive program on the basis of their promise in teaching and research, their interest in undergraduate teaching and in developing innovative teaching skills, and their potential for making a positive impact on the teaching culture in their department, college, and broader campus community.

"One glaring problem that computer scientists everywhere are confronting is that of declining enrollment and an incredible lack of diversity in classes, especially female students," says Corner. "Studies have shown that the primary barrier to entry is the perception that computer science equals programming, and that computer scientists work alone." For his Lilly project, Corner plans to confront both of these problems at an introductory level of undergraduate computer science education. He will begin a new class, called Usability, to show undergraduate students a side of computer science rarely seen at the introductory level: the interface between computation and humans.

The course will be structured around team projects, hands-on user studies, and class collaboration through the use of wikis. Corner hopes to find links to the Psychology department, as well as to bring potential majors from the Information Technology program. The first run of the class is being taught this fall.

Professor Corner joined the department in 2003. He co-leads the Privacy, Internetworking, Security and Mobile Systems Lab (PRISMS) with Professors Brian Levine and Kevin Fu. Corner received his Ph.D. in Electrical Engineering from the University of Michigan (2003), and his M.S. and B.S. in Electrical Engineering from the University of Virginia (both in 1998). Corner received a National Science Foundation CAREER Award in 2005. He received Best Paper Awards at the USENIX Conference on File and Storage Technologies (FAST '07) and ACM Multimedia Conference ('05).

Previous Lilly Teaching Fellows in the department include Emery Berger (2006-2007), Andrew McCallum (2005-2006), Brian Levine (2003-2004), Prashant Shenoy (2001-2002), James Allan (1999-2000), Ramesh Sitaraman (1996-1997), David Mix Barrington (1994-1995), Jim Kurose (1993-1994), and Eliot Moss (1991-1992).

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Computing Systems Association, in 2007. According to the association, USENIX conferences have become the essential meeting grounds for the presentation and discussion of the most advanced information on the developments of all aspects of computing systems.

Laboratory for Advanced Systems Software graduate student Peter Desnoyers and Associate Professor Prashant Shenoy won Best Paper at USENIX '07 for "Hyperion: High Volume Stream Archival for Retrospective Querying."

Graduate student James Cipar and Assistant Professors Mark Corner and Emery Berger received the Best Paper Award at FAST '07 for "TFS: A Transparent File System for Contributory Storage."

The Best Student Paper Award at NSDI '07 was given to Michael Piatek, Tomas Isdal, Thomas Anderson, Arvind Krishnamurthy, U. of Washington, and UMass Amherst Assistant Professor Arun Venkataramani for "Do Incentives Build Robustness in BitTorrent?"

Rosenberg feted at ArnyFest

On October 19, 2007, the Department of Computer Science held ArnyFest, a day long celebration to honor Distinguished University Professor Arnold Rosenberg for his many achievements and accomplishments on the occasion of his retirement. Dr. Rosenberg's colleagues from around the United States, Canada, and Europe attended the tribute.

The ArnyFest program included a distinguished lecture from Prof. Nicholas Pippenger, Harvey Mudd College, and technical presentations from Prof. Allan Borodin, University of Toronto, Prof. Lenwood S. Heath, Virginia Tech, Prof. Bruce M. Maggs, Carnegie Mellon University, Prof. Franco P. Preparata, Brown University, Prof. Yves Robert, Ecole Normale Supérieure de Lyon, and Prof. Ramesh K. Sitaraman, University of Massachusetts Amherst.

Rosenberg's research focuses on developing algorithmic models and techniques to deal with the new modalities of "collaborative computing," especially within the context of Internet-based computing.

Rosenberg has chaired the program committees of the four major conferences in his research area: ACM Symposium on Theory of Computing (STOC), ACM Symposium on Parallelism in Algorithms and Architectures (SPAA), IEEE Symposium on Foundations of Computer Science (FOCS), and IEEE International Parallel and Distributed Processing Symposium (IPDPS). He also served as general chair of FOCS and SPAA, each for three years. Rosenberg received the UMass Amherst College of Natural Sciences and Mathematics Outstanding Teaching Award (1997) and Outstanding Research Award (2004).

Prior to joining UMass Amherst, Rosenberg was a Professor of Computer

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New initiatives: from helping the blind to probing the ocean floor

The department's faculty are embarking on many exiting new projects and collaborations. A few are highlighted below:

The National Eye Institute, a division of the National Institutes of Health, has provided a grant to Professors Allen Hanson and Erik Learned-Miller to develop software for a device that can help blind people and other visually impaired people to navigate through complex environments. In this project, "Universal Text Recognition: A Way-finding Tool for People with Visual Impairments," the team will develop technology that will enable the user to take pictures with a portable camera and have the device read aloud the words it sees in the picture. For example, while walking down a street, a person could use the device to read store fronts and signs in order to find a place to eat lunch. Hanson and Learned-Miller (PI) are working with Dr. Bilile Bentzen, a Certified Orientation and Mobility Specialist, who will help in conducting studies with blind and visually impaired individuals to obtain feedback about design decisions.

Associate Professors Brian Levine and Prashant Shenoy are co-PIs on the Massachusetts Center for Networked Sensing in Challenged Environments (NetSenCE), funded by the UMass President's Science and Technology (S&T) Fund. The center is developing affordable, robust, easily deployable wireless sensor networks and platforms, with an emphasis on marine (surface, sub-surface, and ocean floor) and terrestrial environments. Partners include UMass Dartmouth, UMass Lowell, and the Woods Hole Oceanographic Institution.

Professor Rod Grupen, whose robotics research was highlighted in the *New York Times* this summer, has developed the next-generation "uBots", which are designed to interact with humans. Working with MIT Associate Professor Cynthia Breazeal, the team's robots will appear at the Boston Museum of Science in 2009. The uBot-5 designed in Grupen's lab is a small and lightweight research platform for mobile manipulation. It was designed to be an economical robot that is highly capable, durable, and safe to operate. When equipped with an LCD touchscreen monitor and a webcam, the uBot-5 can be used for social tele-presence applications.

