# Inter*Connections*

# UMIACS Faculty Win Six ITR Awards from the National Science Foundation

*S*ix projects involving UMIACS researchers were among those selected in the latest round of Information Technology Research (ITR) awards given by the National Science Foundation (NSF). This competitive program was established by the NSF in 2000 to preserve the United States' position as the world leader in information technology and its applications. Around 10% of the submitted proposals were selected for funding during the latest round of competitions. Following are brief descriptions of the new UMIACS projects.

### Interlingual Annotation of Multilingual Text Corpora

This project, led at the University of Maryland by Prof. Bonnie Dorr (Computer Science/UMIACS), will develop a coherent, consistent, standardized Interlingual representation along with a methodology and sharable tools for annotating large bilingual corpora of parallel texts. In addition to UMIACS, the team includes researchers from New Mexico State University, University of Southern California, Carnegie Mellon University, Columbia University, and the MITRE Corporation.

For this effort, six corpora are being compiled, each consisting of a number of texts in a particular source language along with three translations of each text into English. Then a standardized interlingual representation will be developed based on a comparative analysis of these parallel text corpora. The bilingual corpora will be annotated using the standardized interlingua and following a predefined annotation procedure. Finally, researchers will develop metrics to evaluate the accuracy and appropriateness of the interlingual representations in terms of the grain size of the representation given a particular task.

The resulting annotated, multilingual, parallel corpora will be useful as an empirical basis for developing a wide variety of interlingual NLP systems for tasks such as machine translation, question answering,



**Researchers are developing tools to facilitate semantic web markup for different kinds of documents, such as this photo of a frog.**

web searching, summarization, or presentation generation, as well as a host of other research and development efforts in theoretical and applied linguistics, foreign language pedagogy, translation studies, and other related disciplines.

### Science on the Semantic Web—Prototypes in Bioinformatics

Prof. James Hendler (Computer Science/UMIACS) is the UM PI for this project which will advance the Semantic Web to biodiversity and invasive species science. Along with Prof. Hendler, the research team includes scientists from the University of Maryland, Baltimore County; University of California, Davis; San Francisco State University; and NASA Goddard Space Flight Center.
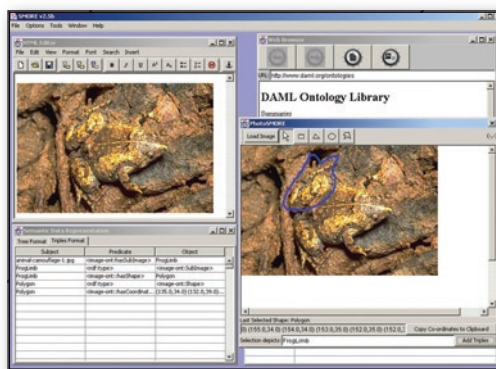
Researchers will construct a framework for conducting science research and education on the Semantic Web and will implement and evaluate prototype tools and applications for use in biodiversity domains. The team will develop capabilities to collaborate and convey meaning through the automatic and semi-automatic annotation of web documents, to improve information retrieval using background information and inference, and to extract and fuse information from multiple, heterogeneous sources in response to a query. The Web portal of the National Biological Information Infrastructure (**http://www.nbii.org**) will serve as researchers' main testbed for development. The ultimate goal of this research is to allow knowledge from one community to be effectively used by another, even in cases where the communities do not normally interact.

### New Technology for the Capture, Analysis, and Visualization of Human Movement

This project will result in the development of the next generation distributed video sensing systems for understanding

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UMIACS
University of Maryland Institute for Advanced Computer Studies

# Welcome to the Fall 2003 issue of InterConnections

After nine and a half years as UMIACS Director, I will be returning to teaching and research full time effective February 1, 2004. It has been my privilege to serve as the UMIACS Director during all these years, which witnessed a substantial enhancement of the Institute's research programs and the establishment of a considerable number of new partnerships and collaborations with industrial and government labs as well as other academic institutions. Our relationships with other units on the College Park campus are broader and stronger than ever before, and our external funding is among the very best in the nation for similar units. I am especially pleased with the outstanding quality of the new faculty hired during my tenure as UMIACS Director. Most of the new faculty have already emerged as leaders in their specific areas. The Institute has also made considerable progress in moving into completely new directions such as bioinformatics and computational biology, pervasive and grid computing, digital libraries, computer security, and multimodal interfaces, which have led to the establishment of several new labs and centers within UMIACS. In addition, we have started a Forum on Strategic Directions in IT to increase our interactions with some of the most influential IT leaders in the nation.

These achievements are primarily due to the dedicated efforts of our outstanding faculty and staff. I am grateful for their constant help and advice, and for their relentless push to move UMIACS into higher levels of excellence. I would also like to thank the upper administration for their enthusiastic support of the UMIACS mission in general, and for playing in particular a crucial role in our efforts to set up new partnerships and collaborations with industrial and government labs.

I am confident that the Institute will continue to gain in national visibility under the new interim leadership of Dr. V.S. Subrahmanian. I wish him the very best and stand ready to help in any way I can.

Joseph JaJa

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# UMIACS Researchers Win Six New Medium-Sized ITR Awards from NSF

human movements. Prof. Rama Chellappa (Electrical & Computer Engineering/UMIACS) is the PI for this interdisciplinary team, which also includes Prof. Larry Davis (Computer Science/UMIACS) from the University of Maryland and researchers from Stanford University and New York University. The researchers' broad spectrum of interests includes biomechanics, computer science, electrical engineering, and kinesiology.

Researchers will use novel models of human movement and structure for modeling the movements of singe-joint and whole bodies with applications to animation, biomotion, and gait analysis for diagnosing and treating movement-related disorders. The proposed research efforts will enable novel approaches for realistic animation and the detection of subtle variations in movement, leading to better diagnostic tools and personalized programs for rehabilitation of movement disorders. Strong educational and industrial outreach programs will also enhance the research program.

