Inter*Connections*

A Report on Interdisciplinary Computing at the University of Maryland Institute for Advanced Computer Studies

UMIACS Researchers Awarded $1.7 Million to Improve Access to Oral History Archives

Researchers in UMIACS recently received $1.7 million as a part of a new multi–year Information Technology Research (ITR) award from the National Science Foundation to a team led by the Survivors of the Shoah Visual History Foundation. The goal of the research is to dramatically improve access to large multilingual collections of recorded speech.

Selected from over 2,000 competitive proposals, the new project is one of only eight large funded projects out of the 309 awards announced this year. Now in its second year, the ITR program is designed to preserve America's position as the world leader in information technology and its applications.

The University of Maryland team includes researchers from three laboratories in UMIACS: the Human Computer Interaction Lab (HCIL), Computational Linguistics and Information Processing (CLIP), and Language and Media Processing Lab (LAMP). In addition to the University of Maryland and the Visual History Foundation, the IBM T.J. Watson Research Center and the Center for Language and Speech Processing at Johns Hopkins University are also partners on the project.

"Digital archives of oral history will be an important method for capturing the human experience, but the size of these collections and expense of manually cataloging multilingual audiovisual materials will make it impractical to rely on manual techniques alone," according to Prof. Doug Oard (Information Studies/UMIACS), principal investigator for the research team at Maryland.

The Visual History Foundation's 400-terabyte Digital Library System is large enough to hold the entire archive of testimonies in digital video files.

The Survivors of the Shoah Visual History Foundation's collection, with over 13 years of digitized interviews in 32 languages from 52,000 survivors, liberators, rescuers, and witnesses of the Nazi Holocaust, is the world's largest coherent archive of videotaped oral histories. The foundation was established by Steven Spielberg in 1994 after the filming of *Schindler's List*. Its mission is to "eliminate prejudice, intolerance, and bigotry —and the suffering they cause—through the educational use of the Foundation's visual history testimonies."

Working with this unique collection, the researchers aim to provide automated assistance for labor–intensive tasks such as multilingual cataloging and to create technologies that can provide entirely new capabilities such as end-user search based on automatic speech recognition.

Research will focus on advancing the state of the art in the technologies that will be integrated to achieve this objective: automatic speech recognition; computer-assisted translation of domain-specific multilingual thesauri; natural language processing techniques for automated creation of metadata; support for efficient professional cataloging; and support for search and exploration.

UMIACS
University of Maryland Institute for Advanced Computer Studies

Welcome to the Fall 2001 Issue of Inter*Connections*

During the past six months, UMIACS has witnessed a substantial expansion of its research programs and its partnerships with industry, as well as the recruitment of new outstanding faculty members. I would like to highlight a few of these achievements.

For the second year in a row, UMIACS researchers have secured a number of awards under the NSF Information Technology Research (ITR) initiative, including one of only eight large projects funded in the nation. We have also been quite successful in the ARL competition under the Collaborative Technology Alliances (CTA) program. Our researchers are the UM lead investigators on three of only five such awards. Also, our faculty are on the winning team of a new Department of Defense Multidisciplinary University Research Initiative (MURI) project to advance the state-of-the-art in machine translation.

A major accomplishment since the last issue of *InterConnections* has been the establishment of the Maryland Information and Network Dynamics (MIND) Laboratory. This exciting venture seeks to form partnerships between the university, private industry, and federal agencies to foster large-scale computer science projects in wireless networking, information services and applications. Under the leadership of Dr. Ashok Agrawala, the MIND Lab has already formed partnerships with several top industry partners, including Fujitsu and Aerospace Corporation.

I am especially delighted to welcome our new faculty. Dr. Atif Memon, who holds a joint appointment with the Department of Computer Science, has done groundbreaking work in software and Graphical User Interface testing. Also jointly appointed with Computer Science is Dr. Aravind Srinivasan who has developed the current best algorithms for various problems in low-congestion routing, hypergraph coloring, and network design. Dr. Min Wu, who shares a joint appointment with the Department of Electrical and Computer Engineering, has developed innovative techniques in digital watermarking technologies, which have already received national attention. In addition, Dr. Gang Qu from the Department of Electrical and Computer Engineering joins UMIACS with research interests encompassing intellectual property reuse and protection, low power system design, and applied cryptography.

I hope you enjoy reading this issue of *InterConnections*. As always, I look forward to your comments and suggestions.

Joseph JaJa

IBM Partnership Celebrated

On September 27, 2001, the University of Maryland celebrated the partnership between the Center for Scientific Computation and Mathematical Modeling (CSCAMM) and Deep Computing Institute of IBM. Above (*l to r*), Dr. Joseph JaJa, Director of UMIACS; Dr. William Pulleyblank, Director of the IBM Deep Computing Institute and Mathematical Sciences Department; Dr. Bill Destler, Sr. V.P. Academic Affairs and Provost; and Dr. James Drake, Interim Director of CSCAMM take part in the celebration in front of the new SP housed in the UMIACS Laboratory for Parallel and Distributed Computing.

ITR Project to Improve Access to Oral History Archives (cont.)

Continued from page 1

In addition to Dr. Oard, members of the research team from Maryland include Bonnie Dorr (CS/UMIACS), Philip Resnik (Linguistics/UMIACS), David Doermann (UMIACS), and Bruce Dearstyne and Dagobert Soergel of the College of Information Studies.

Chuan Sheng Liu, interim Vice President for Research and Dean of Graduate Studies, said the project would draw on the strengths of several departments and continue to build strong partnerships.