Distinguished Professor Don Towsley and Assistant Professor Arun Venkataramani received an NSF grant for their project "A Swarming Architecture for Internet Data Transfer." The grant is through a new NSF initiative called FIND (Future INternet Design) whose goal is to discover how a next-generation Internet would look.

Distinguished Professor Bruce Croft received funding from NSF for two new projects. One is a collaboration with Carnegie Mellon University Computer Science Professor Jamie Callan (UMass Amherst CS Ph.D. '93) working on Supporting User Data, Privacy, and Evaluation in the Lemur Toolkit. Lemur has become a standard resource for researchers in the field of information retrieval. The combination of very efficient indexing tools, support for a variety of retrieval models, and a powerful query language has enabled a wide variety of research projects. In this project, Croft and Callan are continuing to add new features, search techniques, efficiency improvements, and evaluation measures to broaden the range of research it can support and to keep up-to-date with the latest research. In Croft's other new project, "Searching Archives of Community Knowledge," he is studying the task of finding good answers in Q&A (question and answer) archives created in Web services such as Yahoo! Answers.

Assistant Professor Kevin Fu presented his research team's findings on contactless radio-frequency identification (RFID) credit cards to executives from several of the Federal Reserve Banks. The Federal Reserve oversees the regulation of the credit card industry, and sought information on how to measure and potentially regulate this rapidly growing payment technology. Fu emphasized the importance of security and privacy for consumers.

Children interact with uBot-5 during a demonstration in the CS building.

Attendees included representatives from the Federal Reserve Banks, Visa USA, MasterCard, Wells Fargo, and a number of merchants that process millions of credit card transactions annually. Led by Fu and ECE Professor Wayne Burleson, their team has devised an inexpensive and efficient way to improve security for RFID tags, the wireless devices that allow consumers to pay for their gas or access buildings without pulling out their wallets. The breakthrough, which uses variations in the tags' existing memory cells, will make their stored information more secure while retaining their small, convenient size. The RFID research was recently highlighted in *ACM TechNews, Slashdot, RFID Journal,* and *Government Computer News*. The UMass Amherst team leads the RFID Consortium for Security and Privacy (**RFID-CUSP, www.rfid-cusp.org**), an NSF-funded multi-institution research initiative to improve security for the wireless "smart tag" gadgets.

Fu is also involved in a consortium of leading national cyber security institutions. He and Brian Levine lead the Institute for Information Infrastructure Protection (I3P) for UMass Amherst. The institute's main role is to coordinate a national cyber security R&D program and help build bridges between academia, industry, and government. The I3P continues to work toward identifying and addressing critical research problems in information infrastructure protection and opening information channels among researchers, policymakers, and infrastructure operators.

Associate Professor Andrew McCallum is collaborating with UMass Lowell, University of Pennsylvania, and the UMass Amherst Linguistics Department on a $5 million Office of Naval Research (ONR) Multi-University Research Initiative (MURI) program grant. In this project, "SUBTLE: Situation Understanding Bot Through Language and Environment," the team is developing a language understanding capability for a bot, either a physical robot or a software agent, functioning in a real-world environment, focusing on the task of Urban Search and Rescue (USAR). They are tackling these synergistic tasks: (1) Machine Learning & Stochastic Optimization, (2) Human–Robot Interaction, (3) Syntactic Analysis, (4) Semantic Interpretation, (5) Pragmatic Enrichment, (6) Parameterized Action Representation, (7) Formulating Specification for Robot Motion Planning, (8) Corpus Collection, (9) Testbeds and Integrated Demonstrations, and (10) Building a Human-Bot Communication Community.

In another research project awarded this year, McCallum is working with Lockheed Martin on Defense Advanced Research Projects Agency's (DARPA) new Information Integration Program.

Graduate students Jacob Sorber (left) and Michael Jones in the Amherst area tracking turtles using "TurtleNet" research.

The ongoing "TurtleNet" research being undertaken by Professors Mark Corner, Emery Berger, and Brian Levine has gotten considerable media attention over the past few months. *Scientific American* featured photos of the project. The scientists have outfitted local snapping turtles with small, solar-powered batteries and relay devices that transmit information on the creatures' whereabouts. The researchers' technology allows them to efficiently track their subjects, providing migratory information important to conservation efforts. The project was also highlighted in the *Globe, New York Times.com, Washington Post.com, Forbes.com, Newsday, Houston Chronicle, Miami Herald, Philadelphia Inquirer, Denver Post, Cleveland Plain Dealer, San Diego Union Tribune, ABC News.com, CBS News.com, MSN Money, Fox News.com, Sydney Morning Herald* (Australia), *Jerusalem Post* (Israel), *Globe and Mail* (Canada), and other local papers around the country picked up through the AP wire. Corner and Levine's project to provide wireless Internet to downtown Amherst, MA, was also highlighted in a number of media outlets including local newspapers and *Government Technology* news.

Research Professor Beverly Woolf is collaborating with a number of colleagues on four newly funded NSF projects totaling $1.6 million. These awards deepen and extend the use of artificial intelligence techniques in education and all projects are deployed and evaluated within K-16 educational settings.

