



InterConnections

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

International Children's Digital Library Project Celebrates Launch at Library of Congress

On the evening of November 20, a celebration to launch the International Children's Digital Library (ICDL) was held at the Library of Congress in Washington, DC. The event was attended by more than 200 people, including project participants, government officials, librarians, publishers and authors of children's literature, software and media company officials, and members of the press.

Led by UMIACS' Human-Computer Interaction Laboratory (HCIL) and the Internet Archive, the project is designed to provide children ages 3 to 13 with an opportunity to experience different cultures through literature. The ICDL launched with nearly 200 books in 20 languages representing 27 cultures, with a five-year plan to grow to 10,000 books representing 100 cultures.

A pioneer in working with children as partners in designing new technologies, the HCIL brings together researchers from computer science, information studies, education, psychology, and other fields. This interdisciplinary, intergenerational team, including its 11 children ages 7 to 11, gave attendees hands-on demonstrations of the interface and navigation tools they designed before the formal start of the celebration.

Tom Kalil, former Deputy Director of the White House Economic Council, served as master of ceremonies for the event. Speakers included Librarian of Congress James H. Billington, University of Maryland President C.D. Mote, Jr., author Elma Flor Ada, National Library of New Zealand Librarian Lynne Jackett, National Science Foundation Director of Intelligent Information Systems Michael Pizzanni, Institute of Museum and Library Services Director Robert Martin, and Internet Archive Founder and Director Brewster Kahle.



PHOTO BY BEN SHNEIDERMAN

**Dr. James H. Billington,
Librarian of Congress,
addresses guests at the
ICDL launch celebration.**

During the event, Prof. Allison Druin (College of Information Studies/UMIACS) and Jade Matthews and Carl White, two children from the design team, gave a digital tour of the ICDL. They demonstrated different features of the interface designed for the project, including how users can search for books and the different readers children can use to read books. When asked what her favorite feature of the ICDL was, nine-year old Matthews responded, "the book is never checked out."

The team from the University of Maryland is led by Profs. Druin (PI), Ben Bederson (Co-PI; Computer Science/UMIACS), and Ann Weeks (Co-PI; College of Information Studies). In addition to the HCIL and the Internet Archive, the Library of Congress and the American Library Association are also participants in the project. The National Science Foundation has provided the bulk of the funding through an Information Technology Research award. Added support for project comes from the Institute of Museum and Library Services, the Kahle/Austin Foundation, Adobe Systems, Inc. and the Markle Foundation.

The ICDL's launch has received significant coverage from major news organizations such as the *Washington Post*, the *New York Times*, National Public Radio, the Associated Press, Fox 5 News, *USA Today*, *The Guardian* (UK), and *Le Monde* (France).

For more information about the project or to access the library, see <http://www.icdlbooks.org>.



ICDL users can choose to view books in three different formats, including a standard reader, a comic book reader, or the spiral reader shown here.



Inside this issue

- | | |
|-------------------------------------|-------------------------------------|
| 2 Message from the Director | 9 In Short . . . |
| 3 UMIACS in the Media | 10 Workshops & Conferences |
| 4 Research Updates | 11 Industrial Collaborations |
| 6 Highlights of New Projects | 12 Awards |
| 8 New UMIACS Faculty | |



Welcome to the Fall 2002 issue of *InterConnections*

During the past six months, a number of the UMIACS research projects have received an impressive amount of attention from national and international media. Such publicity is due to a number of factors, including the relevance and timeliness of these projects, the innovative research directions pursued, and the high visibility of our faculty. I am delighted that the environment provided by UMIACS has played a major role in fostering such cutting-edge interdisciplinary projects. In particular, the publicity generated after the launch of our International Children's Digital Library (ICDL) project has been phenomenal—an extensive list of the media reporting on this project is available on the UMIACS web site. Moreover, about 30,000 users visited the site within the first three days of its launch, downloading hundreds of thousands of full resolution pages from the library. In this issue, you will also read about the strong publicity generated by our other projects.