### Parallel Random-Access Model (PRAM)-On-Chip

Researchers in this project will investigate the viability of  the PRAM (Parallel Random-Access Model, or ``Machine") algorithmic model as an alternative to the serial algorithmic theory. Led by Prof. Uzi Vishkin, the research team also includes Profs. Gang Qu, Bruce Jacob, and Manoj Franklin, all having joint appointments between Electrical & Computer Engineering and UMIACS.

Researchers will investigate if a breakthrough high-end parallel computer can be built through truly designing a machine that can look to a programmer like a PRAM. The problem of building a general-purpose parallel computer that is significantly faster than its serial counterpart has been a major open problem for computer science since the inception of the field. This proposal will provide the research backbone in the development of a holistic computation framework, called Explicit Multi-Threading (XMT), which seeks to resolve this problem. Technical activities will include the following: architecture studies including memory systems and interconnection networks, improving XMT compiler analysis, enhancing XMT optimizations, automatic extraction of parallelism for XMT, prototyping performance of several APIs, as well as some modern software architectures, on XMT.

### An Electronic Field Guide: Plant Exploration and Discovery in the 21st Century

Researchers in this project, led at the University of Maryland by Prof. David Jacobs (Computer Science/UMIACS), will build the first generation of electronic field guides for use by botanists for exploring and discovering new plants.  The resulting tools will allow field botanists to have access to a wealth of information that is currently housed in special collections far from where new specimens are discovered.  For more information, see the related story on Page 7.

### Distributed Smart Cameras: Algorithms, Architectures, and Synthesis

Led by Prof. Shuvra Bhattacharyya (Electrical & Computer Engineering/UMIACS), researchers on this project will develop new techniques for distributed smart camera networks through an integrated exploration of distributed algorithms, embedded architectures, and software synthesis techniques.  For more information, see the related story on Page 6. ✐

## Arbaugh Talks Security with C-Net and Tech TV

*P*rof. William Arbaugh (Computer Science/UMIACS) a well-known researcher in computer security, spoke with C-Net News on November 7 about the implications of trusted platform technology for privacy issues. Trusted platform computing is a new generation computing technology that, according to proponents, promises significant increases in security both at the office and at home. The technology works by "walling off" key blocks of data on a computer, rendering the data unusable by programs like Trojan horses or viruses in attempts to take control of the system. While proponents argue that the technology will make it significantly more difficult for hackers, others have noted that there are still significant design issues to be worked out with the trusted platform model of security. While acknowledging that it does have the possibility of improving security, Prof. Arbaugh noted that the technology still retains great potential for abuse by companies employing it. He told C-Net News, the technology "as it stands now is unacceptable."

On October 2, Prof. Arbaugh was a guest on Tech TV's show "The Screen Savers." The program's topic was wireless network security. As one of the authors of *Real 802.11 Security*, Prof. Arbaugh shared his expertise on how viewers can protect their home wireless network. ✒

### Media Briefs

- Prof. James Hendler (Computer Science/UMIACS) was interviewed by **internetnews.com** for a September 12 feature about the Semantic Web. Prof. Hendler is a co-chair for the W3C Web Ontology group and leads a team of researchers at UM working on Semantic Web technologies.
- A technology column in London's *Independent* raves about two tools developed in the Human-Computer Interaction Laboratory. Treemap and PhotoMesa both offer users unique information visualization capabilities.
- The Center for Bioinformatics and Computational Biology was mentioned in a September 11 *New York Times* article for its upcoming use of the Berkeley Open Infrastructure for Network Computing (Boinc) to analyze DNA sequence data to investigate molecular evolution.
- A July 15 article in *The Indian Express* focuses on a recent Department of Defense exercise where researchers had to rapidly develop translation tools for a surprise language, Hindi. Commenting on the success of the program, Prof. Doug Oard (Information Studies/UMIACS) told the paper, "I don't know a word of Hindi, but my systems do, and using these I have become pretty good at reading English translations of Hindi documents."

## New Scientist *Covers UMIACS Researchers' Vision Work*

*T*he work of Profs. Yiannis Aloimonos (Computer Science/UMIACS) and Cornelia Fermüller (UMIACS) recently received a great deal of attention from the media. Their work on developing better "eyes" for robots was featured in the October 3 edition of *New Scientist*. This research was also the topic of a recent Reuters article featured in a number of places, including on Yahoo! and CNN.com. In 1998, Profs. Aloimonos and Fermüller's work demonstrated that robotic vision designs allowing robots to see in all directions rather than simply straight ahead resulted in more accurate motion sensing and improved navigational skill without the need for adding additional motion sensors. Their recent application of their finding into a new robotic design called the "Argus Eye" (named after a Greek god with eyes all over his body), could be the first step in many future refinements of robotic sight that enables robots to become ever more adaptive to their external environments. ✒

## *National Geographic* Tests UMIACS Vision Researchers

*A*s part of a series of articles about surveillance technologies, the November issue of *National Geographic* featured a test of the state of the art in facial-recognition systems by University of Maryland researchers, led by Prof. Rama Chellappa (Electrical & Computer Enginneering/UMIACS). Enlisting the help of former CIA operative and disguise expert Tony Mendez, the magazine tried to fool a basic face-recognition program. Current tools had difficulty matching older photos of Mendez to current photos of him in disguise. A more recent photo, however, elicited more likely matches from the system despite his disguises. ✒

### *Shneiderman in* Federal Computer Week

*A*n October 27 Federal Computer Week article covered the federal government's new user-friendly web design guidelines, which include a preface from Prof. Ben Shneiderman (Computer Science/UMIACS). Prof. Shneiderman encouraged practitioners to use the new publication as a "living document" rather than a static collection of ideas. He suggested that users set up a clear system of exemptions to the guidelines' "do's" and "don'ts." Such a system, he noted, allows end-users an open channel for new and creative solutions to ongoing design challenges. Of the publication as a whole, Prof. Shneiderman noted, "Design is difficult, but these new research-based guidelines are an important step forward in providing assistance to those who are dedicated to quality." ✒

# Vision Researchers Win VACE Phase II Contract

UMIACS vision researchers have successfully proposed and been awarded two contracts to participate in Phase II of the Advanced Research and Development Activity's (ARDA) Video Activity and Content Extraction (VACE) program. Led by Principal Investigator Prof. Larry Davis (Computer Science/UMIACS), the group is focusing on developing an end-to-end framework for surveillance video analysis.

