

# Significant BITS

Newsletter of the  
DEPARTMENT OF COMPUTER SCIENCE  
(formerly "LOOSE CHANGE")

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The Computer Vision Lab is letting environmentalists see the world's forests accurately and in very high resolution through processing digital video imagery.

## Seeing the forest for the trees

Department research group determines the biomass of forest tracts through aerial image analysis

From the New England fall foliage to the national parks of Bolivia to the heart of the Amazon rain forest, digital aerial video footage is yielding data in a new and unique process that's helping environmentalists understand and preserve fragile forest ecosystems.

The Aerial Environmental Monitoring Project uses technology from the Computer Vision Laboratory and draws on resources from within the Department and beyond. The Vision scientists are working with the Department of Natural Resources and Conservation to identify species of trees and the

*continued on page 4*

### A career of recognition

*After three decades, Ed Riseman continues to improve computer vision*

"A machine needs to think about the world not only in the patterns of light and color, but also in terms of the spatial relationships between objects and their surrounding context," says Professor Ed Riseman.

In his early research, Riseman studied pattern recognition, originally a subfield of artificial intelligence. He worked on character recognition: "Letters, words, context."

Then in the early '70s several MIT Ph.D. theses emerged. They discussed the computations involved with recognizing blocks on a table.

"That didn't seem very ambitious," Riseman says, "so we asked, why not take our project outdoors to figure out how to recognize the outdoor world — roads, houses, grass, sky?"

So Riseman and his

*continued on page 5*

## FROM THE CHAIR

## The view from here

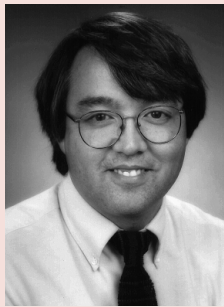
By Jim Kurose

**W**OW! I'm writing this piece for *Significant Bits* on the very first day in my new office in our new Computer Science building. Not only is the view over the sunny, autumn Berkshire mountains spectacular, but so too is the view within our beautiful new building. Over the next few weeks, the Department will complete its move into the new Computer Science Building. While we will maintain some educational and research laboratory space in the Lederle Graduate Research Center, this beautiful new building will be our new home.

I've always found the Department has always been a warm and congenial environment. Our move to take ownership of our new "house" will only further deepen those feelings of community.

A new building, like a new house, leads one to think about the future that will unfold in the new structure. What is that view of the future? As a department, we face many challenges – huge increases in enrollments in our

undergraduate courses; an increasing need to deliver broad-based "information technology" courses not only to our on-campus students, but to off-campus students as well; increased competition to at-




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**A new building, like a new house, leads one to think about the future that will unfold in the new structure. What is that view of the future?**


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tract and retain the best and the brightest students and faculty; an increased need for resources to make this all happen.

But the view of the future from here looks excellent indeed. Several of the articles in this edition of *Significant Bits* indicate the basis for this optimism. We've had continued success in hiring – we've welcomed Micah Adler and Brian Levine into our faculty this Fall. We've had a record-setting incoming class of graduate students – a record number of applications (nearly 800 applications for the 40 spots in our incoming class), and a record number of students who accepted our offer of admission

(particularly among those potential students who we brought to campus last spring as part of Candidates' Weekend). We've seen our graduating students launch what promise to be out-

standing careers. Finally, our research programs continue to flourish, with continued recognition of the successes of our faculty and students, new research collaborations formed within the department and with outside industry and academic partners, and another banner year of grants.

So indeed, the view from here is great. We all hope that our Departmental friends – alumni, colleagues in industry, academia and government – will come visit us in our new home. (A convocation and building dedication ceremony are planned for next year. More about that in our next issue). Come and check out the great view! 

## Workshop hits IT workforce shortage

Diverse group to study demand


Coping with shortages in the Information Technology (IT) workforce was the focus of a two-day workshop held on the UMass Amherst campus in mid-September.

This event, sponsored by the UMass Amherst IT Workforce Working Group, crafted a UMass response to this critical issue in today's economy. Key-note presenters included Dr. Paul Harrington, associate director of the Center for Labor Market Studies at Northeastern University and Mary Ellen Condon, director of information management and security for the U.S. Department of Justice.

The task group is a subset of a system-wide group of volunteers organized by the President's Office to address IT issues at the various campuses.

IT workforce shortages are apparent in every region of the country and many, if not all, segments of the economy. In exploring the nature of the IT worker shortage, this workshop analyzed the array of skills and knowledge that are required in the many occupations that encompass this broad-spanning group.

With a goal of formulating a response and recommendations for IT education, the workforce documented the need for IT workers in education, looked at what can be learned from other IT programs, and addressed the validity of IT as a true academic discipline. The group has released a report that includes recommendations for a campuswide IT program.

For more information about this workshop and the report, email Wendy Cooper (cooper@cs.umass.edu) or call her at (413) 545-2492. 

For information about Department research, visit

[www.cs.umass.edu](http://www.cs.umass.edu)

# Two assistant professors join Dept. ranks

## • Micah Adler

### *Algorithms theorist explores the higher mathematics of computer science*

“Looking at fundamental algorithmic questions is exciting since it requires the use and development of elegant mathematical ideas in ways that can have a significant impact on technology,” says Micah Adler.

Adler, who has joined the Department as an assistant professor, brings these interests to the Department group. He has also assumed codirectorship of the Theoretical Aspects of Parallel and Distributed Systems lab (TAPADS).

Adler’s research interests include design and analysis of efficient algorithms, especially for areas of network transmission protocols, packet routing with quality-of-service requirements, mobile and wireless computation, and parallel and distributed computation. He is using and developing techniques in communication complexity, randomized computation, combinatorics, coding theory, lower bounds, and queuing theory.


These areas excite Adler because of their “dynamic nature, as well as their increasing prevalence in today’s society.” His 19 papers address these wide-ranging interests. He will be on the program committee for the Symposium for Parallel Algorithms and Architectures 2000, to be held in Bar Harbor, Maine.