"The project will involve Maryland students in user needs assessment, system design, implementation, and evaluation," Liu said. "Experts in the field will be invited to campus for presentations that will broaden and deepen insights about these materials and how to make them accessible. It provides an opportunity to enhance access and use of immensely valuable resources through the use of advanced information technology."

More information on this project is available at *http://www.clsp.jhu.edu/research/MALACH/*.

Bill Arbaugh's Work on Wireless Security Achieves High Visibility

*T*he security of wireless computing networks currently has some serious flaws according to Bill Arbaugh (CS/UMIACS). Recent articles in the *New York Times* (April 3, 2001), *InfoWorld* (June 25, 2001), and *MicroTimes* (July 9, 2001) focus on concerns about wireless network security and cite Arbaugh's research into the 802.11 wireless security standard and its inherent weaknesses in keeping digital information safe. In a recent paper entitled, "Your 802.11 Wireless Network has No Clothes," Arbaugh explains that his work, combined with the work of others, shows that all existing security mechanisms are "completely ineffective."

Bederson's *PhotoMesa* Highlighted on Java's Web Site

*I*nnovative software developed by Ben Bederson (CS/UMIACS) was the focus of a recent article on the Java web site (August 2001). Developed using his *Jazz* framework, *PhotoMesa* offers users an opportunity to zoom across hundreds of digital images quickly. For more information on Bederson and *PhotoMesa*, see the Human Computer Interaction Laboratory's Research Update on page 7.

Druin in the *Washington Post* and Named a "Shaper of Our Future"

*A*llison Druin (Education/UMIACS) was featured in a *Washington Post* article (August 16, 2001) about educational software for children. The story focused on a shift in how the publishers of these programs are moving away from the traditional PC-based devices to more interactive and portable machines. Druin's work in the Human Computer Interaction Laboratory using children as design partners was used as an example of new models for creating software that combine learning with play.

Also in acknowledgment of this work, Druin was selected by *Converge Magazine* (August 2001) as one of 25 "shapers of our future." According to the magazine, the list includes those who "deserve special recognition for their work in education and technology and their positive impact on the lives of other."

Shneiderman Weighs in on Usability, Wireless Web

*I*n a *Computerworld* article (April 12, 2001) about the 18th annual Computer/Human Interface (CHI) conference, Ben Shneiderman (CS/UMIACS) says the future of how humans and computers interact is changing. "The old concept of computing is, 'What computers can do.' The new concept of computing is 'What people can do'." During the conference, he was the recipient of the second-ever CHI achievement award.

Shneiderman's expertise in human computer interaction was also called upon in an article on wireless Web browsers in the *Arizona Republic* (July 17, 2001). Recently, some manufacturers of mobile telephones have added the interface and functionality of personal digital assistants (PDAs) to their products. By increasing the screen size and quality, he thinks they are heading in the right direction. "The Web and computing environment is mostly a visual medium, so I'm a great fan of larger displays and higher resolution," Shneiderman says.

Hendler Discusses Agents with AP

*I*n a recent Associated Press article, James Hendler (CS/UMIACS) explains the importance of software agents in sorting through vast amounts of intelligence information. Hendler, former chief information systems scientist for DARPA, says "It takes us too long to get the intelligence to a weapons system. These agents route the right information to the right people at the right time."

The article ran locally in the *Montgomery Journal* (October 4, 2001) and around the country in newspapers in Indiana, Tennessee, and New Jersey, as well as on Yahoo!News.

HCIL Research Assistant Featured in *Computerworld*

*S*oftware developed by Harry Hochheiser, a graduate research assistant in the Human Computer Interaction Lab, was the feature of a recent *Computerworld* article (June 4, 2001). Hochheiser's *TimeFinder* software allows users to query large databases with simple graphical tools and gives its results represented on a graph. Interviews with various professionals, from financial analysts to life sciences researchers, suggest excitement at the variety of applications of the software.

Hochheiser built *TimeFinder* using *Jazz*, an open-source software development kit created by Ben Bederson in the HCIL. Ben Shneiderman (CS/UMIACS), Hochheiser's advisor, is also featured in the article citing the research assistant's work as "a great example of the improved visual interface that lets a novice perform at the level of an expert."

New UMIACS Research Attempts to Catch What's "Lost" in Translation

Translation is more than simply substituting words in one language for those in another. In order to obtain a high-quality translation, a higher level of understanding of both languages is needed. Can computers be trained to this level? Researchers in the Institute for Advanced Computer Studies think so.

To extend the possibilities of machine translation, a team including researchers from UMIACS was awarded more than $1 million over a three-year period as a part of the Department of Defense's Multidisciplinary University Research Initiative (MURI) program. The team includes Philip Resnik (PI-Linguistics/UMIACS), Bonnie Dorr (CS/UMIACS), and Amy Weinberg (Linguistics/UMIACS) as well as researchers from the Johns Hopkins University.

Research in machine translation, like this UMIACS project, continues to bridge the gap between languages.

MURI is a program designed to address large multidisciplinary topic areas representing exceptional opportunities for future DoD applications and technology options.

In order to improve the quality of machine translation, translation models need to be able to exploit linguistic features currently not taken advantage of in the traditional, statistical models. More than just what a word "means," these models must understand its part of speech, its role in the sentence, and other linguistic features.

Current models can do this; however, they need large, annotated samples of the foreign language, which do not exist and would be time- and labor-intensive to create manually. To overcome this obstacle, researchers aim to develop a method for creating new parallel, annotated samples automatically by leveraging the ability to automatically annotate samples in English. First, they will obtain parallel text of English and the foreign language. Then, after running algorithms to automatically discover links between words in the two languages, they will project linguistic annotations from the English side to the foreign language side, using the automatically obtained alignments as a bridge. The result will be linguistically annotated data for the foreign language on a large scale.