The project proposes a vertically integrated research program in multi-camera visual surveillance, which builds on the research conducted under Phase I of VACE and integrates prior UM research results. The principal emphasis is on modeling and recognition of activities involving people, vehicles and objects operating in a site about which one has coarse geometric and functional knowledge.

During the past two years, under support of Phase I, the group's basic research focused on fundamental problems underlying the development of real time visual surveillance systems. That research emphasized basic early vision problems such as background modeling and detection, detection of independent motion, visual tracking and spatio-temporal models for image segmentation. Towards the end of that project, the team turned its attention to important intermediate and high level problems: "fingerprinting" techniques for people and vehicles, methods for acquiring action and activity models from video using computational learning theory, and high level specification of surveillance tasks and control of surveillance systems using temporal logic programming.

The current two-year, Phase II effort is divided into three primary thrusts: core-level vision algorithms, fusion level integration modules and event level system integration. The goal is to create a system that human operators can control by specifying surveillance tasks using natural interfaces, and then performing ad hoc queries about activities and patterns of activities extending over very long periods of time.

Because competent image analysis is critical to building surveillance tools, a significant emphasis is placed on developing, delivering, and making available to others, sophisticated core image analysis algorithms including: Background subtraction, Scale-space spatio-temporal segmentation, tracking, fingerprinting algorithms for people and vehicles and action recognition.

These core level image and video analysis algorithms will be integrated with inference mechanisms to construct fusion level capabilities that extend across time and space (i.e., multiple sensors). The fusion capabilities first include recognizing interactions between people and objects such as the use of fingerprinting algorithms to recognize that a person has acquired or disposed of an object, the use of gait models and appearance information to infer changes in the state of a carried object or inferring physical properties of an object from its appearance. For example, one may wish to determine that an object like a briefcase is "heavy" when viewed at one time but "light" when viewed at another. A second fusion capability is persistent tracking, in which fingerprint models for people and vehicles can be used to recognize them as they enter and leave the fields of view of surveillance cameras over long time periods.

The final level of event level research focuses on the modeling and recognition of events that extend over a long period of time relying on temporal logic and data mining of event databases. According to Prof. Davis, given the hierarchy of automated tools for processing video, perhaps a more important challenge is how one can effectively integrate humans into the solution through visualizations of the system's current state, and whether an appropriately designed visualization and interaction tool would make humans more efficient or accurate in solving a broad class of analysis problems. For example, one might task the man/machine system to identify all people who arrive at a facility in one vehicle, but then leave in another. To this end, the group will first design the *Forensic Video Tool* (FVT), a specialized visualization and interaction tool that allows the human to investigate the effects of firm matching decisions on the global matching process for the basic persistent matching problem of pairing up all people who have entered and left a facility.

The goal is to extend the interface to video and to augment it with tools that allow analysts to establish links between images and video. They hope to learn from this experience so that one can construct a more general visualization and interaction tool that can be used to help people address a wide variety of matching problems subject to fairly general classes of spatial and temporal constraints. The evaluation of these tools forms an important part of the evaluative component of the research.

The team is composed of a number of additional UMIACS faculty and research scientists including Profs. Rama Chellappa (Electrical & Computer Engineering/UMIACS), Yiannis Aloimonos (Computer Science/UMIACS), David Doermann (UMIACS), Daniel DeMenthon (UMIACS), Cornelia Fermüller (UMIACS), and David Harwood (UMIACS). Related to this team's work, Dr. Yaser Yacoob (UMIACS) won a Phase II subcontract from Alphatech (see story on Page 11). ✍



**Researchers will use fingerprinting algorithms to track a person acquiring or disposing of an object, like a briefcase.**

# PIRL Achieves Spatial Audio Technology Breakthrough

Researchers in the Perceptual Interfaces and Reality Laboratory (PIRL) have developed a new technique that will be useful in creating more authentic auditory representations. Drs. Ramani Duraiswami, Nail Gumerov, and Dmitry Zotkin of UMIACS have come up with a more efficient method for obtaining the Head-Related Transfer Function (HRTF), a measurement of how sound waves are affected by the shape of the listener's body and ears. Their patent-pending approach has important implications for rendering virtual audio.



**Conventional techniques for HRTF measurements rely on producing sound from known locations and measuring the received sound using microphones implanted in the ears of the subject. These techniques are time consuming, tedious, and neglect the dependence of the HRTF on the range of the source.**

The HRTF is typically measured using a series of sounds produced by speakers placed at known locations relative to the listener. The process can take anywhere from 40 minutes to several hours, during which the subject has to maintain a relatively steady pose. Since the hoop is generally fixed at approximately one meter from the subject, no range data is obtained in this approach.

PIRL researchers have come up with an ingenious approach to the problem of measuring the HRTF. Their method results in measurements in one or two minutes and includes range data. Their approach relies on the Reciprocity Principle. Based on this principle, the researchers switched the single microphone and series of speaker-location measurements to a single sound source in the ear and an array of tiny microphones. The primary advantage of this method is the ability to measure the full-sphere HRTFs in one shot by placing the microphones in all desired positions, playing one signal through the ear-mounted speaker, and capturing the signal at all microphones simultaneously.

The researchers have also developed physically valid methods to interpolate the HRTF in azimuth, elevation and range thereby providing the act the range dependence of the HRTF from the measurements.