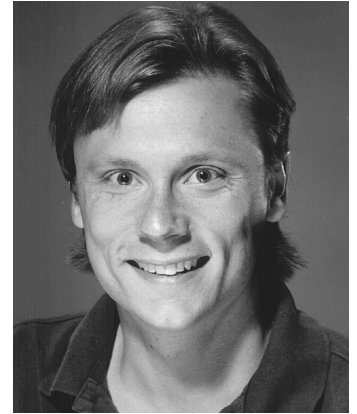
Adler received his Ph.D. from the University of California at

Berkeley. Following his bachelor’s degree from the Massachusetts Institute of Technology, Adler worked in the private sector at Oracle in the company’s consulting group. He comes to the Department from the University of Toronto, where he was a postdoctoral research fellow.

“I have had an interest in

both mathematics and computers since my preteen years,” Adler says. “As an undergraduate, I was introduced to theoretical computer science, and I quickly realized that this was a wonderful way to combine these two interests.”

Adler had sought a “supportive, friendly, and, above all, collaborative atmosphere” in which to pursue those interests, an environment that could offer high-quality colleagues. “UMass seems to be exactly that kind of place,” he says. 



Micah Adler

## • Brian Levine

### *Internet multicasting researcher looks forward to career in academia*

“UMass was the school I wanted to end up at,” says Brian Levine, who has joined the Department as assistant professor. “I am so impressed with the work that goes on here.”

Levine is teaching and researching topics in computer networks. “My specific research interests are in group communication on the Internet,” he says. His seminar (CMPSCI 691M) explores such issues as routing, large-scale applications, and security.

Levine received his B.S. in applied mathematics and computer science from the State University of New York at Albany in 1994. He received his Master’s and Ph.D. in computer engineering from the University of California Santa Cruz in



Brian Levine

1996 and 1999, respectively.


Levine is as challenged by the intellectual rigor of computer science as he is interested in the social implications of the information revolution. He has numerous publications in the area of IP multicasting and group communication and two book chapters in *Multimedia Communications: Protocols and Applications* (Prentice Hall, 1997), and the forthcoming second edition of *Routing in*

*the Internet* (Prentice Hall).

Before joining UMass, Levine worked briefly at Sun Labs, Bell Labs, INRIA (RODEO group in Sophia-Antipolis), and Sprint Advanced Technology Labs. He is a member of the program committee for the first International Workshop on Networked Group Communication, and is responsible for Student Travel Grants for SIGCOMM 2000.

#### A worthwhile career

“I got into teaching because I felt it was a career that is worthwhile and will remain challenging my whole life,” Levine says. “There are lots of jobs out there for computer engineers and scientists, but I think many of them don’t have such qualities, and most of them don’t give you the relationships that are available to a teacher and student. My mom was a teacher, and not much else brought her more joy. I see teaching as an opportunity to affect people’s lives positively on an individual basis.”

“When I began my search, I had worked with Jim [Kurose] a bit during my last year of grad school,” Levine says. “And from talking to students, I knew it was a great place to be.” 

To learn about upcoming events,  
click “Department Calendar” at  
[www.cs.umass.edu](http://www.cs.umass.edu)



## MONITORING ..... (from page 1)

amount of their living matter, or biomass.

With such data, environmental advocacy groups such as The Nature Conservancy can purchase development rights from third world countries, preserving fragile tree cover and the air we breathe.

“We are the only ones in the world with this capability,” says Vision Lab Codirector Edward Riseman, who codirects the lab with Allen Hanson. Riseman is spearheading the project, which he describes as “a new aerial digital system technology.”

Such technology is also well-suited to provide data for the U.S. Geological Survey’s GAP Analysis Program, which seeks to map the entire U.S., analyzing and projecting populations of vertebrate species. “We just flew over New England this fall to collect data,” says Riseman, who also foresees commercial potential. One such application, he notes, might be “aerial surveys for real estate agencies in virtual fly-through,” or surveillance and monitoring applications.

Such technology dramatically simplifies a challenge in conservation: cataloguing attributes of a forest from the air by counting and analyzing individual trees themselves. “What used to take months will soon be done automatically in much less than a day,” Riseman says.

As a result, the Vision project, in removing much of the human labor, lets environmentalists go beyond a daunting and sometimes intractable process to focus on the data itself. By infusing the process with a cost-effective and practical monitoring methodology, the tech-

nology becomes a driving force in the conservation effort.

#### Collecting images

A sampling of video frames of the underlying terrain generates a statistically valid representation of the terrain elevation. The path from images to biomass takes place with the help of data acquired through various tools of geographic information systems. One such system, the Department of Defense’s Global Positioning System (GPS), computes a position on the Earth in three dimensions with pinpoint accuracy.

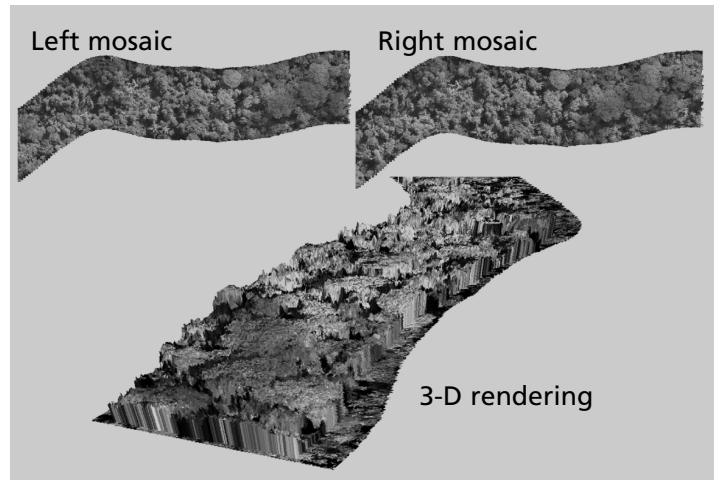
But while the data from the GPS system is extremely accurate, satellite data usually provides too low a resolution to recognize specific objects, Hanson explains. However, that data can provide frames of reference for the low-altitude video of such high resolution that one pixel represents a four-inch square of the terrain. (By comparison, one pixel in the coarser satellite data represents 10,000 square feet.) The high-resolution video is recorded with a data system that tags each frame with time-code information.