The resulting annotated sample will serve as the starting point for new statistical translation models. These new models will have the advantage not only of existing statistical translation methods but also the benefit of relevant linguistic features. ✐

University Acquires SUN Fire 6800 through NSF Grant

Through a grant from the National Science Foundation, the University of Maryland was able to acquire 24-processor SunFire 6800, an array of 50 PCs to use as an active disk array, and gigabit networking equipment. Researchers in this project are investigating the computer science technologies needed to support enterprise applications on such a platform. The active disk array provides high storage capacity and the ability to use processors close to the disks in order to filter and pre-process data. The shared-memory multiprocessor, the active disk array, and an existing 32-node Linux cluster are connected through three Gigabit switches.

The applications to be explored include database servers, file servers, multimedia servers, and "enterprise application" servers. The equipment will initially support ten current faculty and approximately 35 graduate students and post-docs. Though the group's projects include a broad range of specific activities, the overriding vision for the group will be a unified investigation of how to structure and support large-scale server

The new Sun Fire 6800 surrounded by (left to right) Kyung Ryu, Bill Pugh, Alan Sussman, Jeff Hollingsworth, and Peter Keleher.

applications. They are taking a vertical approach to this problem, investigating issues at every level from the application down to the network protocol level. ✐

UMIACS Faculty Lead Three Teams in Army Research Lab Awards

*F*aculty members in UMIACS are leading three new projects awarded by the Army Research Laboratory (ARL) Collaborative Technology Alliances (CTA) program. The CTA program follows the successful ARL Federated Laboratory (FedLab) program, which has been running for more than five years. The CTA program expands upon FedLab by updating the three existing consortia and adding two additional ones. Researchers from the University of Maryland will be participating in all five programs, with Rama Chellappa (ECE/UMIACS) and Larry Davis (CS/UMIACS) serving as Maryland PIs for three of these.

Each winning project consists of an eight-year contact with ARL with project values ranging from $49 million to $76 million over the eight-year period. The programs involve teams of researchers from industry and universities, led by industry, working very closely with ARL personnel.

Advance Sensors Alliance

Advanced sensors are the elements of systems that view the environment and convert basic raw data into meaningful information suitable for military use. The Advance Sensors Alliance will develop affordable sensors that provide the Department of Defense with continuous situation awareness, rapid precise discrimination and targeting of all threats in all environments, and the ability to sense surroundings so as to navigate rapidly and defend oneself. Research will focus on electro-optic smart sensors, advanced radio frequency concepts and microsensors.

The project carries a total agreement value of $61.2 million over an eight-year period. It is led by BAE Systems. In addition to the University of Maryland, other participants include Northrop Grumman Corporation; Quantum Magnetics; DRS Infrared Technologies, LP; General Dynamics Robotics Systems; the University of Michigan; the University of New Mexico; Massachusetts Institute of Technology; Clark Atlanta University; Georgia Institute of Technology; the University of Florida; Jet Propulsion Laboratories; the University of Illinois; and the University of Mississippi.

Participants from the University of Maryland include Rama Chellappa (Maryland PI); Shuvra Bhattcharyya (ECE/UMIACS); Mario Dagenais (ECE); K.J. Ray Liu (ECE/ISR); and Shihab Shamma (ECE/ISR).

The Advance Sensors Alliance will develop tools to determine the best view of an object (in this case, a tank) then compress the image for transmission.

Advance Decision Architectures Alliance

The Advance Decision Architectures Alliance's research goal is to provide Army warfighters with proof-of-principle solutions to conducting military operations on the 21st Century digitized battlefield. Key to developing these integrated tools is a well-defined software architecture based on open commercial standards and compliant with the evolving Defense Information Infrastructure and Common Operating Environment (DII/COE). This architecture shall be scalable, adaptable, extensible, and flexible enough to support the integration of the technologies across the echelons of the future Army force structure. The overall goal of this Alliance is to place advanced information technologies into Army field use.
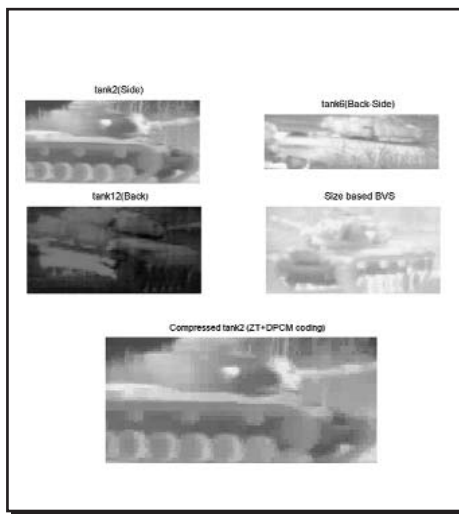
This project carries a total agreement value of $56.3 million over an eight-year period and is led by Micro Analysis & Design, Inc. In addition to the University of Maryland, other participants include Klein Associates, Inc.; SA Technologies, Inc.; ArtisTech, Inc.; SAIC; Ohio State University; The Regents of New Mexico State University; University of West Florida; Carnegie Mellon University; Massachusetts Institute of Technology; and University of Central Florida.

Participants from the University of Maryland include Rama Chellappa (Maryland PI) and V.S. Subrahmanian (CS/UMIACS).

Robotics Alliance

The Robotics Alliance will develop technologies required to permit inanimate systems (or sub-systems) to perform in a seemingly human fashion, concentrating its efforts on advanced perception, intelligent architectures/behaviors and human interface/planning techniques. Participating faculty from the University of Maryland include Professors Larry Davis (PI-CS/UMIACS), Rama Chellappa (ECE/UMIACS), and Yiannis Aloimonos (CS/UMIACS).