This patent-pending technology is currently available to license from the University of Maryland's Office of Technology Commercialization. ✍



**The new technology places the speaker in the ear (inset) and measures the received sound in parallel at a multitude of locations. With the new interpolation and fitting theory a complete representation of the transfer function is achieved.**

## UMIACS Launches Knowledge Integration Research Initiative

The ability to integrate data from multiple heterogeneous sources and to synthesize this data into "nuggets" of useful knowledge is becoming increasingly important. In addition, different such nuggets may be useful for different end users. We must be able to deliver the right nuggets of knowledge to the right end users at the right time. UMIACS has started a Knowledge Integration Research Initiative (KIRI) in order to articulate, address, and implement the computational methods needed to solve such problems. The Army Research Laboratory has awarded an incrementally funded contract worth more than $ 6 million to a team headed by Prof. V.S. Subrahmanian (Computer Science/UMIACS) to support this work over the next 5 years. Other faculty involved in KIRI are Professors Ben Bederson (Computer Science/UMIACS), Larry S. Davis (Computer Science/UMIACS), Lise Getoor (Computer Science/UMIACS), and James Hendler (Computer Science/UMIACS).

These faculty members will focus on techniques to elicit knowledge from data sources (including databases, sensory sources such as audio, video and image sources, and text streams), develop methods to reason about such data and draw higher level conclusions (e.g. predicting where and when enemy vehicles will be in the future), develop methods to integrate knowledge from multiple sources and deliver them at the right time to the right users (e.g. using agent technology, mediation technology, ontologies), and methods to browse large collections of knowledge of different types (e.g. browsing images, browsing video, delivering interactive presentations, etc.). UMIACS researchers will work jointly with researchers not only at the Army Research Lab but also with their other research partners. ✍

# ITR to Advance Distributed Smart Cameras

As part of a new project awarded through the National Science Foundation's Information Technology Research program, UMIACS researchers will develop new techniques for distributed smart camera networks through an integrated exploration of distributed algorithms, embedded architectures, and software synthesis techniques. Researchers are developing new architectures and tools that are designed to handle modern video algorithms. They also are developing new algorithms that can leverage distributed architectures and are compilable into efficient implementations.

The principal investigator for this project is Prof. Shuvra Bhattacharyya (Electrical & Computer Engineering/UMIACS). Other members of the research team include Profs. Rama Chellappa (Electrical & Computer Engineering/UMIACS) and Wayne H. Wolf of Princeton University.

Participating researchers will investigate a series of complex smart camera algorithms and applications–specifically, human gesture recognition; self-calibration of the distributed camera network; detection, tracking and fusion of trajectories using distributed cameras; view synthesis using image based visual hulls; gait-based human recognition; and human activity analysis. Through analysis of these applications, they are exploring domain-specific programming models and software synthesis techniques to automate their translation into efficient implementations. By translating domain-specific, formal models of distributed signal processing systems into streamlined procedural language implementations, these synthesis techniques are complementary to the growing body of work on embedded processor code generation techniques.

This research will lead to new embedded architectures for distributed smart camera networks, and to video processing algorithms that are tailored to the opportunities and constraints associated with these architectures. The research also will result in a better understanding of relationships among distributed signal processing, embedded multiprocessors, and low power/low latency operation, and develops synthesis tools that use this understanding to help automate the implementation of smart camera applications.

The research program poses challenges in video analysis algorithms, embedded system architecture, and synthesis tools for embedded systems. Performing recognition across multiple cameras requires fusing data at appropriate points in the processing chain in order to create a model of the scene in world coordinates rather than camera coordinates. In addition, these video algorithms must run in real time and with low latency. Distributed smart cameras will be used in many closed-loop applications; excessive processing delay will make it difficult to use the analysis results to control other actions. Also, smart cameras process large volumes of data and perform a great deal of computation on that data. The distributed system architecture must be designed to put appropriate amounts of computation at the proper spots in the processing pipeline; the network must be designed to handle real-time requirements. The entire system must also be architected to minimize power consumption—excessive power consumption will cause nodes to run too hot, increasing installation and maintenance costs.



**An example of gesture recognition using multiple cameras.**

Tools that help designers map applications onto distributed embedded systems are critical to the long-term viability of this approach. The programming models aspect of this work seeks to develop software synthesis and model-based design technology for video processing applications.

Distributed systems are complex heterogeneous systems that are much harder to program than are the workstations or PCs traditionally used in video research. Because multiple applications can be run on a single distributed system, developing tools for a distributed smart camera will allow us to use the same architecture for many video applications. Tools will also be portable to other distributed signal processing domains.

Tools and model-based design also provide high-confidence implementations in the face of complex algorithms that must meet multiple implementation goals. Model-based design refers to the design of applications using components that have well-defined behavior and interact through well-defined models of computation. By software synthesis, researchers mean the automated derivation of software implementations from model-based representations. Model-based design is used widely for algorithm development and simulation of one-dimensional signal processing applications, such as those used in speech/audio processing and wireless communication. However, its use for software synthesis and video applications is limited by the expressive power of existing model-based DSP design tools. Such design tools do not adequately support control flow and multidimensional DSP operations. As a result, engineers are typically forced to use model-based design tools for early, sub-system-level algorithm exploration, and then manually develop and integrate the subsystem-level implementations for the final production code. This leads to inconsistencies between the model-based specifications and the production code, which is error-prone and negates useful properties, such as bounded memory, deadlock avoidance, and local synchrony qualities, that are offered by the model-based specifications. ✍

## UMIACS Researchers to Develop Electronic Field Guide

Researchers in UMIACS will build the first generation of electronic field guides as part of an Information Technology Research (ITR) award from the National Science Foundation. Prof. David Jacobs (Computer Science/UMIACS) is the University of Maryland PI for this project. Other members of the ITR team include Dr. John Kress of the Smithsonian Institution and Profs. Peter Belhumeur, Steve Feiner, Ravi Ramamoorthi of Columbia University.