Another impressive development since the last issue of *InterConnections* is the significant growth in our industrial collaborations. This comes at a time when the national economy is sagging and many high-tech companies are downsizing. The factors

that have contributed to our success in the industrial collaboration arena are very much similar to those that have contributed to our publicity success—innovative, timely research projects led by internationally known teams. Add to that the willingness of many of our faculty to reach out to potential industrial collaborators and work hard to build productive and mutually beneficial relationships.



In this issue, you will read about the exciting cutting-edge activities of our Center for Automation Research (CfAR), one of the top two or three centers in the world in computer vision.

You will also get introduced to the outstanding group of new Computer Science faculty who have joined the campus, as well as to several of our new projects including the federated persistent archive project involving a collaboration between UMIACS, the National Archives, and the San Diego Supercomputer Center.

I hope you will enjoy reading this issue of *InterConnections* and as always I look forward to hearing from you.

Media Briefs

- A November *PCWorld* article referred readers to the Web site of Prof. Bill Arbaugh (Computer Science/UMIACS) for information on 802.11 wireless security vulnerabilities.
- Computer science graduate student Nizar Habash was featured in the Spring 2002 *Old Dominion University*, the alumni magazine for his alma mater. The profile points to his growing up in a variety of countries and cultures as an impetus for his research into machine translation, the topic of his dissertation.
- The September 27 *Chronicle of Higher Education* notes a nearly \$400,000 grant from the federal Institute of Museum and Library Services to UMIACS researchers to evaluate the impact of the International Children's Digital Library project on children.
- Prof. Ben Shneiderman (Computer Science/UMIACS) was featured on National Public Radio's *Morning Edition* (September 4) for a story about homeland security in the information age. Shneiderman also noted that technology must be put to public use with care in a September 23 *InformationWeek* article about high-tech voting tools.
- Prof. Ben Bederson (Computer Science/UMIACS) spoke at the Microsoft Research Faculty Summit 2002. Bederson's participation in the event was covered in a July 29 *eWeek* article, a July 29 *InfoWorld* story, and an August 5 feature in *GRIDToday*. For more information, see the related article on page 9.

Iftode's Pervasive Computing Course Profiled

The education column of the April-June issue of *IEEE Pervasive Computing* featured an extensive profile of "Network-Centric Systems," a class taught by Prof. Liviu Iftode (Computer Science/UMIACS). The article pointed to this course as an example of how new research fields, such as pervasive computing, enter the classroom. The class also illustrates how innovative curriculum helps to develop qualified research assistants, prepare the future workforce, and expand faculty members' knowledge of a topic. Iftode plans to make this a regular course offering at the university and to continue to examine pervasive computing from a variety of perspectives. ☺

eWeek Asks Arbaugh about Computer Security

Two articles in *eWeek* turned to Prof. William Arbaugh (Computer Science/UMIACS) for his expertise in computer security.

A July 29 story about Microsoft's Palladium security architecture focused on questions the security community has about the capabilities of the technology. "I don't think Palladium needs to be thrown out because it's being started by a big company," Arbaugh said. "The fundamental issue is giving users control." The technology at the heart of Palladium was described in a 1997 paper that he co-authored.

Arbaugh was also featured in a September 9 *eWeek* article about wireless security. Although the new 802.1x specification for WLAN security is gaining momentum in the marketplace, the article points to a paper he published that describes two problems that could allow someone to hijack user sessions and execute man-in-the-middle attacks. ☺



Associated Press Asks Resnik About Machine Translation

In late June, an Associated Press article focused on the research of Prof. Philip Resnik (Linguistics/UMIACS) into using the World Wide Web as a corpus for machine translation. The article was featured in a number of newspapers around the world, including *USA Today*, the *Toronto Star*, and the *Boston Herald*.

In order to improve machine translation tools, researchers need large bodies of parallel, translated text. Resnik is looking to the World Wide Web for these resources. He has developed a program that scours the Web for documents that are translations of each other and that has been more than 90 percent effective in finding matches. He has compiled parallel text of 1 million words each in English and Arabic when using the program to search the Internet Archive. Resnik points out that advantages of mining the Web include less manual work, access to more languages, and the ability to keep up with changes in usage. ☺

Media Focus on HCIL High-Tech Voting Research

Last spring, Prof. Ben Bederson (Computer Science/UMIACS) and Paul Herrnson, professor in the Department of Government and Politics and director of the Center for American Politics and Citizenship, conducted research with the new touch-screen voting machines that four Maryland counties began using in this September's primary. While the researchers found the machines to be fundamentally sound, they recommended programming and hardware changes to the system and an intensive education program for poll workers and voters.