Woolf (PI), Professor Andrew Barto, Dr. Ivon Arroyo, and UMass Amherst Engineering Professor Donald Fisher are working on the NSF-funded project "Affective Learning Companions: Modeling and supporting emotion during learning," which develops computer tutors that adapt their response to *differently enabled* students, specifically those who exhibit frustration, boredom, fatigue, or a lack of motivation or self-confidence. Machine learning software

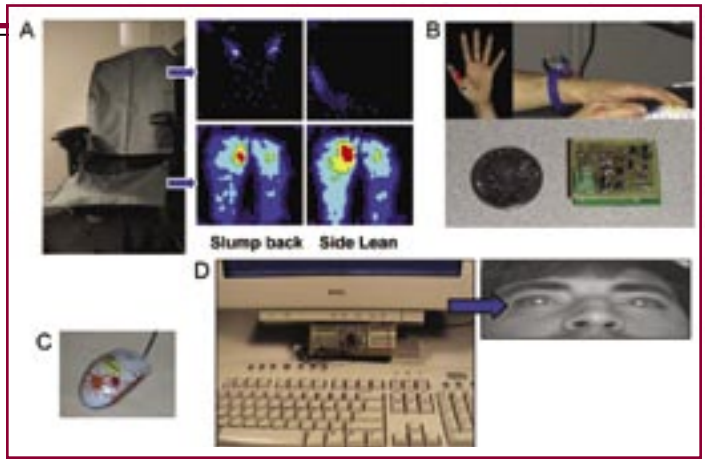

Figure 1: Machine learning software and physical sensors detect student emotion.

and physical sensors (Figure 1) detect student emotion and then optimization algorithms search for policies that further engage students. Based on perceived student emotion, computer interventions are adapted for individual student needs.

Working with University of Hawaii Professor Dan Suthers (UMass Amherst CS Ph.D. '93) and Hampshire College Biology Professor Merle Bruno, Woolf (PI) received NSF funding for the project "Effective Collaborative Role-playing Environments." This award supports transparent collaboration among physically distant students and ensures that the history of student contributions is available to all participants. Furthermore, automated agents coach students on the content and social aspects of their collaboration.

"What kind of Math Software works for Girls? The effectiveness of motivational and cognitive interventions" is an NSF project led by Dr. Ivon Arroyo (PI), Woolf and UMass Amherst Psychology Professor James (Mike) Royer. The project examines the impact of multimedia on girls' learning of mathematics with an intelligent tutor and analyzes how to produce motivational and achievement gains for girls at several crucial moments of girls' development of attitudes towards science. NSF approved funding for "International Dimensions of Ethics Education in Science and Engineering," in which Woolf is collaborating with UMass Amherst Political Science Professors Jane Fountain (PI) and Martha Peterson, UMass Amherst Public Health Professor Paula Stamps, and UMass Amherst Physics Professor Marc Acherman. The project designs, pilots, and

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Alum Matters

A newsletter for alumni of the Department of Computer Science

Rakesh "Teddy" Kumar (top) and Harpreet Sawhney

Kumar's and Sawhney's vision of the future

Rakesh "Teddy" Kumar ('92) and Harpreet Singh Sawhney ('92) joined the department (at that time called the Computer and Information Science Department) in Fall 1985 and worked under Professors Al Hanson and Ed Riseman. They defended their dissertations in Computer Vision just one day apart from each other. Currently they are both members of the Vision Technologies Division of Sarnoff Corporation in Princeton, NJ. Kumar is Senior Technical Director of the Vision & Robotics Laboratory, and Sawhney is the Technical Director of the Vision & Learning Laboratory.

"Vision activity at Sarnoff has grown from about a 20 person group in the early 1990s to a 140 person enterprise," says Sawhney. Kumar and Sawhney lead about half of this enterprise, directed by Dr. Peter Burt (UMass Amherst CS Ph.D. '76), Vice President of the Vision Technologies Division.

Kumar's and Sawhney's areas include applications such as aerial video surveillance, automotive, security, simulation and training, robotics, video data mining, and medical imaging. The application areas are vitalized by R&D in real-time video motion analysis, object detection and tracking, geo-registration, 3D motion and scene analysis, object and event recognition, video databases, multi-camera distributed sentient systems, and biometrics.

"A key technology developed at Sarnoff in the 1990s was precision alignment of motion video frames with parametric and non-parametric motion and structure models using multi-resolution pyramid-based direct methods," says Kumar. He experienced the power of these real-time methods when he worked with Sarnoff researcher Dr. Keith Hanna on online synthetic advertisement insertion in sportscast TV videos such as baseball and soccer.

The technical challenge was to automatically detect a pattern (a rectangular board) behind home plate in baseball in live videos from a broadcast quality pan-tilt-zoom camera. Subsequently, the synthetic billboard is warped onto the pattern and inserted into the live video while maintaining the foreground pixels from objects such as moving players. The alignment, segmentation, and insertion should happen in real-time with drift- and jitter-free broadcast quality. After refining the algorithms in the lab and in the field, the system was proven ready for use in sportscasts and was later commercialized by Princeton Video Imaging (PVI). PVI extended the technology to create the now famous yellow first down line in NFL football broadcasts.

The precision alignment technology was further honed by Kumar and Sawhney in their early work on video geo-registration. Geo-registration aligns video frames to a reference image database that contains geo-coordinates (i.e. latitude/longitude) for each pixel and assigns these coordinates to each pixel in the video frame (Figure 1: Video Georegistration). This research led to the development of a Sarnoff product, Terrasight™, for aerial video exploitation that is in use by the U.S. Department of Defense.

During the late 1990s, Kumar's and Sawhney's group commercialized VideoBrush, consumer software for creating real-time video and image sequence mosaics. It was one of the earliest mosaic tools to hit the market before digital cameras and camcorders became a reality. A memorable experience for the pair was showing off real-time mosaicking in the Sarnoff booth at COMDEX'97 (then the biggest computer show) and seeing people awed by the mosaic being painted on the big screen on the wall.

Kumar and Sawhney took on the challenge of designing a tool for IMAX to create binocular large-format 3D movies while avoiding the use of two mini-refrigerator sized IMAX cameras. The goal was to use a binocular image sequence in which one stream is captured at the typical IMAX resolution of 8Kx6K pixels while the second stream is only captured at 2Kx1.5K, 1/16th of the original. "The problems of precision alignment between streams of binocular frames using high quality stereo and

Alumni Connections

Daniel Bernstein (Ph.D. '05) received Honorable Mention for the ICAPS Best Dissertation Award. ICAPS runs the premier conference on Automated Planning & Scheduling. The 2007 award is for dissertations completed in the previous two years. One award winner and three honorable mentions were selected. The awards committee noted Bernstein for "his highly innovative research on planning under uncertainty for multiple agents introducing and characterizing a new framework of decentralized MDPs."