Knowledge about biological diversity has formed the basis of crucial scientific and medical discoveries. However, most scientists agree that the global environment is facing a serious threat as human populations expand and natural resources are consumed. Naturalists are in a race to catalog and understand biological diversity before much of it disappears. This project will speed the process of exploration, discovery and description dramatically and enable naturalists to gain fundamental knowledge before habitat degradation results in species extinction.

The project will attempt to do this by building the first generation of electronic field guides: computing devices that allow a taxonomist in the field access to critical comparative information on plant species. Currently, when botanists in the field collect specimens and want to verify the existence of a new species, they must borrow physical samples from museums and herbaria, such as the Smithsonian type specimen collection. This process is extremely time-consuming and inefficient. The electronic field guide will speed and automate this process.

At the core of the system will be a type specimen digital collection. This will include digital images of the Smithsonian Institution's 95,000 botanical type specimens. These are the definitive reference specimens used to identify new species, and the Smithsonian houses the world's largest such collection. This core data will be linked to photos and 3D models of additional specimens and of live plants.

Researchers will also develop algorithms for visual plant recognition. These will be central to searching images in the digital collection, in conjunction with conventional text search. To do this they will borrow and build upon successful recognition methods used in other domains, such as human faces, optical and handwritten characters, and fingerprints. This component is in many ways the most challenging of the three. Yet, success here is achievable because the user does not require that the system identify the specimen, but rather that it aid in reducing the search.

Finally, researchers will create a set of mobile and wearable prototypes with novel user interfaces so that botanists in the field can photograph plants and access the system with these photos and text. Their research will concentrate on the design of user interfaces that exploit the complementary abilities of the user and the recognition system.

The resulting system will allow field botanists to have at their fingertips information that is currently housed only in special collections far from where the specimens are discovered. It will also provide content-based retrieval that goes well beyond current methods for navigating this knowledge. These new technologies will greatly accelerate the discovery and identification of the remaining undescribed plants of the world. ✍



### Visual and Textual Searches
*A Schematic of the Proposed System*
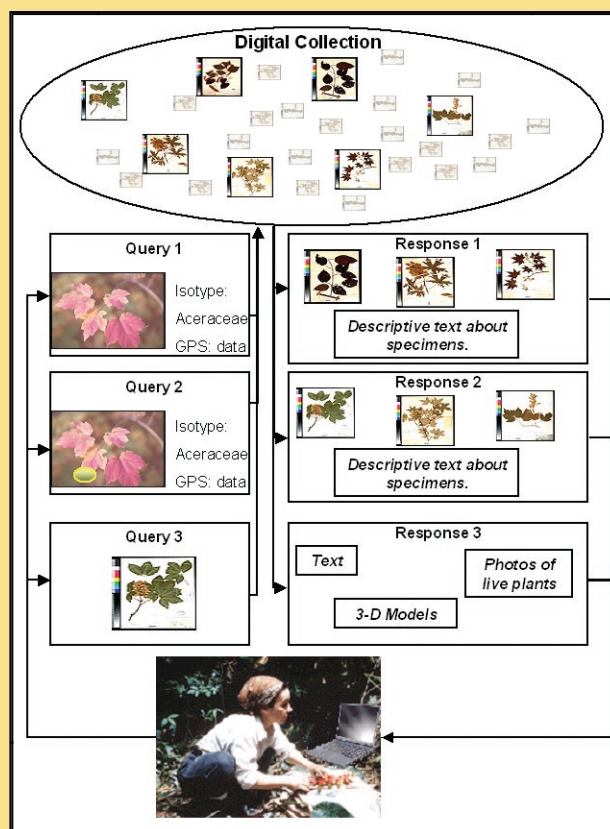
A botanist in the field queries the type specimen digital collection. Some basic information, such as her knowledge of the genus and GPS data, narrows the search in the digital collection to a manageable subset. Three queries are shown here. On the first row, text information combines with a photo she has taken to retrieve relevant species. In the second row, the botanist circles the tip of a leaf to emphasize its importance, producing a more accurate retrieval. In the third row, she has selected one of the type specimens returned, to retrieve a suite of information about the plant of interest. This research aims to fill out all this information, as well as producing the search engine to find it.

# Michael Cummings

**M**ichael Cummings is a new Associate Professor with joint appointments in the Department of Biology and the Center for Bioinformatics and Computational Biology in UMIACS. Since 2000, he has been the Director for the Workshop on Molecular Evolution at the Marine Biological Laboratory in Woods Hole, Massachusetts. Cummings has also held postdoctoral appointments with the University of California, Riverside and the University of California, Berkeley.

Dr. Cummings' principal research interests are in the areas of molecular evolution and genetics and include examination of patterns and processes of sequence evolution. He draws on methods from computational molecular biology, population genetics, systematics, statistics, and computer science. Focal points of his research include the analysis of genotype–phenotype relationships using tree–based statistical models (decision trees), comparison of statistical measures in phylogenetic analysis, and codon usage bias.

Dr. Cummings received his bachelor's degree in botany from the University of California, Davis in 1983. He earned his Ph.D. in biology from Harvard University in 1992.

For more information on Dr. Cummings and his research, see **http://serine.umiacs.umd.edu/**. ✍

# Marie desJardins

**M**arie desJardins comes to UMIACS as an assistant professor with a joint appointment in the Department of Computer Science and Electrical Engineering at the University of Maryland, Baltimore County (UMBC), where she has been since 2001. Prior to coming to UMBC, she was a Senior Computer Scientist in the Artificial Intelligence Center of SRI International in Menlo Park, California.

Prof. desJardins' research focuses on the area of artificial intelligence. Her primary interests include machine learning, distributed and mixed-initiative planning, communication and coordination in multi–agent systems, representing and reasoning with uncertainty, and interactive techniques for AI systems. Other areas of interest include information management, user modeling, knowledge representation, and real–time AI.

In addition to her affiliation with UMIACS, Prof. desJardins is also associated with UMBC's Bioinformatics Research Center and the Center for Women in Information Technology.