#### Three-dimensional views

“We are developing a three-dimensional analysis that represents

an accurate version of characteristics of the physical world,” says Professor Howard Schultz, also of the Vision Lab. “Current mechanisms allow only for analysis of two-dimensional image representation.”

Schultz’s work takes multiple frames and creates a 3-D representation of the canopy. “Local surface patches are matched in two or more images to create a 3-D reconstruction, Schultz explains.



Riseman and his interdisciplinary team of colleagues and students can create a 3D terrain map from video flyovers.

Flying over an area and analyzing a surface from different viewpoints in successive frames allows data to be combined into three-dimensional terrain. A digital elevation map, or DEM, provides an array of elevation measurements, and when an image is draped over, it creates a “3-D visualization, similar to computer games but with realistic and accurate terrain appearance.”

“But here the goal is to view the terrain — the Amazon rain forest or the New England ground cover — from new and different aerial viewpoints while flying under user control,” Riseman continues.

#### Analyzing data

After converting the video frames into a three-dimensional reconstruction, Riseman explains, “the problem of computing biomass of the forest requires us to supply the environmentalist with the height, diameter, and species identity of each significant tree.”

One such environmentalist is Research Fellow Dana Slaymaker, with the UMass Department of Natural Resources and Conservation, whose funding from the USGS and the NSF provides the Vision group with an on-site expert and codeveloper of this new

technology.

With this data, “we can put a value on the mass of carbon sequestered (i.e., permanently preserved) in the forest,” Slaymaker says. Allometric equations define the relationship of canopy diameter to trunk size, allowing aerial views to infer its biomass, most of which resides in the trunk.

As a plane flies over the area, a laser altimeter transmits a laser beam to the ground and computes distance as a function of the light’s reflection time.

Consequently, Slaymaker says, “We can tell the height of the tree canopy and intermittently get ground elevation through the leaves.”

#### The learning process

The final step in estimating the total biomass of a terrain is the classification of the trees’ species. This step is critical because different species differ in their biomass, with hardwoods varying significantly from softwood species.

This project has already automated much of this process, with a goal of progressively decreasing the amount of human involvement in the analysis. Using both the elevation data and the images to segment the trees, human analysts train soft-

**We are the only ones in the world with this capability**

—Ed Riseman

ware to identify and isolate species identities.

Since this type of process can be learned, the work of Professor Paul Utgoff of the Machine Learning Laboratory has contributed computational processes that allow computers to learn the attributes that ultimately let the systems classify species with increased accuracy.

One goal of the project is to decrease the amount of human involvement in the analysis. This is being done by interactively providing incremental training samples to a real-time decision tree classifier.

**A group effort**

Hanson, who was involved in writing the original proposal, is the principal investigator on a small, related NSF proposal for interpretation of sites in the Amazon data with the Smithsonian Institute. He works on the project at a number of levels.

Visiting Professor Zhigang Zhu, from Tsinghua University, Beijing, is primarily responsible for the video mosaic processing that is a key part of the whole effort. "He is a brilliant researcher and has been contributing in critical ways to the Vision Lab," Riseman says.

Within the Department, the Vision group has drawn on the expertise of Professors Kathryn McKinley and J. Eliot B. Moss for efficiently storing and manipulating the massive amounts of visual data these flyovers have collected. The high-performance computing aspects of the processing will be critical in the future, given the 10 terabytes of video data collected over the Amazon Basin.

**A 'valuable moral force'**

The explosive potential of this technology and its positive applications bring a smile to the face of Riseman, who has been

with the Department for 30 years (*see accompanying article*). Other faculty working on the project agree on the positive, tangible social benefits that come along with the technology. "This energizes me and helps me feel that my work has valuable moral force," Moss says.

The project has taken place with funding from the National Science Foundation, DARPA, USGS, Conservation International, and the Nature Conservancy. For more information, visit [vis-www.cs.umass.edu/projects/Forestry/index.html](http://vis-www.cs.umass.edu/projects/Forestry/index.html). SB

**RISEMAN** ..... (from page 1)

colleague Professor Al Hanson wrote a successful, large National Science Foundation proposal. "And boom!" Riseman recalls. "The next thing you knew, we were on the map."

Thus began the Computer Vision Laboratory, which Riseman and Hanson still co-direct. The Lab's research has spawned companies and collaborations as diverse as hospitals and defense agencies.

**Growing with the Department**

Riseman joined the Department in 1969 as its fifth faculty member. He hailed from Cornell University, where he earned his Ph.D. in electrical engineering that same year.

A prodigious and intense scholar, Riseman has a 27-page vita; he is also quick to give credit to his students and his colleagues.

One colleague in particular is Hanson, who studied beside Riseman both at Cornell and at Clarkson, where both were undergraduates. They supervised their first Ph.D. student together in 1972, while Hanson was at the University of Minnesota and spending summers at UMass. Hanson joined the Department in 1978, and the two have been collaborating full-time ever since.

Riseman, who was promoted to full professor that same year,

served as chair from 1981 until 1985. During that time, Riseman and associate chair Lori Clarke managed a period of explosive growth: faculty nearly doubled from 13 to 22 and external funding mushroomed from \$1 million to \$6 million.