Under the Robotics Alliance, the cooperative agreement has a total value of $66 million over an eight-year period. The cooperative agreement was awarded to the Robotics consortium, led by General Dynamics Robotics Systems, Inc. In addition to the University of Maryland, the consortium includes: Carnegie Mellon University; Florida A&M University; SRI International; Applied Systems Intelligence, Inc.; Jet Propulsion Laboratory; BAE Systems; Sarnoff Corporation; Micro Analysis and Design; PercepTek; Science and Engineering Services, Inc.; Signal Systems Corporation; and AAI Corporation. ✍

New MIND Lab Brings University, Industry, and Government Interests Together

A new UMIACS laboratory seeks to form partnerships between the University of Maryland, private industry, and federal agencies. The Maryland Information and Network Dynamics (MIND) Laboratory is designed to foster new, large-scale computer science projects in the areas of wireless networking, networking infrastructure and services, information services and information-centric applications, and information assurance and security. Prof. Ashok Agrawala (CS/UMIACS) will serve as the director of the new lab.

The mission of the MIND Lab is to provide an environment for collaborative research and development efforts among the participants. Efforts will be organized as projects with well-defined milestones and deliverables. Some projects will address basic research questions, while others are more applied.

A New Model of Cooperation

The new model by which the MIND Lab operates stresses the need for genuine partnerships between the university, industry, and government. The MIND Lab intends to create several testbeds in which applications can be quickly deployed to assess their functionality, performance, security, and scalability. It aims to push the technological envelope by rapidly developing and exploiting the latest technologies and then integrating them into demonstrable systems. This collaborative partnership allows companies and other entities to bring more advanced products to market at a faster rate than industry could do on its own.

Researchers in the MIND Lab believe that this innovative approach to working together creates a win-win situation for both the university and its partners. MIND Lab industry members have access to some of the best resources and researchers in the field of computer technology in the nation, while top-notch graduate students gain critical real-world experience with some of the world's most dynamic companies.

Unlike many university-industry relationships, corporate partners will be active participants in the work of the MIND Lab. These partners will help to define the direction and priorities of research, not only through funding but also through the participation of their personnel, facilities, and equipment. An example of this can be seen in the new lab's relationship with one of the world's leading technology companies.

On April 1, 2001, Fujitsu Laboratories Ltd. and its U.S. subsidiary, Fujitsu Laboratories of America, established a new research institute in College Park to develop technologies that more closely link computers to people's everyday lives. Pervasive computing, bioinformatics, and quantum computing are among the first research initiatives pursued at Fujitsu's new lab. Occupying separate floors of the same building, the MIND Lab and Fujitsu's new College Park lab will work closely, but separately.

Fujitsu signed on as founding partner of the MIND Lab in March. In August, the Aerospace Corporation joined the team as an affiliate partner. High-level officials at other companies and agencies have expressed interest in developing a collaborative relationship with the MIND Lab.

PinPoint & Rover Technologies

One of the first activities of the new lab involves a patent-pending technology developed by Prof. Agrawala with A. Shankar, Ronald Larsen and Douglas Szajda. Their PinPoint Technology was winner of the University's invention of the year award. It is an accurate, rapid and inexpensive technology that determines the spatial layout of a wireless network of nodes. PinPoint also allows every node to ascertain the relative offset and drift of every other node's clock, making it possible for all of the nodes to carry out a precise synchronized action. Research results show that the PinPoint Technology can determine location to an accuracy of a few centimeters and determine clock differences to an accuracy of a nanosecond. Currently, investigators in the MIND Lab are working to use PinPoint technology to power a revolutionary personal communications device, Rover Technology.

Rover Technology incorporates an applications server, a wireless network, and client handheld PCs. The applications server, based in a Windows 2000 environment, gives system administrators access to information about each current user, as well as the ability to manage events and broadcast messages.

On April 28, 2001, as part of the festivities for Maryland Day, the MIND Lab unveiled a prototype of Rover Technology. The event, which hosted more than 40,000 visitors, featured more than 300 activities geared toward interactive learning and fun. At the event, users were able to try out the Rover Technology to help guide them through the day's activities. The prototype device gave guests on the campus mall a complete,

Graduate research assistant Suman Banarjee demonstrates Rover Technology for President C.D. Mote as Prof. Agrawala (right) looks on.

Human Computer Interaction Lab Continues to Develop Innovative Tools

D r. Ben Bederson, Director of the Human Computer Interaction Lab (HCIL), has received recognition from numerous technology publications and industry leaders for his creation of PhotoMesa, a zoomable image browser. He built the browser using HCIL's *Jazz* Toolkit for Zoomable User Interfaces.

While many image management systems have focused on annotating and searching, *PhotoMesa* concentrates on browsing. The inter-face lets you con-centrate on the images, w i t h o u t having to m a n a g e scrollbars, menus, or p o p - u p w i n d o w s . It also lets you group images by a v a i l a b l e
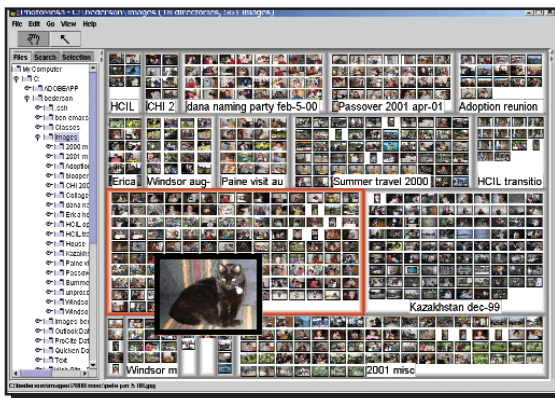
Curiosity can find the cat with *PhotoMesa,* an image browser developed by Ben Bederson of the HCIL.

metadata, such as directory location, image creation date, and words in the filename. *PhotoMesa* introduces two new layout algo-rithms—Quantum Treemaps and BubbleMaps—to layout the images on the screen, using space efficiently while showing the groups the images are in.