Prof. desJardins earned her Ph.D. in computer science from the University of California, Berkeley in 1992. She also holds a bachelor's degree in engineering/computer science from Harvard University.

More information about Prof. desJardins and her research is available at **http://www.cs.umbc.edu/~mariedj/**. ✍

# Faculty News

**William Arbaugh**
• Invited talk at USENIX '03 on the future of Wireless Security
• Keynote Speaker at MIS Mobile and Wireless Conference
• Book co-author with Jon Edney entitled "Real 802.11 Security" published by Addison-Wesley
• Editorial board member of the IEEE's *Security and Privacy Magazine*

**Victor Basili**
• Best Paper Award for "Identifying Implicit Process Variables To Support Future Empirical Work" (with Jeff Carver) at the 17th Brazilian Symposium on Software Engineering (SBES 2003). October 2003.

**Rama Chellappa**
• Distinguished Scholar-Teacher talk on Monday Nov. 4. "Machine Perception of Humans and Their Activities."

**Michael Cummings**
• Invited Talk: "Statistical Analysis of Opsin Spectral Tuning," in the Special Symposium, Evolution of Color Vision, Meeting of the Society for Molecular Biology and Evolution, Newport Beach, California, July 2003
• Invited Lectures: Workshop on Molecular Evolution, Biodiversity and Bioinformatics, Korean Ocean Research & Development Institute, South Sea Institute, Jangmok, South Korea, August – September 2003.
• Guest Professorship, Department of Biology, University of Konstanz, October – November 2003.
• Invited Talk: "Comparing Bootstrap and Posterior Probability Values in Phylogenetic Analysis," the National Museum of Natural Sciences, Spain, October 2003.

**Allison Druin**
• Nominated by President George W. Bush for an appointment on the National Commision on Libraries and Information Science.

**James Hendler**
• Finalist for Homeland Security Award from the Christopher Columbus Foundation.

**Atif Memon**
• Associate Editor: *Proceedings of the 2003 IEEE International Conference on Information Reuse and Integration*
• Guest Editor: *IEEE Transactions on Software Engineering*, October 2003.
• Invited Talk: Software Testing, National Institutes of Health, August 2003
• Invited Talk: Hughes Network Systems, One-day Workshop on Software Testing, June 2003
• Invited Talk: Avaya Labs Research, Seminar on Event-based Software Testing, June 2003

# Dorr Named to FDA Advisory Committee

*P*rof. Bonnie Dorr (Computer Science/UMIACS) has been appointed as a member of the FDA Drug Safety and Risk Management Advisory Committee (2003-2006) to assist in the automatic detection of potentially confusable drug names. In a recent talk entitled "Computational Linguistics Meets the FDA: Techniques for Identifying Sound-alike Drug Names," Prof. Dorr described her collaboration with Dr. Greg Kondrak of the University of Alberta on the application of a new phonological string-matching algorithm for identifying look-alike and sound-alike drug names: **http://www.umiacs.umd.edu/~bonnie/Drugname-Talk-2003.ppt**

The approach has been demonstrated to identify potentially confusable names more accurately than standard edit-distance, DICE, and Levenshtein approaches.

The degree of drug name confusion has become so staggeringly high that the FDA established the advisory board as a part of a new initiative to investigate different ways of eliminating medical errors stemming from aspects of drugs under its regulatory control. The goal is to assist the FDA in identifying potentially confusable drug names during the process of approving drug names proposed by pharmaceutical companies.

On June 26, Prof. Dorr served as a panelist at a public web-broadcasted meeting of the Drug Safety and Risk Management Advisory Committee in Washington DC. The meeting, which had a turnout of over 300 people, focused on a wide range of issues concerning medical errors related to drug name confusion. For more information see **http://www.fdaadvisorycommittee.com**. ✍

## Chellappa Delivers Distinguished Scholar-Teacher Lecture

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*A*s part of the University of Maryland's annual Distinguished Scholar-Teacher Lecture Series, Prof. Rama Chellappa (Electrical & Computer Engineering/UMIACS) presented a talk entitled "Machine Perceptions of Humans and Their Activities: Opportunities and Challenges" on November 3, 2003. The Distinguished Scholar-Teacher Lectures are given by faculty members who are being honored for their outstanding accomplishments in both scholarship and teaching. The program honors a small number of faculty members each year and is sponsored by the University's Office of Academic Affairs and is administered by the Associate Provost for Academic Affairs. ✍

# Faculty News (cont.)

**Jack Minker**
- Compiled a comprehensive history of the beginnings of the study of computing at the University of Maryland. The report can be accessed at: **http://prism.cs.umd.edu/people/minker.html**

**Doug Oard**
- Co-chair, the Cross-Language Evaluation Forum's interactive track for third year in a row.

**Philip Resnik**
- "Supervised Learning without Annotated Data, and Other Sabbatical Adventures in the Making," Johns Hopkins University, September 9, 2003.
- "A Linguist's Search Engine," Conference on Spatial Language and Spatial Cognition, Johns Hopkins University, September 17, 2003.
- "Supervised Learning without Annotated Data," University of Colorado, October 9, 2003.
- "A Linguist's Search Engine," University of Colorado, October 10, 2003.

- United States Patent 6,615,168 Resnik, et al., September 2, 2003: Multilingual agent for use in computer systems

**Azriel Rosenfeld, David Doermann, and Daniel DeMenthon**
- Edited Book: *Video Mining.* Boston: Kluwer Academic Publishers (2003).

**Ben Shneiderman**
- Opening Keynote Addresses: ACM Conference on User Interface Software and Technology, Vancouver, November 2003.
- Opening Keynote Addresses: ACM Conference on Universal Usability, Vancouver, November 2003.
- Invited Talk: "Universal Usability" as part of the American Association of Retired People's "Older, Wiser, Wired" initiative. AARP Headquarters, Washington, DC, October 2003.