Media coverage of their research included an August 14 Capital News Service article, a September 9 Cox News Service story, and an October 2 *IEEE Spectrum Online* feature. Bederson and Herrnson also co-authored a letter to the editor in the September 20 *Washington Post* that evaluated the performance of the new systems during Maryland's September 10 primary. Noting that many of their predictions came to pass during voting, the researchers called for Maryland election officials to step up voter education efforts concerning the new machines. ☺

New Scientist Covers Face-Recognition Research

The June 1 issue of *New Scientist* reported on the findings of UMIACS researcher Yasser Yacoub concerning facial expressions and face-recognition systems. With Prof. Larry Davis (Computer Science/UMIACS), Yacoub showed that face-recognition systems have a better chance of making accurate matches if the pictures in their databases are of smiling faces rather than blank expressions. Even people with similar-looking faces reveal different features when they smile since these expressions expose more information about the muscle and bone structure of the face. Smiling also produces different shading to the surface of the skin. ☺

Press Takes Note of Katz's Discovery

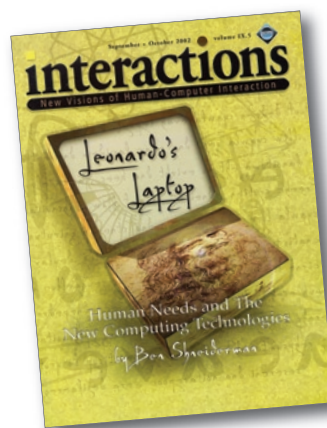
Prof. Jonathan Katz (Computer Science/UMIACS) received widespread attention from the mainstream press, including stories on the Associated Press and Reuters newswires, when he developed and implemented an attack against the PGP e-mail encryption program. In addition to appearing on the wire services, reports about the discovery also ran in the *Wall Street Journal*, *eWeek*, and *PC Magazine*.

PGP, or Pretty Good Privacy, is the most popular program used for encrypting electronic mail. With Bruce Schneier of Counterpane Internet Security, Katz found that an attacker who intercepts an encrypted communication from one party to another could send the original recipient a specially formed message based on the intercepted, but still garbled, transmission. This message would appear as gibberish to the recipient, but if the recipient were to unwittingly attach the message in a reply to the attacker, the attacker could recover and decrypt the original message. The research resulted in a refinement of the current standard for the PGP encryption software. ☺

Druin Shares Her Education Expertise

In an August 22 interview with the *Washington Times*, Prof. Allison Druin (College of Information Studies/UMIACS) spoke about the Personal Electronic Tellers of Stories (PETS) project and what it suggests for the use of robotics in education. Built in the Human-Computer Interaction Laboratory (HCIL), the current PETS prototype is a robot with an animal-like covering that responds to input from sensors that the user wears on his or her body. In working with the robots, children can be creative and learn critical lessons about problem solving. Anthrotronix, a startup company, is currently working with the HCIL to develop the PETS prototype into a product that will encourage physical activity in children with physical disabilities.

An article in the July 16 *Washington Post* also featured Druin discussing the ways that the Internet has changed education. She noted that, in addition to using the Internet as a tool, children can also add their own thoughts to it, by creating a Web site as a class project for example. "That's pretty powerful stuff for a kid," she said. ☺



The September/October 2002 issue of *ACM Interactions* featured an excerpt from *Leonardo's Laptop: Human Needs and the New Computing Technologies*, Prof. Ben Shneiderman's most recent book, which was published by MIT Press in October 2002. Shneiderman (Computer Science/UMIACS) is founding director of the Human-Computer Interaction Laboratory.



CfAR at the Forefront of Vision Research

Researchers in UMIACS' Center for Automation Research (CfAR) are playing a leading role in developing methods to recognize humans at a distance using biometric measurements derived from gait and face. Broadly referring to how a person moves, gait can include characterization of posture, arm and leg swings, hip and upper body sway, or some unique walking style. Gait-based identification is useful when persons are at distances of many hundreds of feet. The hope is that gait-based identification methods will serve as a filter and produce the top few matches that can be passed on to a face recognition system.