PhotoMesa was built with the intention of being useful in informal situations, such as looking at photos together among fam-ily members. Others have found it useful as a way of finding what is on their hard disk. It requires only a set of images on disk, and does not require the user to add any metadata, or manipulate the images at all before browsing, thus making it easy to get started with existing images.

Bederson points to a limitation of *PhotoMesa* that he intends to change. "*PhotoMesa* is an image viewer, not a file management tool. At present, you can't delete images, change file names, or manipulate the image's content with it, but that is a limitation I want to address." To do so, he is currently looking for one or more partners to further develop and integrate these technologies.

"Even though I developed *PhotoMesa* to browse images in my own collection, I realized that it is potentially useful for browsing thumbnail search results on the web from professional stock photo houses," says Bederson. He is hoping to convert *PhotoMesa* into a tool for professional use as well.

The *PhotoMesa* application, the *Jazz* Toolkit and the layout algorithms are available for download on the Internet at **http://www.cs.umd.edu/hcil/photomesa**.

The interdisciplinary HCIL team led by Professor Allison Druin has developed *SearchKids*, a digital library for children. The development of *SearchKids* is part of an ongoing three-year research project, supported by the National Science Foundation, to develop computational tools that support children as researchers and a multimedia digital library that supports the learning chal-lenges of young children. The research team consists of faculty and students as well as elementary school children (ages 5-11) and teachers from Yorktown Elementary School. HCIL believes that it is critical to the research process that professionals from various dis-ciplines (e.g., computer science, education, biology, etc.) collabo-rate with children. Each professional and child has important expertise and points of view that should be heard during the research process.

In working with children and teachers, HCIL is focusing on developing visual interfaces that support young children in query-ing, browsing, and organizing multimedia information. Children want a way to visually explore; therefore the developers are build-ing upon the work led by Professor Ben Bederson in zoomable user interfaces. They have found with *SearchKids* and with *KidPad*, a zooming storytelling tool for children, that children are thor-oughly engaged when zooming through information.

Children also enjoy the social experience of learning through collaboration, not just with distant collaborators, but with children right in the same room. HCIL con-siders co-located collaboration tools a priority in sup-porting children as researchers. The lab has devel-oped versions of *KidPad* and *SearchKids* that support the use of simultaneous users at the same com-puter at the same time. They each
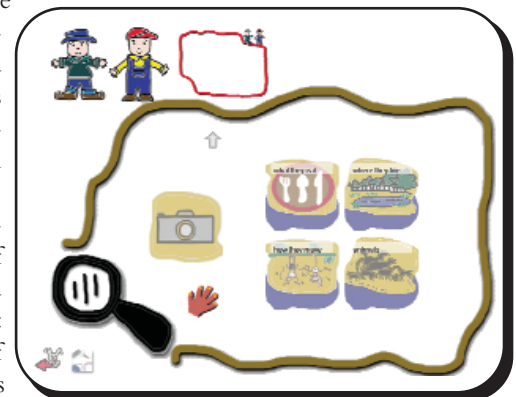
The *SearchKids* interface is a fun way for children to connect with information.

have their own input device and can work simultaneously. Three children can use *KidPad* with three individual mice, to draw simul-taneously. Also, with *SearchKids*, multiple children can search together. Allison Druin believes that digital libraries for children and the creative tools that go with them must be as shareable as a box of crayons, yet as easy to organize as sticking pushpins into a bulletin board. ✍
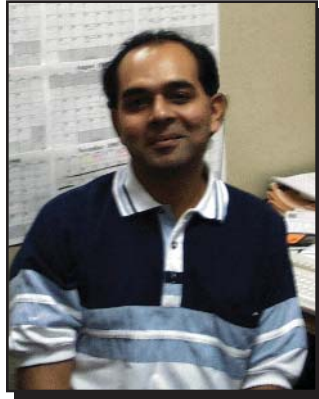
Atif Memon

Atif Memon is a new faculty member, jointly appointed to the Department of Computer Science and UMIACS. His research interests include software testing and Graphical User Interface (GUI) design. Through his research, he developed the first and most comprehensive framework for automatically testing GUIs. Currently, he is looking at more complex GUIs that employ context- and resource-based events or menus.

To date, his research has focused on testing GUIs for correctness. Memon looks forward to collaborating with researchers in human-computer interaction to develop techniques for automated usability testing. In addition, he sees other points of departure from this work, "Web site testing has gained tremendous importance. I am exploring the possibility of extending my GUI testing techniques to web site testing."

He has developed an innovative test oracle that automatically verifies the correctness of a GUI, which possibly could be expanded for use with object-oriented and reactive software. Memon also has developed the first event-based coverage criteria for determining GUI test adequacy and is currently investigating ways to apply these criteria to component-based, object-oriented, and reactive software.

Memon received a bachelor's degree in computer science from the University of Karachi in Pakistan in 1991 and an M.S. in computer science from King Fahd University of Petroleum and Minerals in Saudi Arabia in 1995. In 2001, he received a PhD in computer science from the University of Pittsburgh.

More information on his research can be found at **http://www.cs.umd.edu/~atif/**. ✎

Min Wu

Min Wu comes to the University of Maryland with a joint appointment in the Department of Electrical and Computer Engineering and UMIACS. She has bachelor's degrees in engineering and in economics from Tsinghua University in China (both with the highest honors). Wu received her M.A. and Ph.D. in electrical engineering from Princeton University in 1998 and 2001, respectively.