Jeff Bonar (Ph.D. '85) is the founder and chairman of JumpStart Wireless. Bonar's Florida-based company developed applications that can be used on wireless devices such as cell phones and email systems to transmit data from the worker in the field back to the office, thus eliminating paperwork and improving productivity. His work was recently highlighted in the media nationwide.

Baystate Scholar **Hee-Jin Chae** (M.S. '07) joined Raytheon after presenting her RFID security research in Spain.

After five years in Chicago as an Andersen Consulting (now Accenture) Senior Consultant in the New Age Systems Group, **Jen Hall** (B.S. '90) left to become an Outward Bound instructor. She climbed trees and coached effective teams for five years before getting back into technology as a freelance web programmer. She is currently the Director of Internet and Web Development of Conover Tuttle Pace (www.ctpboston.com). Hall is also a volunteer firefighter and a single mom having recently adopted a baby boy.

Former CS student and Teaching Assistant (TA), **Jedidiah Mitchell** participated in the FJORG! 32-hour iron animator event at SIGGRAPH in San Diego. While at UMass Amherst, Mitchell was a TA for Prof. Beverly Woolf's animation course, and he worked in the Center for Computer-Based Instructional Technology (CCBIT). Mitchell is the son of CS staffer Gwyn Mitchell.

Ramachandran Ramjee (Ph.D. '97) has moved from Lucent Bell Labs to Microsoft Research in Bangalore, India. He is a Senior Researcher in the Mobility, Networks, and Systems Group. Ramjee's research interests are in architecture, protocol, and performance issues in next generation wired and wireless networks.

Carnegie Mellon University Professor **Tuomas Sandholm** (Ph.D. '96) was highlighted in the *Pittsburgh Post-Gazette* for creating a system to match living kidney donors with potential recipients.

Steven Willis (B.S. BDIC '78) joined the Board of Advisors for PlumChoice, a leader in remote technology services for the home and small office. He has been a pioneer in developing core Internet technologies for more than 20 years. He co-founded Wellfleet Communications, a pioneering Internet router company, and started Wellfleet's Advanced Engineering Group, which developed key Internet and ATM standards and technologies. In 2001, he joined Datapower as vice president of advanced technology and drove the development of a high-performance, hardware-based XML processor.

motion processing, and rendering with color and motion artifact correction, were solved through persistence and experimentation," says Sawhney. "The satisfying moment came when a blind test of real and synthesized 3D movie clips projected in a 3D IMAX theater revealed no perceptible differences between the real and synthesized data." (Figure 2: IMAX).

Starting in 2000, Kumar's and Sawhney's team started working on multi-camera distributed systems for large area situational awareness applications. This work includes 3D contextual visualization of numerous camera videos, tracking and classification of vehicles and humans, cross-camera association and tracking, and real-time forensic database querying and alerts. Working in a close-knit team with Sarnoff's Keith Hanna, Supun Samarasekera, Manoj Aggarwal, and others, Kumar and Sawhney commercialized a multi-camera platform for wide area situational awareness called VideoFlashlights (Figure 3: videoflashlights) and video-based analytics called VisionAlert. "This platform started as a research prototype in the lab and was deployed as a pilot system at a number of airports and other installations before Sarnoff licensed it for commercialization," says Sawhney.

During the early part of this decade, Kumar and Sawhney started foundational work on 3D light detection and ranging (lidar) and video based object recognition, 3D navigation, mapping, and modeling. Kumar's group

continued on next page

(left-rt) top row: (1) Video Geo-registration, (2) IMAX image-based rendering, (3) VideoFlashlights. Bottom row: (4) 3D Lidar based real-time vehicle recognition, (5) Visual Mapping and Localization, (6) Vehicle Querying.

Robot contest

Led by Brian Pinette (Ph.D. '94; pictured here, far left), the Frontier Regional High School Robotic Club in South Deerfield, MA, placed second in the world in the 14th Annual International Trinity College Firefighting Home Robot Contest. Pinette, a Senior Research Fellow in the department, advised a team of students who competed regionally against U.S. teams before reaching the international competition. Their robot, named Buffalo, successfully maneuvered through a maze to extinguish two "fires" and locate a baby trapped in a simulated home.

KUMAR / SAWHNEY - *continued from previous page*

developed a system called SiteMaker which can automatically build 3D models of scenes (800 sq km in less than a day). Later Sawhney's group developed algorithms and real-time systems for precision recognition and fingerprinting of vehicles from a database of hundreds of vehicle models (Figure 4: lidar). Furthermore, object classification of pedestrians and vehicles in roadside scenes captured from moving vehicles is an active area of R&D for automotive and robot safety applications.

In addition, Kumar's group has created a real-time system for precision localization of mobile platforms with better than 0.1% drift over kilometers of distance traveled (Figure 5: visualmapping). "This technology is creating a lot of excitement especially in applications where localization in GPS-free environments is critical such as in urban canyons and indoors," says Kumar.

Sawhney's group is also active in large-scale video databases that combine real-time video processing with creation of objects, tracks, and events as database entities. The databases are connected with systems for geo-spatial visualization, querying, and video forensics (Figure 6: vehiclequerying).

Kumar's and Sawhney's experience with Professors Hanson and Riseman instilled in them a sense of the complexities and excitement of dealing with real-world problems. "Sarnoff has provided us a playing field where cutting edge R&D and real-world systems are both actively worked on to push the frontier of knowledge as well as make a difference in the world with technology. The future holds a lot of promise for vision at Sarnoff and vision at large," notes the team. Robotics is maturing with sensing and perception as key components. "My dream of creating a robot with vision that my wife would love to buy will be realized within the coming decade," says Kumar.

"The UMass Amherst Vision group of the late 80s with Ed and Al at the helm motivated us to address challenging problems and gave us the stamina to work on them with perseverance," say Kumar and Sawhney. The experience of those heady days extended into the conceive-create-deploy-refine cycle at Sarnoff that has created a unique lifestyle for Kumar and Sawhney in the prime of their careers.

Where have they gone?