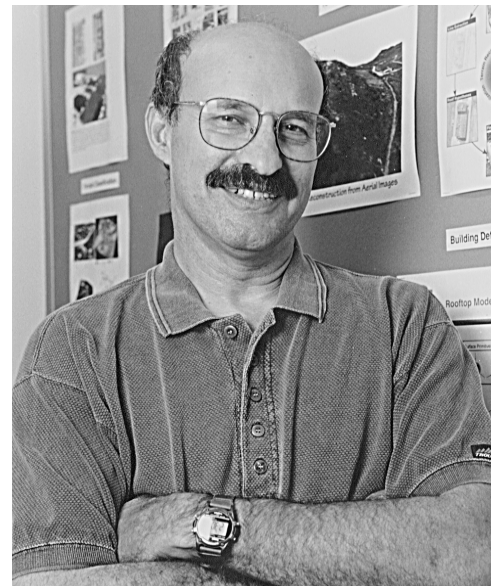
"Despite the chaos, we stayed committed to a department of close cooperation and support, a principle which remains prevalent to this day," Riseman reflects.

This academic year is no exception in the career of Riseman, who was named a UMass Distinguished Lecturer in 1989. He has received the prestigious Faculty Fellowship to underwrite his management of the Aerial Environmental Monitoring Project (*see accompanying article*). "Ed has enriched the Department in so many ways. This is just one way the campus can say, 'Thank you'," comments current chair Jim Kurose.

**Research goals for a lifetime**

For thirty years, Riseman has been working with Hanson to manage the innovation and collaboration on projects that range from recognition of roads on terrain to mobile robots and motion analysis to aerial interpretation.

These projects roughly de-



**Professor Ed Riseman, celebrating 30 years with the Department, has been granted a faculty fellowship for his work on the Aerial Environmental Monitoring Project.**

fine phases, the first being known as the VISIONS period. The VISIONS (Visual Integration by Semantic Interpretation of Natural Scenes) system became so well known that many in the department still refer to their lab by the plural acronym.

From the mid-1980s to the early 1990s, the Vision Lab became involved in the motion analysis and control of mobile robots. This work culminated with the landmark-based outdoor navigation of an unmanned HMMWV vehicle (a.k.a. a "Hummer") driving autonomously on campus.

The 1990s, centering on aerial imagery research, should receive the same renown as the

earlier VISIONS system did. "The Aerial Environmental Monitoring Project," Riseman says, "has the potential to revolutionize the manner in which government and conservationists track how natural resource and land use is conducted."

It's been a long path from the days when Riseman and Hanson performed their computations with paper tape as a storage medium on the old PDPs. In an environment where computational tools have advanced, their research vision has remained surprisingly consistent from the mid-'70s proposal.

"That's because we where overreaching," Riseman laughs. "We still can't do what we set out to do then." SB

## ON THE SIDE

## Graduate student builds world's tiniest Web server

iPic takes TCP/IP to match-head-size device

A graduate student in the Department has built what is believed to be the world's smallest Web server. The match-head-sized device costs less than \$1 to construct, potentially bringing a Web interface to the smallest devices.

Hariharasubrahmanian Shrikumar ("Shri") created the design using only the small microcontroller chip called the iPic, which measures 1/4 of an inch by 1/4 of an inch.

The previous title for the world's smallest Web server was held by a researcher at Stanford University. Shri, who knows the TCP/IP standard inside and out, was impressed, but knew he could do better. Shri built the

server in his spare time.

Shri's device is enjoying a great deal of media attention. Between July 14, the day the server went on-line, and August 11, it served about 45,000 Web pages to about 6,000 users from 56 countries. When news of the server broke in the media, the iPic started receiving 40,000 hits per day through the end of September. Shri believes the iPic would have received even more hits if the dialup line to the device had not limited its output.

### The technology

Shri has not only connected a small computer on the Web, but has achieved breakthroughs in the size of the network software running on the chip. The



**H. Shrikumar ("Shri"), who created the world's smallest Web server. The device owes its enormous potential to its small size and cost.**

software consists of an iPic TCP/IP stack running on 256 bytes of memory, using its own equally tiny operating system. Despite its size, the TCP/IP stack is fully compliant with the requirements of the relevant standards. It is connected to the Internet through a serial port. Because the machine functions only as a server, it does not need a keyboard or display. It is controlled from another computer using a Web connection.

The server has become almost 400 times smaller than the previous recordholder, and 1,000 times smaller in software size, Shri said. "This sets the limbo bar in this race down to a new, lower peg," he said.

Many research teams worldwide are drawn both to the potential of the technology and the challenge of building the world's tiniest server, Shri says. Several contenders to the title have emerged, though the record is unlikely to be surpassed anytime soon.

### Web interface applications

"New ideas are coming in everyday," says Shri, who sees huge potential in the marriage of Web interfaces to the operation of small appliances. The chip has "lowered the price point" for TCP/IP, he says.

The iPic combines Internet technology with the microchips

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**"I am not sure I would insist that my pop-up toaster deserves its own home page on the Web, but should I want to do it, the technology is here," said Shri.**

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that run many of the appliances we use each day, both at home and at work. Each appliance has its own array of buttons and indicators. "We can now replace all of these with one easy-to-use point-and-click Web browser," suggests Shri.

Computer networking researcher John Romkey predicted in 1990 that one day every toaster would be on the Net. "I am not sure I would insist that my pop-up toaster deserves its own home page on the Web, but should I want to do it, the technology is here," said Shri. "And it costs less than the bagels I put in it."

For more information, visit Shri's Web page ([www-ccs.cs.umass.edu/~shri/iPic.html](http://www-ccs.cs.umass.edu/~shri/iPic.html)), which offers a detailed technical description of the device. **SB**

## Shri's "day job"

PICTURE SOMETHING like the computational guts of an airliner's autopilot system, which not only adjusts automatically to circumstances and context, but must do so under constraints of time. If one task is missed, the whole system has essentially failed. Such is the concept of *hard real time*.

Shri's research in the Real Time Systems Laboratory involves integrating a separate and similarly mature field, fault tolerance, with such systems. Fault tolerance involves the science of providing safety nets for system failures, often through scheduling algorithms that back up data over networks connections, providing various forms of redundancy.

Sometimes, though, these separate scheduling algorithms conflict. Shri's research in hard real time systems with fault tolerance finds ways to resolve the two approaches so they can be applied to a problem simultaneously.