Wu's research interests focus on multimedia communication, signal processing, and information security, including data hiding, content analysis, and communication over network and wireless channels. Her work in multimedia data hiding, or digital watermarking, has many applications including tracking of manipulation of data and copyright protection. Currently, Wu is working with Bede Liu on revising a monograph on multimedia data hiding to be published by Springer Verlag.

She is an author or co-author of about 20 refereed journal and conference papers and holds two U.S. patents, with half a dozen more pending. During the 2000 Public Challenge issued by Secure Digital Music Initiative (SDMI), she proposed and implemented successful attacks on three out of four watermarking technologies as well as tested the variations of the attack on the fourth. These successful attacks received coverage in the IEEE Spectrum, *Chronicle of Higher Education*, *New York Times*, *Washington Post*, and on CNN.

More information about her research can be found at **http://www.ece.umd.edu/~minwu/**. ✎

Gang Qu

Gang Qu is a new faculty member in UMIACS and affiliate faculty in Computer Science. He joined the Department of Electrical and Computer Engineering in August 2000 as an assistant professor.

Qu's research interests include intellectual property reuse and protection, low power system design, applied cryptography, computer-aided synthesis, and sensor networks. He won the *Outstanding Master of Science Awards* (1998) at University of California, Los Angeles for his master thesis work on "Scheduling Problems for Reducing Energy on Variable Voltage Systems." He is a recipient of the *36th Design Automation Conference Graduate Scholarship Awards* (1999). He co-authored the paper "Exposure in Wireless Ad-hoc Sensor Networks" and won the *Best Paper Awards* in ACM International Conference on Mobile Computing and Networking (MobiCom 2001).
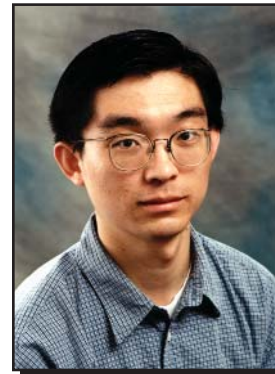
Qu received his B.S. in mathematics and non-linear science in 1992 and his M.S. in applied mathematics in 1994, both from the University of Science and Technology of China in Hefei. In 1994, he earned a master's degree in mathematics from the University of Oklahoma. From there, Qu went on to receive his master's degree and PhD in computer science from UCLA in 1998 and 2000 respectively.

For more information on his research, see **http://www.ece.umd.edu/~gangqu/**. ✎

Aravind Srinivasan

*A*ravind Srinivasan is a new associate professor in the Department of Computer Science with a joint appointment in UMIACS. Prior to coming to the University of Maryland, he was a member of the technical staff in the Mathematics of Networks and Systems Research department at Bell Labs.

Srinivasan's research interests include the design and analysis of algorithms with applications in networking, combinatorial optimization, information retrieval, and related areas. His research specialty is the employment of probabilistic methods in developing algorithms for computationally difficult problems; he has developed the current-best algorithms for various problems in low-congestion routing, hypergraph coloring, and network design through new probabilistic approaches.

Srinivasan has been involved with developing algorithms and systems for various Internet/WWW-related technologies, including Internet telephony, optical network design, and multimedia information retrieval. In terms of his current research, he says, "I enjoy working on, and learning from, the synergy between theory and practice. I look forward to continuing research in the foundations of computer science, as well as in the Internet computing-networking-systems areas. The former has helped me develop algorithmic ideas for the latter, and the latter has enabled me to think about formal models and ideas that derive from the foundations of computer science." His current research activities include Steiner problems that arise in multicast, the strength of linear programming-based approaches in combinatorial optimization, and information retrieval with Quality of Service constraints.

He earned his bachelor's degree in computer science from the Indian Institute of Technology in Chennai, India in 1989. He received both his M.S. (in 1992) and Ph.D. (in 1993) in computer science from Cornell University.

More information on his research is available at **http://www.cs.umd.edu/~srin/**. ✍

MIND Lab Established (cont.)

location-specific listing of the day's events. No matter where users were, their assistant was able to tell them what activities were available nearby, based upon their specified interests.

The demonstration of the Rover Technology at Maryland Day utilized Global Positioning System for location determination. Future versions of the technology will incorporate PinPoint Technology for this purpose.

Devices using Rover Technology offer endless possibilities, but one current area of interest for implementation is in museums. Using one of these devices, visitors to a museum could have a virtual guided tour of a museum's collection. After specifying their areas of interest, the amount of time they have, and other variables, museum guests would receive an itinerary of their visit. Their handheld guides would give them directions throughout the day and background information about the exhibits they are near.

For groups of visitors, the benefits would be even greater. A teacher organizing a field trip could send broadcast messages to all members of a group and individual members could communicate with each other, locate friends, or coordinate their plans to see a special event in the museum together. Guests could even find out about items for sale in the gift shop related to exhibits they visit and pre-purchase items to pick up at the end of their trip. These devices would also allow them to purchase a CD-ROM record of their visit to relive the experience on their home computers.

Beyond these partnerships between the university and industry and the development of new tools, Prof. Agrawala sees the research of the MIND Lab as having a profound effect on the way we live. "Ultimately, this work will change the way people do computing." ✍

Hendler Co-Authors *Scientific American* Cover Story

*P*rof. James Hendler (CS/UMIACS) was one of the authors of a May 2001 *Scientific American* cover story about the Semantic Web. Along with Tim Berners-Lee and Ora Lassila, Hendler discusses a new form of content for the Web that is meaningful to computers.