The following computer science students have graduated with Ph.D.s from UMass Amherst within the past year:

Brendan Burns: "Exploiting Structure: A Guided Approach to Sampling-Based Robot Motion Planning" (Oliver Brock, Advisor); Assistant Professor, Union College.

Jamieson Cobleigh: "Automating and Evaluating Assume-guarantee Reasoning" (Lori A. Clarke, Advisor); Software Engineer, The MathWorks.

Jiwoon Jeon: "Searching Question and Answer Archives" (W. Bruce Croft, Advisor); Software Engineer, Google Inc.

Purushottam Kulkarni: "SensEye: A Multi-tier Heterogeneous Camera Sensor Network" (Prashant Shenoy and Deepak Ganesan, Advisors); Assistant Professor, I.I.T. Bombay.

Wei Li: "Pachinko Allocation: DAG-Structured Mixture Models of Topic Correlations" (Andrew McCallum, Advisor); Senior Software Development Engineer, Yahoo! Inc.

Donald Metzler: "Effectively Modeling Term Dependencies in Information Retrieval" (W. Bruce Croft, Advisor); Research Scientist, Yahoo! Research.

Hema Raghavan: "Tandem Learning: A Learning Framework for Document Filtering" (James Allan, Advisor); Research Scientist, Yahoo! Applied Research.

Jiaying Shen: "Communication Management in Distributed Sensor Interpretation" (Victor Lesser, Advisor); Computer Scientist, SRI International.

Kyoungwon Suh: "Monitoring, Measurement, and Control of Multimedia Traffic in IP Networks" (James Kurose and Donald Towsley, Advisors); Assistant Professor, Illinois State University at Normal.

Xing Wei: "Topic Models in Information Retrieval" (W. Bruce Croft, Advisor); Research Scientist, Yahoo! Research.

Xiaolan Zhang: "Routing in DTN: Performance Modeling, Network Coding Benefit and Real Trace Studies" (James Kurose and Donald Towsley, Advisors); Assistant Professor, Fordham University.

Spotlight on CS graduate student Megan Olsen

Megan Olsen in this year's Halloween costume

Megan Olsen is a Ph.D. student in the Biologically Inspired Neural and Dynamical Systems Lab (BINDS) under Associate Professor Hava T. Siegelmann. Since the fall of 2006 she has been on a Department of Homeland Security Fellowship, and was recently awarded a Verizon Rising Star Fellowship (see story on page 14). Her research interests are in biologically inspired computation and artificial intelligence. Her current work includes improving the robustness of self-regenerating cooperative multi-agent systems, and examining the role of apoptosis in breast cancer via a multi-agent simulation. "I am truly excited to problem solve in both Computer Science and Biology almost simultaneously," Olsen says. "Working toward a Ph.D. is one of the best opportunities I've had to pursue answers to interesting problems, as well as to learn more about a few of the areas that really interest me." She also enjoyed exploring an additional subfield this summer by using artificial intelligence on a real world computer security problem during an internship at Pacific Northwest National Lab.

She is also active in the department, acting as co-chair for the CS Women's Group for a year, Tea Totaller for Thursday Tea for a semester, and helping with Candidate's Weekend, CS Saturday, and Homecoming each year. She enjoys socializing and finds that these events are well-suited to meeting new people both in and out of Computer Science.

When she stumbles upon free time she has an even wider array of activities to pursue. "Although I sometimes spend my time in front of the computer playing games or designing websites, I will often try to be far from any monitors," says Olsen. Occasionally she will bake desserts and bring the extras into the lab, or decorate a cake for a special event. Olsen can also be found at a sewing machine close to Halloween making a somewhat elaborate costume, and through the rest of the year she can be found scrapbooking. When the weather is nice, she enjoys hiking and biking. Thanks to the invention of digital photography, she will usually be found with a camera in hand, and afterward in front of Photoshop and her blog.

Although she enjoys her many outside activities, Olsen also enjoys her work in Computer Science. "I'm still glad that I chose the field and the Ph.D. even as I start my seventh overall year of post-secondary school," says Olsen. "I work with a great group of people in BINDS who share my passion for both learning and creating science."

Spotlight on CS undergraduate Ashley Prudden

Like many other Computer Science (CS) majors, undergraduate Ashley Prudden stumbled onto computer science as her focus for college. "When I was in high school I thought I wanted to major in graphic design or something with web design," says Prudden. "I was editor-in-chief of my yearbook and loved playing around in Photoshop and with html coding. Senior year I decided I'd look into Computer Science as opposed to graphic design because so many schools required a portfolio, and I cannot draw for the life of me." This turned out to be the right choice for Prudden. She expects to graduate in May 2009 with an undergraduate degree in Computer Science.

Ashley Prudden (top left) at a cheerleading competition

Prudden is enjoying college life at UMass Amherst. She spends leisure time going to concerts, hanging out with friends, and watching *Grey's Anatomy* on Thursday nights. In addition, Prudden was on the UMass Amherst cheerleading squad for freshman and sophomore years. She also designed and maintained their current website. She has been a cheerleader since she was 10 years old. Prudden currently cheers on an all-star team at a competitive cheerleading gym and goes to many competitions, when she is not too busy with her computer science coursework. If you go to one of the competitions, you can see Prudden getting thrown through the air during their routines.

Prudden also finds time to work as a Peer Advisor at Commonwealth College where she maintains the Student Life portion of their website. This past summer, she had a co-op position with The Volpe Center in Cambridge. "I got thrown into the world of databases and .NET programming, and I now help maintain and build applications for an online pipeline system," says Prudden. "I was fortunate enough to keep the job when I returned to school this fall, and I now work from my dorm room."

While Prudden claims she is just doing "normal things that a normal college girl would do," it is clear that she does much more than the average student. Associate Professor Hava Siegelmann, who had Ashley in her classes for two consecutive semesters, describes her as one of the brightest students she ever had.