**Don Yeung**
- Invited Talk: "Architecture and Compiler Support for Speculative Precomputation," (with Dean Tullsen and Steve Liao), 12th Annual International Conference on Parallel Architectures and Compilation Techniques, New Orleans, September 2003.

# UMIACS Hosts Forum on Strategic Directions in IT

On November 24, 2003, UMIACS and the Department of Computer Science hosted the Forum on Strategic Directions in Information Technology at the University of Maryland. Initiated by UMIACS to gain a deeper understanding of the research trends of IT and related technologies, the forum also serves to encourage networking with some of the key players in these technologies. The forum will meet at regular intervals and provide a platform for interaction between researchers from the University of Maryland and the strategic decision makers from industry.

The inaugural meeting began with a welcome from University Vice President for Research and Dean of Graduate Studies Dennis O'Connor. UMIACS Director Joseph JaJa gave a brief overview of the goals of the forum and shared information about

**UM Vice President for Research and Dean of Graduate Studies Dennis O'Connor welcomes participants to the Strategic Directions in IT Forum.**

some of the current research trends on which the institute is focussed. Greg Akers, Senior Vice President and Chief Technology Officer for Cisco Systems, Inc., shared his insight on future research directions in networking. Akers was followed by two UMIACS professors sharing more information about specific areas of research. Prof. V.S. Subrahmanian discussed Internet privacy and Prof. Ben Bederson (Computer Science/UMIACS) presented information about interface design and visualization research at the Human–Computer Interaction Laboratory.

Following these presentations, the forum participants from industry shared their insights on important directions for future IT research. Leaders from industry attending the forum included Akers; Abdur Chowdhury of America Online, Inc.; Laurie Henrickson, Vice President, The Aerospace Corporation; Clinton Kelly, Senior Vice President, SAIC; C.P. Shankar, Davidson Capital Group; Ashok Thareja, Chief Executive Officer, A and T Systems; Howard Tischler, President & CEO, First American CMSI; Venky Venkatesan, founder and President of Neocera; and Shmuel Winograd, IBM T.J. Watson Research Center.

The program closed with open discussions between industrial and university participants, including more than twenty faculty members, the university's own Interim Vice President and CIO Mark Henderson, and College of Computer, Mathematical, and Physical Sciences Dean Stephen Halperin. ✍

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## MIND Lab Participates in MFRI Congressional Staffer Day

Representatives of the Maryland Information and Network Dynamics (MIND) Lab took part in a special event hosted by the Maryland Fire and Rescue Institute (MFRI) on November 7. Attendees included Congressional staffers and firefighters from around the region. MIND Lab Director

**MIND Lab Director Ashok Agrawala (right) demonstrates new technology for fire and rescue personnel.**

Prof. Ashok Agrawala (Computer Science/UMIACS) and his team demonstrated the basic technologies which are to be used in a Firefighter Accountability System., including biometric sensors, networking, commander's console, and Internet access. ✍

## HCIL To Host Interaction Design & Children Conference

The University of Maryland and the Human–Computer Interaction Laboratory (HCIL) will host the Third International Conference for Interaction Design and Children (IDC 2004) at the University of Maryland on June 1–3, 2004. The conference will focus on emerging technologies for children; the impact that technologies have on children's lives; and research which gives children a voice in design, development, and evaluation methods. This marks the first time the conference will be held in the United States.

IDC 2004 will feature papers, panels, tutorials, workshops, and demonstrations on a variety of topics. Invited keynote panel speakers include: Marvin Minsky, MIT; Alan Kay, Hewlett Packard; Seymour Papert, MIT/University of Maine; Alice Cahn, formerly of Markle Foundation; Henry Jenkins, MIT; and Alice Wilder, *Blue's Clues*. More information is available at **http://www.idc2004.org**. ✍

# Microsoft and HCIL Launch Strategic Partnership

On November 18, the Human-Computer Interaction Laboratory (HCIL) and Microsoft celebrated the launch of a new partnership with the dedication of the new Microsoft Center for Interaction Design and Visualization in the A.V. Williams Building at the University of Maryland. The dedication featured comments from College of Computer, Mathematical, and Physical Sciences Dean Stephen Halperin, HCIL Director Prof. Ben Bederson (Computer Science/UMIACS) and Microsoft Technical Evangelist John SanGiovanni.

As part of the agreement, Microsoft will be funding research in the HCIL for $1 million over three years in the form of licensing, gift, and sponsored research. This agreement is the result of an already successful collaboration between the



**Dean Halperin, Ben Bederson, and John SanGiovanni cut a ribbon to dedicate the new Microsoft Center for Interaction Design and Visualization.**

HCIL and Microsoft Research which resulted in DateLens, a novel calendar interface for the Pocket PC. DateLens is now commercially available at Bederson's startup company Windsor Interfaces, Inc. (see **http://www.datelens.com** for more information).

The major focus of the funding is office and programmer's productivity tools, based on the earlier work on DateLens and other information visualization approaches developed by the HCIL. Other research supported by this gift will include the International Children's Digital Library project (see **http://www.icdlbooks.org** for more information), and the HCI research of Prof. François Guimbretière (Computer Science/UMIACS) and HCIL Research Scientist Dr. Catherine Plaisant. ✍

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# Alphatech Awards Yacoob VACE Phase II Subcontract

Adding to UMIACS vision researchers' success in being selected to participate in Phase II of the Advanced Research and Development Activity's Video Activity and Content Extraction (VACE) program (see related story on Page 4), Dr. Yaser Yacoob (UMIACS) won a Phase II subcontract from Alphatech to work on meeting room video analysis. In this joint research, scientists are looking into developing algorithms for identification and analysis of participants' actions in public meetings such as those for towns or school boards. Identification of participants from one meeting to another and when multiple cameras are recording the event or a video camera is being moved are addressed by analyzing hair and clothing properties to compensate for the typically low resolution of faces and non-frontal views.