The Semantic Web is the next step in the evolution of the World Wide Web. While most of the content on the Web today is designed for humans to understand, in the future pages can also be tailored to the give "meaning" to computers. With enriched data, software agents could scour the Web for information more precisely. Computers will find the meaning of semantic data by following hyperlinks to definitions of key terms and rules for reasoning about them logically.

From e-commerce to academic research to tracking down information about an old high-school friend, the applications for the Semantic Web are as broad and exciting as the Web itself.

The article is available at ***http://www.sciam.com/***. ✍

Rama Chellappa Named Director of CfAR, Permanent UMIACS Faculty

*E*ffective July 1, 2001, Prof. Rama Chellappa (CS/ECE/UMIACS) was appointed Director of the Center for Automation Research (CfAR) for a period of five years.

Chellappa notes that "CfAR is involved in many cutting edge basic research programs of national importance. CfAR researchers are involved in the NSF Information Technology program, three ARL Collaborative Technology Alliances, and the DARPA program on Human Identification at a Distance. Several fundamental issues involved in the understanding of human interpretation of motion, structure and sound are also being pursued."

Chellappa was also appointed permanent faculty in UMIACS in recognition of his prominence as a top researcher in the world in image processing and computer vision. ✍

David Doermann to Receive Honorary Doctorate

*D*avid Doermann (UMIACS), co-director of the Language and Media Processing (LAMP) Laboratory, will be awarded an honorary doctorate from the University of Oulu in Oulu, Finland. Dr. Doermann is one of five people selected for this honor by the university's Faculty of Technology.

Faculty and researchers from the University of Oulu frequently collaborate with Doermann and others in the LAMP Lab. "We are currently involved with the Media Team at the University on a number of projects and proposals for video indexing and retrieval and pervasive computing," he notes.

Doermann will receive the honorary doctorate at the culmination of the conferment ceremony on May 26, 2002 in Oulu, Finland. ✍

Faculty News

Victor Basili
- Keynote Address: "Building an Experience Base for Software Engineering: A Report on the First eWorkshop," PROFES 2001, Kaiserslautern, Germany, September 2001.
- Keynote Address: "Implementing the Experience Factory Concepts as a Set of Experience Bases," SEKE 2001 Conference, Buenos Aires, Argentina, June 2001.
- Invited Talk: "Improving Software Inspections by Using Reading Techniques" (with F. Shull and I.Rus), ICSE 2001 Conference, Toronto, Canada, May 2001.
- Invited Talk: "Implementing the Experience Factory Concepts as a set of Experience Bases," Osaka University, Osaka, Japan, June 2001.
- Invited Talk: "Software Improvement Feedback Loops: The SEL Experience," 10th Software Development Expo and Conference, Tokyo, Japan, June 2001.
- Invited Talk: "Using Experiments to Build a Body of Knowledge," IPSJ/SIGSE, Tokyo, Japan, June 2001.
- Invited Talk: "Current Status of Software Quality Research in NASA," NASDA, Tokyo, Japan, June 2001.
- Invited Talk: "Using Defect Analysis to Identify Process Goals," Workshop on Statistical Methods in Software Engineering for Defense Systems, National Academy of Sciences, Washington, DC, July 2001.

Ben Bederson
- Invited Talk: "Zoomable User Interfaces for Searching and Browsing: SearchKids & PhotoMesa," Xerox PARC, October 2001.
- Invited Talk: "Zoomable User Interfaces for Searching and Browsing: SearchKids & PhotoMesa," Microsoft Research, October 2001.
- Joined the editorial board of the new *Information Visualization* journal by Palgrave Press.

Shuvra Bhattacharyya
- Invited Talk: "Modeling and Synthesis using Reconfigurable Dataflow Specifications," Workshop on System Architecture Modeling and Simulation, Samos, Greece, July 2001.
- Invited Talk: "Software Synthesis for Signal Processing Systems," the Vienna Institute of Technology, Vienna, Austria, March 2001.

Larry Davis
- Edited a book entitled *Foundations of Image Analysis* to commemorate Prof. Azriel Rosenfeld's career.
- Keynote Speech: Taiwan Conference on Computer Vision, August 2001.

Howard Elman
- Plenary Speaker: 19th Biennial Conference on Numerical Analysis, Dundee, Scotland, June 2001.
- Editor-in-Chief, *SIAM Journal on Scientific Computing*.

James Hendler
- Keynote Speech: Web Intelligence 2001 Conference, Maebashi, Japan, October 2001.
- Invited Talk: Second Annual Digital Cities Conference, Kyoto, Japan, October 2001.
- Invited Talk: Fujitsu Laboratories, Kawasaki, Japan, October 2001.

Joseph JaJa
- Keynote Address: "On Computation Models for Cluster of SMPs," Workshop on Models for Parallel Computation, International Parallel and Distributed Processing Symposium, San Francisco, CA, April 2001
- Keynote Address: "A Scaleable Infrastructure for Browsing, Processing, and Fusing Distributed Heterogeneous Earth Science Data," the 13th International Conference on Scientific and Statistical Database Management, George Mason University, July 2001.
- ACM Fellow Award.

Sarit Kraus
- Published a book entitled *Strategic Negotiation in Multiagent Environments*, by the MIT Press.

Jack Minker
- Article: "A Logic-Based Approach to Data Integration," (with J. Grant) *Theory and Practice of Logic Programming*, October, 2001.
- Founding Editor-in-Chief of the journal *Theory and Practice of Logic Programming.*

Nick Rossoupolous
- ACM Fellow Award

Workshop Celebrates Azriel Rosenfeld's Career

On June 7, 2001, UMIACS sponsored a Symposium in Honor of Azriel Rosenfeld on the occasion of his 70th birthday and retirement. The workshop recognized his contributions to computer vision and image analysis. More than 140 people attended the day-long event, held at the University of Maryland's Inn and Conference Center. The workshop included presentations made by leading researchers who have collaborated with Prof. Rosenfeld on research topics to which he has made fundamental contributions.