ROSENBERG – – *continued from page 5*

Science at Duke University from 1981 to 1986, and a Research Staff Member at the IBM Watson Research Center from 1965 to 1981. Rosenberg has held visiting positions at Yale University and the University of Toronto. He was a Lady Davis Visiting Professor at the Technion (Israel Institute of Technology) and a Fulbright Senior Research Scholar at the University of Paris-South. He is a Fellow of the ACM, a Fellow of the IEEE, and a Golden Core Member of the IEEE Computer Society. Rosenberg received an A.B. in mathematics (1962), and an A.M. (1963) and Ph.D. (1966) in applied mathematics, all from Harvard University.

During the process of nominating Rosenberg for the UMass Amherst NSM Outstanding Research Award, the Department of Computer Science received a number of letters from colleagues in Rosenberg's technical community. "Given Arny's many accomplishments and accolades, we certainly expected to receive extremely supportive letters," said Distinguished Professor Jim Kurose. "Nonetheless, even we were overwhelmed by the depth, breadth, and profoundness of impact that is indicated in these letters."

Distinguished University Professor Arnold Rosenberg poses with his research colleagues during the celebration of Rosenberg's career. Pictured above (left to right): BOTTOM ROW: Frederic Vivien (ENS-Lyon), Lixin Gao (UMass Amherst ECE; UMA CS Ph.D. '97), Charles Leiserson (MIT), Arnold Rosenberg (UMass Amherst CS), Robert (ENS-Lyon), Franco Preparata (Brown), Anne Benoit (ENS-Lyon), Frank Dehne (Carleton). SECOND ROW: Allan Borodin (Toronto), Greg Malewicz (Google), Fred Annexstein (Cincinnati; UMA CS Ph.D. '91). THIRD ROW: Matthieu Gallet (ENS-Lyon), Nick Pippenger (Harvey Mudd), Bruce Maggs (CMU). FOURTH ROW: Viktor Prasanna (USC), Michael Bender (Stony Brook), Patrice Quinton (ENS-Cachan). FIFTH ROW: Lenny Heath (Virginia Tech), Vittorio Scarano (Salerno). SIXTH ROW: Jothy Rosenberg (Angletec), Danny Krizanc (Wesleyan). TOP ROW: Ramesh Sitaraman (UMass Amherst CS), Sandeep Bhatt (HP Labs), Pierre Fraigniaud (U. Paris), Geppino Pucci (U. Padua).

Rosenberg's colleagues all noted the seminal contributions of a researcher whose career, in the words of one colleague, "has intertwined with almost every phase of computer science across the spectrum of 40 years." Another colleague noted "Arny is widely recognized within the theoretical computer science community for his decades of distinguished scholarship, and his pioneering research in several aspects of computer science. Arny's long list of publications, his leadership roles, and the accolades he has won are testament to his outstanding research contributions and the high esteem he has earned among his colleagues." Yet another colleague noted that Rosenberg is "a true leader in our field, and, by now, a legendary name … Arny's papers on theoretical machines (with other giants like A. Meyer, M. Fischer, etc.) were classical reading material for our generation."

A number of Rosenberg's colleagues also commented on his research paradigm. Initially a pure theoretician, Rosenberg's research focus began to shift in the early 1970s to questions/issues raised by "real-world" computing problems. One of his colleagues noted that Rosenberg's style is to "pick an important and topical area, formulate a rigorous framework to explore and deeply understand the problem domain, illustrate the concepts with a novel solution to a specific problem, and then observe [many] researchers pick up the approach and develop variations on the original theme … Arny is a deeply thoughtful researcher. He is not willing to settle for quick results, nor does he consider a problem solved until he has carefully examined every possible aspect, teased out every source of complexity, and simplified his solution, and formulated a rigorous explanation of why certain approaches are successful and others are not." Another colleague wrote, "I am one of the many … colleagues that were dramatically motivated by his paradigm to focus on theoretical questions … Arny's turn into the pragmatic theory of data structures perhaps marks the start of what I also call 'relevant theory to technology'."

Rosenberg's human side, and in particular his mentoring junior faculty in the theoretical community over the years, has been a constant and valuable resource to faculty both within the computer science department and in the broader computer science theory community. One of Rosenberg's more junior colleagues in the theory community wrote, "Arny was a generous and gentle senior collaborator, ever willing to share new problems, ideas, and credit… he has nurtured several young colleagues, maintaining the highest standards throughout a long and distinguished career." Another wrote, "Arny has served as an unofficial mentor to me, and, I think, to many other researchers, including seven other computer scientists, all now considered stars in their field." The same can be said for many of the University of Massachusetts Amherst faculty. Rosenberg has served as mentor to five UMass Amherst Lilly Teaching Fellows. "He has also served as a research and career mentor to a number of faculty in the department," adds Kurose. "He has been tireless in helping promote the good work within our department and college through his many years on department and college award committees."

EMC Exec. VP Coviello visits CS

Arthur W. Coviello, Jr., EMC Corporation's Executive Vice President and President of RSA, the Security Division of EMC Corporation, spoke to a standing room only crowd in October. Coviello talked about how information security is undergoing a transformation in the very dynamic open world in which we live.

Coviello is responsible for RSA's strategy and day-to-day operations as it delivers EMC's global vision of information-centric security. He was Chief Executive Officer of RSA Security, Inc. prior to its acquisition by EMC in 2006. He joined the company in 1995 and was a driving force in its rapid growth, increasing revenue from $25 million in 1995 to more than $310 million in 2005. Under his stewardship RSA became acknowledged as the de facto standard for two-factor authentication and encryption, and as a leader in identity and access management.

CS Homecoming October, 2007

above: Donald House (Ph.D. '84) views a demo during the research poster session.

top rt: (l to r) Fred Annexstein (Ph.D. '91), ArnyFest speaker Nicholas Pippenger, and Ed Fisher (Ph.D. '76) gather lunch.

bottom rt: Daniel Amirault (class of 2010) and his father JT Amirault (BS '82) enjoy the homecoming festivities.

INITIATIVES – – – – – – – – *continued from page 7*

evaluates web-based ethics modules for students and faculty that teach about workplace ethics, international accountability, and ethical conflict between nations.