Shri's advisors are Professor Krithi Ramamritham and Jack Stankovic, a former Department professor who now chairs the computer science department at the University of Virginia, Charlottesville. Stankovic is the chair of Shri's thesis committee.

Shri, who started at the university in the fall of 1992, did TCP/IP work in the telecommunications industry prior to his graduate studies.



## CENTERS

# Getting E-smart

## Center for Electronic Enterprise helps students and industry keep pace

Have you seen the press lately? There's an e-craze going on.

Two UMass faculty members have decided to take the fear out of the uncharted territory of e-commerce by establishing the Interdisciplinary Center for Electronic Enterprise (ICEE). Codirected by Department of Computer Science Professor Lee Osterweil and Les Ball, the Isenberg School of Management's (ISOM) associate dean of information technology programs, ICEE supports synergy between these two disciplines. The center will devise unique approaches to the interdisciplinary challenges posed by electronic enterprises of all sorts, including, but not limited to, e-commerce, digital government, and virtual enterprises.

Collaboration between schools and departments on campus is not new, but establishing a joint center is. Describing the association as "timely" and "a first," Osterweil says, "The issues that underlie electronic enterprise are complex because they touch so many disciplines."

### Four areas of focus

ICEE will offer research, teaching, outreach, and e-community service. Research is defined by those areas of computer science and business administration that affect electronic enterprise: information retrieval, data mining, security and privacy, networks, ethics, information systems management, marketing, finance, organizational process redesign, and collaboration technology.

More than 20 faculty from both the school and the

Department will be Center affiliates.

### Graduate work in e-commerce

Training a new generation of managers is an important goal for the UMass Amherst campus, and to Ball and Osterweil, in particular. ICEE's long-term goal for teaching is to offer a graduate degree in Electronic Commerce. For now, the directors are offering their graduate course, Topics in Electronic Commerce, which is fully enrolled with a mixture of MBA, computer science, and electrical engineering students.

The course, which filled almost immediately, "is new in a couple of ways," said Ball. "It's the first for UMass and one of only of a handful of such courses across the country. Also, this is the only one created and taught jointly by faculty in business and computer science."

### A resource center

The directors plan extensive outreach to industry. "Companies are grasping for information about the effects of the Internet on their business," comments Osterweil.

An annual conference, day-long seminars, and executive education programs are already in the works. "Our first conference was a huge success," remarks Marla Michel, conference manager and external relations director for the Department.

"Electronic Commerce: Foundations for the Future," held in June in Boston, drew more than 120 CEOs and senior managers from the US and as far away as South Africa and Israel. UMass President William M. Bulger was the con-

ference's honorary chairman. Participants were actively involved in presentations that centered on the business, research, education, and payments issues of e-commerce. The call for participation for next year's conference, "Launching the e-Millennium," scheduled for May 2-4, 2000, again at the BankBoston Conference Center in Boston, has been released. Tutorials will also be included as part of the program.

ICEE will contribute to establishing and serving the e-community, both locally and nationally. ICEE will also play an active role in organizations in support of electronic enterprise.

ICEE will get much of its support through industry memberships to the Center. "We have several letters of intent from charter members and discussions with several others are feeling very positive," notes Osterweil. "The caliber of the faculty in the Department and the Isenberg School of

Management is extremely high. That bodes well for the Center, and that's why membership inquiries have been numerous."

### Positive support

Ball and Osterweil feel confident about ICEE's future. "There is a lot of activity within the center, and a lot of very positive feedback from our industry partners. We've got a great team and are poised to succeed," says Ball.

He's not alone. In his opening remarks for ICEE's June conference, Bulger fully supported the Center. "This Center will address the convergence of business and technology as no other organization in this country can do," he said.

"The amount of support we've received from the campus has been exhilarating," adds Osterweil. "It always feels good when you're working in a hot area, but to be so wholeheartedly endorsed is a bonus."

For more information, visit [icee.cs.umass.edu/ecommerce](http://icee.cs.umass.edu/ecommerce). SB

## CCBIT works with schools, museum on digitizing historic images

The Center for Computer-Based Instructional Technology (CCBIT) is collaborating with a local history museum and a local school system on Turns of the Centuries, a project designed to digitize the museum's holdings and make them available for teachers in Web-based history lessons.

Ten teachers from the Frontier Regional School District have worked for over a year on curriculum units using the Pocumtuck Valley Memorial Association's collections as primary sources. CCBIT has assisted by: training teachers to use the technology and to employ effective web-based pedagogical techniques, assisting the museum staff in resource selection and digitization, and building a web site that provides the teachers' curriculum activities for stu-

dents' use. Teachers work with museum and CCBIT staff to develop educational activities that use the museum's collections effectively and that also fit into the new state curriculum frameworks for history and social studies.

The CCBIT staff helps the teachers turn these activities into Web-based exercises for their students. This collaboration has recently received an award of \$210,000 from the National Endowment for the Humanities to support further development of the digitized collection, and several smaller grants totaling \$70,000 from the Massachusetts Department of Education for joint work between the Turn of the Centuries collaborators and the University's School of Education.

For more information, visit [www.cs.umass.edu/~ckc/](http://www.cs.umass.edu/~ckc/). SB

## ALUMNI

## Dept. grads honored in industry, academia

The Department is proud of the students who earn Ph.D. degrees. Whether it is in industry or academia, UMass Amherst Computer Science graduates excel.

That conclusion is borne out by the lengthy list of alumni who have received several prestigious awards in the national academic arena.