Researchers are also developing algorithms for tracking the upper body movements of participants with focus on gestures that are relevant to the substance of the meeting, for example, voting or gavel banging. First, detection of upper body parts is done using models that reflect typical postures of individuals in a meeting space. Then, the movements of the body parts are tracked and the specified activities are recognized when they occur. ✍

# MIND Lab Partner KoolSpan Featured in *Washington Post*

Bethesda-based start-up KoolSpan Inc., a partner in the Maryland Information and Network Dynamics (MIND) Lab, was profiled in a November 17 *Washington Post* article. The company is developing technology to make wireless computing more secure. They have developed an affordable VPN-like approach to Wi-Fi security that allows businesses to provide secure authentication and data transmission for all Wi-Fi users, even when they are using public Wi-Fi networks. This development took place partly in the MIND Lab.

KoolSpan and the MIND Lab are recipients of a grant from the Maryland Industrial Partnerships (MIPS) program to support further development of this technology. The company also was awarded funds from the Maryland Technology Development Corporation for commercialization. ✍

# Awards (June 2003 - November 2003)

- Classroom of the Future (NSF)
  *A. Druin*
- Customizable Audio User Interfaces for the Visually Impaired and the Sighted (NSF)
  *R. Duraiswami, L. Davis*
- Data Collection Infrastructure for Digital Government Applications (NSF)
  *H. Samet, L. Golubchik, S. Khuller*
- Decision Making in the Context of Commitments to Team Activity (NSF)
  *S. Kraus*
- Detecting, Classifying, and Handling Contradictions in a Large, Dynamic Information Environment (Air Force)
  *D. Perlis*
- Development of a Formal Theory of Agent-Based Computing for System Evaluation and System-Design Guidance (DARPA)
  *J. Horty*
- Distributed Smart Cameras: Algorithms, Architectures, and Synthesis (NSF)
  *S. Bhattacharyya, R. Chellappa*
- Electronic Field Guide (NSF)
  *D. Jacobs*
- Evaluation and Improvement of Machine Translation Using Parallel Corpora (DARPA)
  *D. Doermann, B. Dorr*
- Fast Multipole Translation Algorithms for Solution of the 3D Helmholtz Equation (NSF)
  *N. Gumerov, R. Duraiswami, H. Elman, I. Mayergoyz, D. O'Leary*
- Federated Persistent Archive (NARA)
  *J. JaJa*
- Gesture-Based Interfaces in Virtual Reality (ONR)
  *L. Davis*
- Human Tracking and Verification in Video (ONR)
  *R. Chellappa*
- Information Acquisition as a Factor in Improving Agent Performance in Negotiation and Decision Making (NSF)
  *S. Kraus, J. Wilkenfeld*
- Infrastructure to Develop a Large Scale Experiment Testbed of Multi-modal Resources (NSF)
  *L. Raschid, D. Doermann, B. Dorr, D. Oard, A. Weinberg*

- Integration of Data and Interfaces to Enhance Human Understanding of Government Statistics (NSF)
  *C. Plaisant, B. Shneiderman*
- Interlingual Annotation of Multilingual Text Corporation (NSF)
  *B. Dorr*
- Knowledge Integration Research Initiative (DoD)
  *V. Subrahmanian, J. Hendler, L. Davis*
- International Children's Digital Library (NSF)
  *A. Druin, B. Bederson, A. Weeks*
- LAMP Lab (DoD)
  *D. Doermann, A. Weinberg*
- A Landcover Earth Science Information Partnership (NASA)
  *J. Townshend, J. JaJa*
- MURI-Bootstrapping out of the Multilingual Resource Bottleneck (JHU/ARO)
  *P. Resnik, A. Weinberg, B. Dorr*
- Modeling Question-Answer Exchanges for Domain-Oriented Conversational Adequacy (ONR)
  *D. Perlis*
- Multilingual Access to Large spoken ArCHives - MALACH (NSF)
  *D. Oard, D. Doermann, B. Dorr, P. Resnik*
- MURI-Bootstrapping out of the Multilingual Resource Bottleneck (JHU/ARO)
  *P. Resnik, A. Weinberg, B. Dorr*
- NPACI - San Diego (UCSD/NSF)
  *J. JaJa, A. Sussman*
- New Technology for the Capture, Analysis, and Visualization of Human Movement (NSF)
  *R. Chellappa, L. Davis*
- PRAM-On-Chip (NSF)
  *U. Vishkin, G. Qu, B. Jacob, M. Franklin*
- Real-Time Capture, Management and Reconstruction of Spatio-Temporal Events (NSF)
  *H. Samet*
- Scalable Intelligent Agent Architecture for the 21st Century Battlefield (ARL)
  *V. Subrahmanian, D. Nau*
- Science on the Semantic Web—Prototypes in Bioinformatics (NSF)
  *J. Hendler*

- Search Interfaces for Biodiversity Informatics (NSF)
  *B. Bederson*
- Secure Wireless Infrastructure Test Bed (NIST)
  *W. Arbaugh, A. Agrawala*
- Sustainability of NASA EOS Products (NASA)
  *J. Townshend*
- System Support for Enterprise Application Servers (NSF)
  *P. Keleher, J. Hollingsworth, B. Pugh*
- Textual Information Access for the Visually Impaired (NSF)
  *L. Davis, R. Duraiswami*
- Translingual Information Access (Navy)
  *D. Oard, B. Dorr, P. Resnik*
- Uncovering and Exploiting Memory Parallelism in Pointer-Chasing Applications (NSF)
  *D. Yeung, C. Tseng*
- University Partnership with Laboratory for Telecommunication Sciences (DoD)
  *J. JaJa*
- Using the Web as a Corpus for Empirical Linguistic Research (NSF)
  *P. Resnik, B. Dorr*
- Zoomable User Interfaces for the Semantic Web (Air Force)
  *B. Bederson*
- 3D Description and Recognition of Human Activities Using Distributed Cameras (NSF)
  *R. Chellappa*

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