Senior Research Scientist Howard Schultz received a grant from the Office of Naval Research (ONR) to build a new type of camera for studying water waves.

Senior Research Scientist Dan Corkill is part of a team of researchers working on a DARPA-funded project to develop an artificial intelligence learning system.

Associate Professor David Jensen and his Knowledge Discovery Lab (KDL) received a five-year grant to study the application of machine learning techniques to construct simulation models of dynamic social networks. The award is from the Intelligence Advanced Research Projects Activity (IARPA). Purdue University Assistant Professor Jennifer Neville (UMass Amherst CS Ph.D. '06) is a co-PI on the project with Jensen. In another project, Jensen has partnered with the Comcast Interactive Media Labs to explore how KDL's technologies for knowledge discovery can be applied to media indexing.

Intel provided support to Assistant Professor Emery Berger to research ways to use multiple cores to improve software reliability and security. Assistant Professor Yanlei Diao received funding from Cisco Systems for a project on in-network event processing over distributed streams.

In other corporate support, the department is pleased to announce three new members of its Industrial Affiliates Program. EMC Corporation, BBN Technologies, and Cisco Systems joined this fall. Yahoo! is also supporting the department by sponsoring the weekly Machine Learning & Friends lunch speaker series.

TOWSLEY– *continued from page 1*

like the Internet to create reliable connections and exchange data.

Over the past 30 years, Towsley has developed foundational modeling and analysis techniques used by researchers throughout the world to model, predict, and better understand the performance of computer and communication systems. Towsley is responsible for seminal work in network tomography, sample path analysis of networks, and analytical Transmission Control Protocol modeling. He currently co-directs the Networking Research Laboratory with Distinguished Professor Jim Kurose.

In addition to the SIGMETRICS Award, Dr. Towsley received the prestigious 2007 IEEE Kobayashi Computer and Communications Award, the 1999 IEEE Communications Society William Bennett Award, and several conference/workshop best paper awards. He also received the Chancellor's Medal in 2001-2002 and an Outstanding Research Award from the College of Natural Sciences and Mathematics.

Towsley is one of the founders of the Computer Performance Foundation and has twice received the IBM Faculty Fellowship Award. A fellow of the IEEE and the ACM, he serves on the editorial board of the *Journal of the ACM* and the IEEE *Journal of Selected Areas in Communications*. He is Editor-in-Chief of the *IEEE/ACM Transactions on Networking*. Towsley is the chair of the International Federation for Information Processing Working Group 7.3 on computer performance, measurement, modeling, and analysis.

Faculty News


The UMass Board of Trustees approved the promotion of **Eliot Moss** (far left) to full professor and approved tenure for Associate Professor **Andrew McCallum.**

Lee Spector joined the department as adjunct faculty. He is a Professor of Computer Science in the School of Cognitive Science at Hampshire College.

Distinguished Professor **Jim Kurose** received the IEEE Communications Society Publications Exemplary Service Award "For Dedicated and Outstanding Service as the Founding Editor in Chief of the IEEE/ACM *Transaction on Networking* and as ComSoc's Director of Journals." Kurose also published the 4th edition of *Computer Networks: A Top Down Approach* (Addison Wesley). He is the general co-chair of 2007 ACM CoNEXT with Henning Schulzrinne (UMass Amherst Ph.D. '92) and general co-chair of IEEE COMSWARE with former UMass Amherst CS Professor Krithi Ramamritham.

Professor **Lori Clarke** will give a keynote address, entitled "Using Software Engineering Technology to Reduce Medical Errors" at the 2008 International Conference on Software Engineering, to be held in Leipzig, Germany in May 10-18, 2008.

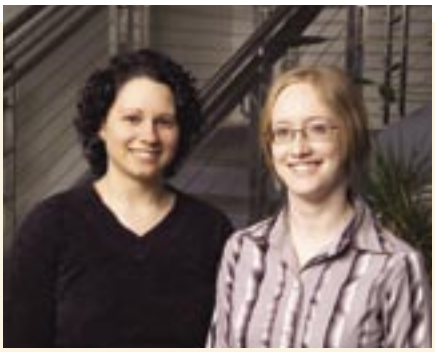
Distinguished Professor **Don Towsley** presented the keynote lecture at the 26th Annual IEEE Conference on Computer Communications (INFOCOM 2007) in Alaska.

Distinguished University Professor **Arnold Rosenberg** was named one of two computer scientists on the International Scientific Steering Committee of the Galileo School at the University of Pisa. Rosenberg gave a plenary lecture at a joint meeting of the Canadian Mathematical Society (CMS) and the Mathematics of Information Technology and Complex Systems Network (MITACS), in Winnipeg, Manitoba.

Assistant Professor **Mark Corner** is the program chair of the Ninth Workshop on Mobile Computing Systems and Applications (HotMobile 2008) to be held in Silverado, California in February.

Assistant Professor **Emery Berger** is the associate editor of ACM *Transactions on Programming Languages and Systems* (TOPLAS). He is also the general chair for the ACM SIGPLAN Workshop on Memory Systems Performance and Correctness (MSPC 2008) to be held in Seattle, Washington, in March.

Verizon Rising Stars



For the third straight year, the Verizon Foundation has awarded fellowships to two rising second year graduate students in the Computer Science Department. This year's recipients of the Verizon Rising Star Fellowships are Benessa Defend (above, left) and Megan Olsen (above, right).

Defend is a Ph.D. student advised by Assistant Professor Kevin Fu in the PRivacy, Internetworking, Security, and Mobile Systems Laboratory (PRISMS), where she investigates RFID security/privacy and human authentication using brain waves. In addition to the Verizon Fellowship, she is a recipient of the Ford Foundation Diversity Predoctoral Fellowship and of the 2006 NSF East Asia and Pacific Summer Institutes Fellowship for research at Kyushu University in Japan. Defend is currently in Japan at Kyushu University for a five month collaborative RFID study abroad experience. Her research involves security, privacy, and anonymity with a focus on RFID and resource-constrained devices. She is a member of the RFID Consortium for Security and Privacy (RFID-CUSP). In 2005, she earned her B.S. in Computer Science from Austin Peay State University.