• The *National Science Foundation CAREER Award* directs \$200,000 to young researchers. The highly competitive, four-year grant supports the work of young faculty members. Recent award winners for the Department and their advisors (in parentheses) include:

Rahul Simha '86 . . . . . (Jim Kurose)  
 Suresh Singh '90 . . . . . (Jim Kurose)  
 Panayiotis Chrystanthis '91 . . . . . (Krithi Ramamritham)  
 Adele Howe '93 . . . . . (Paul Cohen)  
 Carla Brodley '94 . . . . . (Paul Utgoff)  
 Claire Cardie '94 . . . . . (Wendy Lehnert)  
 Martin Herbordt '94 . . . . . (Robbie Moll)  
 Ellen Riloff '94 . . . . . (Wendy Lehnert)  
 Keith Decker '95 . . . . . (Victor Lesser)  
 Matthew Dwyer '95 . . . . . (Lori Clarke)  
 Tomas Sanholm '96 . . . . . (Victor Lesser).  
 Lixin Gao '97 . . . . . (Arny Rosenberg and Ramesh Sitaraman)  
 Zhili Zhang '97 . . . . . (Don Towsley)

The *Presidential Young Investigator (PYI) award* was the predecessor to the CAREER award. PYI recipients include:

Edmund Durfee '87 . . . . . (Victor Lesser).  
 Kevin Ashley '88 . . . . . (Edwina Rissland)

• The *Office of Naval Research (ONR) Young Investigator Awards* are offered to attract outstanding new university faculty members to naval research, to support their research, and to en-

## Leaving the nest

### Graduates head to new research venues

After years of teaching, mentoring, nurturing, and support, faculty and staff members have proudly watched seven graduate students, Ph.D. in hand, begin their careers as research professionals:

- Warren Greiff's thesis topic was "Maximum Entropy, Weight of Evidence and Information Retrieval" (Bruce Croft). He will begin work at Mitre Corporation.
- Sneha Kumar Kasera, "Scalable Reliable Multicast in Wide Area Networks" (Don Towsley and Jim Kurose), will begin work at Lucent Technologies – Bell Labs Innovations.
- Chi-Jen Lu, "Time, Space, and Randomness: Trade-offs in Various Models" (David Mix Barrington) will begin work at Academia Sinica.
- Zhihong Lu, "Providing Scalable Distributed Information Retrieval" (Kathryn McKinley), will begin work at AT&T Labs.
- Gleb Naumovich, "Data Flow Analysis for Verification of Application-Specific Properties of Concurrent Software," (Lori Clarke), will begin work at Polytechnic University.
- Ron Papka, "On-line New Event Detection, Clustering, and Tracking" (Bruce Croft and James Allan), will begin work at Dataware Technologies.
- Darko Stefanovic, "Properties of Age-Based Automatic Memory Reclamation Algorithms" (Eliot Moss), will begin work at Princeton University. SB

courage their teaching and research careers. ONR tries to grant at least 18 new awards each year to academic researchers who have recently received Ph.D. or equivalent degrees.

Awards are \$100,000 per year for three years, with the possibility of additional support for equipment or collaborative research with a Navy laboratory. Matthew Dwyer '95 (Lori Clarke) is the Department's recent recipient. SB

## STUDENTS

## Incoming grad students set records

### More applications, better students demonstrate growth in quality

The Department has experienced continued growth in applications over the past several years, leading to more and better students entering the graduate program, says Graduate Program Director Rod Grupen.

Approximately 800 prospective graduate students applied for this year, an increase of more than 14 percent over last year. The Department of-

ferred admission to the top 10 percent of those applicants and nearly half of this very select group accepted the offer. As a result, 40 new students joined the Department this fall.

"We're pleased that our program has grown in popularity, but we're even more excited about the quality of students we've accepted," Grupen noted.

Competition for graduate students is fierce. There are other graduate programs and industry to contend with. As a result, the Department works very hard to entice top students to its program.

Each spring, top students from around the country are flown in to learn about the department and its merits during a Candidates' Weekend. This

event gives prospective students the opportunity to become acquainted with the campus, the faculty, and other graduate students. It gives them firsthand experience with the Department's research labs.

This year, the Department saw a 65 percent acceptance rate from these "courted" students, another new record.

"We now have 160 full-time, fully-funded graduate students in our program. We're ecstatic about this year's incoming graduate students," Chair Jim Kurose said. SB



NEWS

# The suspense builds

*As moving day looms, department prepares for gala to mark opening of new facilities*

The recycling bins are overflowing as members of the Department prepare for the big move to the new Computer Science building later this semester. Excitement is in the air as the number of tours increases and Department members examine their new space in the building that has been in the making for eight years.

“The process of designing, receiving bids, making choices, and managing this building project is almost over,” Steve Cook, the Computer Science building’s project manager and director of its computing facility, says with relief. “It has been an enormous amount of work to realize this building, but we can now see the light at the end of the tunnel.”

Department Chair Jim Kurose concurs. “A lot of people have devoted a significant amount of energy to this project,” he says. “The Department, University, and the larger technical community will all be the beneficiaries of this investment for years to come.”

The concept for the building received state approval in 1992. Funding for the building received final legislative approval in the spring of 1997.

### Having a party

A grand opening celebration has been set for September 14-15, 2000. “We wanted the building to be complete and to feel alive with all the energy of the Department’s research,” remarks Marla Michel, the department’s external relations director and chair of its building opening committee.

The gala will feature a public and technical focus. The first day will include a convo-

cation with the conferring of selected honorary degrees, building tours, and many demonstrations of the department’s research accomplishments. Legislators, campus members and the public at large will all be encouraged to attend.

The second day will have a more technical slant beginning with distinguished keynote presentations by invited researchers followed by technical talks by Department faculty and students.

“It’s going to be a great party,” Michel adds. SB

# Intel, Sprint give research funds

With the goal of investing in the advancement of computer science, two large corporations have recently given funds to the department’s Computer Networks Research Group.

The Intel gift to Professors Jim Kurose, Don Towsley, and Prashant Shenoy supports their research in multimedia networking and operating systems. The gift was made possible by Dr. Raj Yavatkar, a research scientist at Intel’s Hillboro, Oregon, Architecture Labs, who is familiar with the research of the three professors.

The Department is now one of about a dozen university research efforts in the communications and networking areas that enjoy Intel’s support, which will be used to extend the group’s ongoing effort in multimedia proxy servers.