Speakers at the event were Reinhard Klette, University of Auckland; T.Y. Kong, City University of New York; Yiannis Aloimonos, University of Maryland; Rama Chellappa, University of Maryland; Hanan Samet, University of Maryland; Chuck Dyer, University of Wisconsin; Shmuel Peleg, Hebrew University; Angela Wu, American University; Narendra Ahuja, University of Illinois; Peter Burt, Sarnoff Corp; Peter Meer, Rutgers University; and

Prof. Azriel Rosenfeld (center) surrounded by the speakers at the Workshop held in his honor.

Steve Zucker, Yale University.

Widely regarded as the world's leading researcher in the field of computer image analysis, Prof. Rosenfeld has made many fundamental and pioneering contributions to nearly every area of the field over a period of nearly 40 years. He wrote the first textbook in the field (1969), was founding editor of its first journal (1972), and was co-chairman of its first international conference (1987). Prof. Rosenfeld has published more than 30 books and more than 600 book chapters and journal articles.

The papers presented at the workshop were based on chapters in a collection entitled *Foundations of Image Understanding*. The collection, edited by Larry Davis (CS/UMIACS), brings together Prof. Rosenfeld's previous students, postdoctoral scientists, and colleagues. The book focuses on various areas of computer image analysis and illustrates how current research has been influenced by Prof. Rosenfeld's work. ✍

Faculty News (cont.)

Continued from page 10

Ben Shneiderman
• Keynote Speech: Brazilian Conference on Human-Computer Interaction, October 2001.

Aravind Srinivasan
• Invited Talk: the First Arizona Workshop on Algorithms, Arizona State University, October 2001.

Sarah Tishkoff
• Packard Fellowship from the David and Lucile Packard Foundation.

Amitabh Varshney
• Invited Talk: University of Tuebingen, Germany, July 2001.
• Guest Editor: *IEEE Transactions of Visualization and Computer Graphics*, July–September 2001.
• Co-Editor: *Proceedings of the IEEE Visualization '01*, October 2001

Uzi Vishkin
• Colloquia Talks: Bar Ilan University, Israel, January 2001; the Technion-Israel Institute of Technology, January 2001; the IBM Haifa Research Laboratory, January 2001.
• Invited Talk: 12th Annual Combinatorial Pattern Matching (CPM 2001), Jerusalem, Israel, July 2001.
• Steering Committee: ACM Symposium on Parallel Algorithms and Architectures (SPAA).
• Program Committee: 13th Annual Symposium on Combinatorial Pattern Matching (CPM 2002).
• Program Committee: 14th Annual ACM Symposium on Parallel Algorithms and Architecture.

Don Yeung
• NSF CAREER Award

ITR Project Holds First Annual Research Review Day

The first annual research review day on the NSF funded ITR project "Personalized Spatial Audio via Scientific Computing and Computer Vision," was held on October 19, 2001. A dozen talks highlighting progress and planned research for the coming year were given on work related to the project. Graduate student Dmitry Zotkin demonstrated a spatial audio system developed as a part of the project. Maryland investigators on the project include Dr. Larry Davis (CS/UMIACS), Dr. Ramani Duraiswami (UMIACS) and Dr. Shihab Shamma (ECE/ISR). ✍

ASIST Meeting Concludes with Shneiderman-Hendler Debate

The closing keynote presentation for the American Society for Information Science and Technology Annual Meeting (November 8, 2001) featured a lively debate between two leaders in the field of human-computer interaction, James Hendler (CS/UMIACS) and Ben Shneiderman (CS/UMIACS). These two highly visible and influential researchers discussed a variety of issues related to the next generation of computer interfaces, including such hot topics as direct manipulation vs. agents, usability, user control and responsibility, and the future of the Web. ✍

Awards
January 2001 - May 2001

W. Arbaugh, A. Agrawala	Secure Wireless LAN/MAN Infrastructure Test Bed (NIST)
R. Chellappa	Preceptor – Phase 1 (General Dynamics)
R. Chellappa	Human Tracking and Verification in Video (ONR)
R. Chellappa	CTA – EO & Microsensors (BAE)
R. Chellappa	Context-Based Detection on Vehicles in Aeriel Images (Lockheed)
R. Chellappa, V.S. Subrahmanian	CTA – Advanced Decision Architecture (MAAD)
L. Davis	Phase II – Crew Performance Analyzer (Foster–Miller)
L. Davis	CTA – Perception & Architectures (General Dynamics)
D. DeMenthon, D. Doermann	Video Frame Ranking Toolbox (Hitachi)
A. Druin	Classroom of the Future (NSF)
C. Plaisant, B. Bederson	Information Visualization (Chevron)
L. Raschid	Query Optimization to Meet Performance Targets (Lockheed)
L. Raschid, D. Doermann, B. Dorr, D. Oard, A. Weinberg	Infrastructure to Develop a Large-Scale Experiment Testbed (Lockheed)
P. Resnik	Using the Web as a Corpus for Empirical Linguistics (NSF)
P. Resnik, A. Weinberg, B. Dorr	MURI – Bootstrapping Out of the Multilingual Resource Bottleneck (JHU)
H. Samet, L. Golubchik, S. Khuller	Data Collection Infrastructure for Digital Government Applications (NSF)
Y. Yacoob	Gesture-Based Control of Mobile Platforms (NIST)

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