Olsen is a Ph.D. student advised by Associate Professor Hava T. Siegelmann in the Biologically Inspired Neural and Dynamical Systems Lab (BINDS). In addition to the Verizon Fellowship, she is currently funded by a Department of Homeland Security Fellowship. Her current research includes improving the robustness of self-regenerating cooperative multi-agent systems, and examining the role of apoptosis in breast cancer via a multi-agent simulation. In 2005, she received a B.S. in Computer Science from Virginia Polytechnic Institute & State University (Virginia Tech). For more details on Olsen, see the student focus article on page 11.

Associate Professor **David Jensen** gave an invited talk, "Beyond prediction: Directions for probabilistic and relational learning," at the 17th Annual International Conference on Inductive Logic Programming.

Associate Professor **Sridhar Mahadevan** taught a four hour tutorial, "Novel Frontiers in Representation Discovery," at the National Conference on Artificial Intelligence (AAAI 2007) held in Vancouver, Canada, in July.

Researcher News

The Information Extraction and Synthesis Laboratory (IESL) welcomed Senior Postdoctoral Research Associates **Khashayar Rohanimanesh** (UMass Amherst CS Ph.D. '06) and **Hanna Wallach.**

David Irwin and **Pablo Serrano Yanez-Mingot** joined the Computer Networks Research Group (CNRG) as Research Fellows. NEC Laboratories Systems Performance Research Laboratory Assistant Manager **Yohei Hasegawa** is a CNRG Visiting Researcher with CNRG.

Lance Williams (UMass Amherst CS Ph.D. '94) is a Visiting Professor in the Visions Laboratory. Williams is an Associate Professor of Computer Science at the University of New Mexico.

Tata Consultancy's **Nikhil Zope** is a Visiting Researcher working with Professors Lori Clarke and Lee Osterweil.

Massachusetts Maritime Academy Associate Professor **Enid Sichel** is a Visiting Scholar working with RIPPLES and on the OWL project.

Student News

Graduate student **Jacqueline Kenney** received this year's Robin Popplestone Fellowship in Robotics & Artificial Intelligence. She graduated from Loyola College in 2007 Summa Cum Laude with a B.S. in Computer Science and a minor in Math.

Graduate students **Marc Cartright** and **Benjamin Teixeira** received Northeast Alliance Fellowships for 2007-2008.

IESL graduate student **Xuerui Wang** received a Graduate Fellowship from UMass Amherst this year.

This year's outstanding undergraduate award recipients are **Matthew Marzilli** (Overall Achievement), **Andrew Roberts** (Artificial Intelligence), **Paul Chukiu** (Networking), Paula Wing (Security), **Eric Raboin** (Software), **Kevin Grimaldi** (Systems), and **Evan Innis** (Theory). Each of the honorees graduated in 2007 with a B.S. in Computer Science. Marzilli is now in the department's Bay State Fellowship program and Wing is in the Ph.D. program.

Edwin Hammond and **Andrew Whalen,** 2007 UMass Amherst CS B.S. alumni, each received 2007 Gerald F. Scanlon Student Employee of the Year Awards in the spring. Hammond worked with Mail Services and Whalen worked on the design the new campus website.

CIIR graduate student **Trevor Strohman** and his wife Anne-Marie welcomed daughter Natalie Jane, born on June 17.

Yun Zhou, CIIR graduate student, and his wife Hairong Wu announced the August 6th birth of daughter Jessica.

Graduate student **Zongfang Lin** and his wife Shuang Feng are the proud parents of Brian Decheng, born on October 24.

Staff News

The main office welcomed **Darlene Fahey** back after a five year hiatus, as the undergraduate program manager. **Frances Holt** joined the department as an outreach assistant working in the main office.

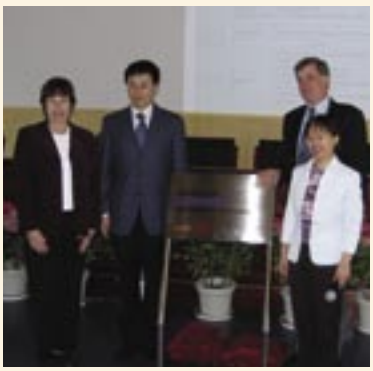
This fall, **Gavin Andresen** joined the IESL as a Senior Software Engineer.

Croft selected for Conti Fellowship Award

Distinguished Professor Bruce Croft received a UMass Amherst 2007-2008 Samuel F. Conti Faculty Fellowship Award. Selection of the awardees is based on demonstrably outstanding accomplishment and potential for continued excellence in research and scholarly or creative activity. Candidates for this honor go through a rigorous competition at the department, college, and campus levels. As part of the Award, Croft received a year's leave of absence to concentrate on activities related to graduate education, research, creative work, and scholarly attainment.

During his Fellowship year, Croft is working with a new group of graduate students on a range of topics related to search and information retrieval. He has been developing more effective search techniques for over 30 years and continues to find new challenges in this technology that we use every day.

LASER and ISCAS join forces



Professors Lori Clarke and Lee Osterweil, Directors of the Laboratory for Advanced Software Engineering Research (LASER), recently visited the Institute of Software Chinese Academy of Sciences (ISCAS) in Beijing, China to formally inaugurate the Joint ISCAS/UMass Amherst LASER research lab. Then-Chancellor John Lombardi signed the joint lab agreement with Mingshu Li, ISCAS Director, several months prior to Clarke's and Osterweil's visit. Pictured above unveiling a plaque to mark the lab and the occasion are (left to right) Clarke, Li, Osterweil, and Qing Wang (ISCAS Associate Chief Engineer).

Significant Bits

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

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A current need within the department is to upgrade the equipment in our instructional education lab and PC lab with new computers. Also, donations to our CS Endowment fund will have continuing benefits to the department's graduate and undergraduate programs.