### Gift from Sprint

A gift from Sprint to Kurose and Towsley will support research in multicast communi-

# Distinguished Lecturer, Topol series brings four top researchers to Amherst

The Department has been hosting several of the nation’s top researchers in computer science to speak on campus as part of the annual Distinguished Lecturer Series (DLS).

This year’s Sidney Topol Distinguished Lecturer Series offering dovetails with the DLS. This special series was established through the generosity of Sidney Topol ’47, a telecommunications pioneer who helped forge the cable-satellite connection that triggered the growth of cable television in the U.S.

- September 15, 1999: **Takeo Kanade, Carnegie Mellon University**, “Virtualized Reality: Digitizing a 3D Time-Varying Real Event As Is and in Real Time.”
- November 3, 1999: (The Sidney Topol Distinguished Lecturer Series.) **Andrew J. Viterbi, QUALCOMM, Inc.**, “The Shifting Sands of Silicon: Wireless Technology and Industry at the Turn of the Century.”
- November 17, 1999: **Jim Gray, Microsoft Research**, “What Next? A Dozen Information-Technology Research Goals.”
- February 9, 2000: **Al Aho, Lucent Technologies/Bell Labs Innovations**, “Application Development Environments for Networks of Networks.”

For more information, visit [www.cs.umass.edu](http://www.cs.umass.edu). SB



**Sambit Sahu, Christophe Diot, Don Towsley, Jim Kurose, and Dan Rubenstein. Sprint has funded Sahu’s and Rubenstein’s research for Kurose and Towsley’s Networks research group.**

cations. This past summer, Department graduate student Sambit Sahu was an intern with Dr. Christophe Diot at Sprint’s Advanced Technology Labs in Burlingame, Calif., working on the emerging Internet differentiated services architecture.

Diot made possible the Sprint gift, which will be used to support Sahu’s work in differentiated services as well as the research work of graduate student Dan Rubenstein, who is working in the area of multicast congestion control. SB

## Adrion accepts new position at National Science Foundation

Professor Rick Adrion will be taking a leave of absence from UMass to become division director of the Experimental and Integrative Activities (EIA) program in the Computer, Information Sciences, and Engineering (CISE) Directorate at the National Science Foundation (NSF), starting in January 2000.



Adrion

Adrion, who served as chair from 1986–1994, is also a founder, president, and chair of the board of the Applied Computing Systems Institute of Massachusetts (ACSIOM), a corporation designed to transfer technology developed at the University of Massachusetts, and Director of the department's Centers for Real-Time and Intelligent Complex Computing Systems (CRICCS). He has been with the Department since 1986.

"This is a wonderful opportunity for Rick. It will be an exciting time at NSF, and a time at which proven leadership and vision such as Rick's can really make a difference to the national computing and IT community," commented Jim Kurose, current department chair, on Adrion's new appointment. SB

## Clarke elected to CRA board, receives IBM partnership award

Professor Lori Clarke, codirector of the Laboratory for Advanced Software Engineering Research (LASER), has been elected to the Computing Research Association's (CRA) Board of Directors and has received IBM's University Partnership Award. Clarke's research interests include analysis of concurrent software, object management, and interoperability of software tools.



Clarke

Clarke is the second department faculty member to be elected to CRA's Board. Her term is three years. Professor Rick Adrion was a member of the board from 1987 to 1996. For more information, visit [www.cra.org](http://www.cra.org).

Clarke has also received an extremely competitive \$40,000 IBM University Partnership Award to investigate extensions to the Flow Analysis for Verifying Systems (FLAVERS) prototype, which supports the evaluation of Java programs. FLAVERS determines whether user-specified safety properties are guaranteed to hold on all possible executions of a system and, if not, displays traces through the system that violate the properties.

The IBM award will support the continuation of this investigation, particularly extensions needed to support Java's exception handling mechanism. SB

## Faculty News

Assistant Professors Kathryn McKinley, Ramesh Sitaraman, and Shlomo Zilberstein have all been granted tenure and promoted to associate professor.

■ Professor **Krithi Ramamritham** has been appointed an editor of the new *ACM SIGMOD Digital Review* (DigRev). DigRev, to be announced at the forthcoming SIGMOD conference in Philadelphia, will be a moderated Web site containing a base of links to a large collection of database work and reviews by distinguished senior members of the database research community. Krithi also delivered the keynote address at the International Workshop on Mobility in Databases and Distributed Systems in Italy in September. He will give an invited talk at the International Conference on Real-Time Computing Systems and Applications (RTCSA '99) in Hong Kong this December. ■ The second edition of

*Programming and Problem Solving with C++*, by Nell Dale, **Chip Weems**, and Mark Headington is now available. The publisher is Jones and Bartlett, Inc., of Sudbury, Massachusetts. Information about the 1142-page textbook can be found at [www.jbpub.com/dale](http://www.jbpub.com/dale). ■ The dissertation of **Prashant Shenoy**, assistant professor in the Laboratory for Advanced System Software, has been awarded the distinctive honor of "Best Doctoral Dissertation of 1998-99" by the computer science department at his alma matter, University of Texas at Austin. His accomplishment and dissertation, "Symphony: An Integrated Multimedia File System," will be commemorated on a plaque with other winners of this honor within the UT department. Shenoy's dissertation has also been nominated to the UT's university-wide Outstanding Dissertation Award and the ACM's nationwide Dissertation Award. ■ **James Allan** led a six-week

## Professor Towsley receives prestigious IEEE Bennet Prize Paper Award

Professor **Don Towsley** recently received the prestigious IEEE Bennet Prize Paper Award for the best paper published in the journal *IEEE/ACM Transactions on Networking* in 1998. The journal is considered the premier archival publication in the data networking and telecommunications field.



Towsley

"Parity-Based Loss Recovery for Reliable Multicast Transmission" was coauthored with Dr. Ernst Biersack of Institut Eurecom in France and Dr. Jorg Nonnenmacher of Lucent Bell Laboratories. Professor and Department Chair Jim Kurose, a frequent research collaborator with Professor Towsley, noted, "This is a great honor for Don, recognizing an outstanding piece of work. ... it is a great indication of his tremendous contributions and impact on the field, and his stature in the technical community."

Towsley is a Distinguished University Professor of Computer Science, codirector of the Computer Networks Laboratory. He is a Fellow of the IEEE and of the ACM. SB

summer research workshop at the Johns Hopkins University. The eight team members of the "Topic-based Novelty Detection" workshop explored automatic techniques for processing broadcast news stories to detect when something new happened in the world. Allan's was one of four workshop teams exploring issues in human language technologies. JHU's Center for Language and Speech Processing has been running these DARPA- and NSF-funded workshops for five years.

### Visitor News

**Young Im Cho** has joined the Multi-Agent Systems Laboratory as a visiting research scholar. ■ **Sue-Tae Chung** is welcomed to the department as a visiting research scholar. ■ **Victoria Getis** joins the Center for Computer Based Instructional Technology as a research fellow. Victoria received her degree in History from the University of Michigan and is currently working with David Hart to implement an on-line museum curriculum. ■ **David Harper** has joined the Center for Intelligent Information Retrieval as a research fellow. ■ **Huan Li** has joined Real Time Systems Laboratory as a visiting lecturer. ■ **Clayton Morrison** is welcomed in the Experimental Knowledge Systems Laboratory as a research fellow. ■ The Computer Vision Research Lab welcomes **Young-Sung Soh** and

### Kurose selected as outstanding instructor

For the ninth consecutive year, Professor **Jim Kurose**, Department chair and codirector of the Computer Networks Research Group, has been selected as an outstanding instructor by the National Technological University (NTU) student evaluations.

**Jianping Liu** as visiting researchers. ■ **Jung-Bong Suk** is welcomed as a visiting research scholar in the Computer Networks Research Group. ■ The Multi-Agent Systems Lab members are pleased to have **Yank Xiang** as a senior research fellow and **He Qunming** as a visiting scholar.

### Graduate Student News

Members of the Center for Knowledge Communication and the Psychology Department have recently been given the outstanding poster award at the Ninth International Conference of Artificial Intelligence in Education, 1999. The poster, "An Ablative Evaluation: Changing Self Confidence with Intelligent Tutoring," was prepared by **Joseph E. Beck**, **Ivon Arroyo**, **Beverly Park Woolf**, and **Carole Beal**. The poster explained how the researchers revamped the intelligent help component from an intelligent tutoring system to study the impact this would have on students' confidence and on how much they liked the using the tutor. The effects were strongly dependent on gender, with girls liking a more supportive tutor and boys preferring the scaled-back tutor. ■ Multi-Agent Systems Laboratory graduate student **Ping Xuan** won the best student paper award at the ATAL-99 conference for his paper "Incorporating Uncertainty in Agent Commitments."

### Alumni News

**Jody Daniels '97**, a major in the army reserves, recently returned from being on active military duty in Kosovo. Daniels, a lead member of the engineering staff at the advanced technology laboratories of Lockheed Martin in New Jersey, is working on conversational spoken language understanding technologies. She also received an award of distinction for superior achievement from the lab in April.

## Callan heads to Carnegie Mellon

"Leaving the people in the Department is the hardest part of the move," says **Jamie Callan**, a research assistant professor who was assistant director of the Center for Intelligent Information Retrieval. Callan has been named associate professor at Carnegie Mellon University, where he'll combine his machine learning background with his research in information retrieval.

Callan joined the Master's program in 1985 while he was working for Digital. He then started working toward his Ph.D., first as a research associate and then as a programmer for the nascent CIIR.

Though information retrieval was a field that "no one looked twice at" at that time, Callan found his own research focus moving in that direction. He was responsible for much of the CIIR's early work on Web-based projects, with search engines for the Library of Congress's Thomas legislative Web site and Inquiry, a search technology adopted and tested by Infoseek and later spun off into the private sector.

Callan cites his "nontraditional" path through the Department and will especially miss working with his students and faculty. "The Department is a really great place," he says. "So many reached out to guide me and look out for me." SB

## Lerner moves over to Williams

**Barbara Lerner** has accepted a tenure track faculty position at Williams College, in nearby Williamstown, Massachusetts, to join one of the nation's premier undergraduate computer science departments.

Lerner, a member of the Laboratory for Advanced Software Engineering Research (LASER), came to the Department in 1990 from Carnegie Mellon University, where she received her PhD. Her research interests include the evolution of persistent types, distributed object management, software processes, and cooperative software engineering. Lerner will continue her research in these areas and foresees continued collaboration with LASER. SB

### Staff News

**Rebecca Bolton** has joined the Department as the new outreach assistant. ■ The Experimental Knowledge System Laboratory is pleased to welcome **Gary King** as a senior staff programmer. ■ The Computer Science Computing Facilities welcomes several new people to their department: **James Foster** as a full time laboratory assistant, **David Korpiewski** as an associate software specialist, and **Steven**

**Morin** as a software specialist 2. ■ The Computer Vision Lab has two additions: **Christopher Holmes** as an associate staff programmer I and **Collin Lynch**, a departmental assistant. ■ **Francois Mechkak** has joined the Multi-Agent Systems Lab as a departmental assistant.

Send news for forthcoming issues to [bits@cs.umass.edu](mailto:bits@cs.umass.edu)





# Significant Bits

NEWSLETTER of the DEPARTMENT OF COMPUTER SCIENCE at the UNIVERSITY OF MASSACHUSETTS, AMHERST

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## Thanks for your support

THE FOLLOWING ALUMNI AND FRIENDS have actively supported the Computer Science Department through September 1999. Such financial support is greatly appreciated and helps maintain a world-class instructional and re-

search program. Contributions of alumni and friends help to fund important special activities that are not supported through the state budget.

Those interested in helping the Department should send a check made

out to the University of Massachusetts to the Alumni Office, Memorial Hall, Box 35410, University of Massachusetts, Amherst, MA 01003-5410. Please state that your gift is restricted to Computer Science.

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