Face recognition from still images has been an active area of research since the early nineties. To improve the performance of face-recognition systems, CfAR researchers are developing methods for performing face recognition from video using sophisticated Monte Carlo Markov Chain methods. Existing methods for gait and face recognition use 2D descriptions of humans. In order to handle pose and illumination variations, though, the use of 3D models of humans will be critical. Profs. Rama Chellappa (Electrical & Computer Engineering/UMIACS) and Yiannis Aloimonos (Computer Science/UMIACS) are developing methods for deriving the 3D structures of full bodies and faces from video with applications in face and gait recognition.

Another research issue is the use of multiple cameras. With cameras getting cheaper, researchers can build a network of distributed cameras and develop robust 3D solutions to human identification using gait and face as well as to many other problems. CfAR's Keck Laboratory for the Analysis of Visual Motion and an outdoor multi-camera system have enabled researchers to experiment with multi-camera-based video-processing algorithms.

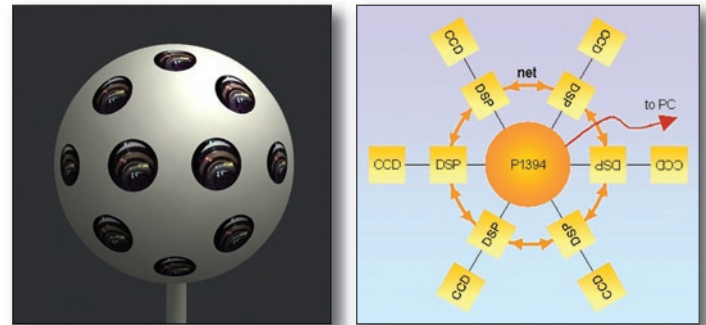
New Eyes for Surveillance

While the cameras that researchers have been using have become more sophisticated technologically, they remain based on the same principle: the pinhole. This model may be so dominant because it is also how human eyes form images. However, in examining the animal world, researchers discover a large variety of eyes. The set of rays that is cut with a surface, the nature of the surface and the distribution and optical properties of the photo-receptors define different eyes. In studying general principles of eye design to determine what makes a good eye or camera, Prof. Aloimonos' group has found that this depends on what kind of processing will be performed on the images collected by the eye. They have concentrated on the problem of making 3D models of the world from multiple views. Their investigations have discovered two principles that affect an eye's usefulness: its field of view and its dioptric number.

Imagine a camera at the center of a sphere, looking at the ceiling. Whether the camera translates parallel to the ceiling or rotates around an axis parallel to it, the acquired videos are basically indistinguishable. But if at the same time the camera could

also look at the wall, the two motions could be easily distinguished. Thus, the problem of making 3D models is ill posed for restricted fields of view but becomes well posed for a full field of view, for example, cutting the rays which converge to a point with a sphere. The problem, however, remains non-linear.

The dioptric number D amounts to the number of viewpoints (or pinholes) that the eye possesses. A single camera has $D = 1$, a stereo system has $D = 2$, a network of 100 cameras arranged on a surface has $D = 100$. As the dioptric number increases, the eye

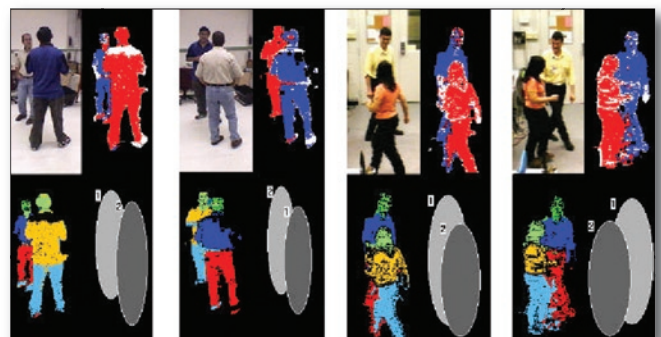


A golf-ball size eye consisting of many cameras looking outward (left) and a system diagram on an Argus eye (right).

is capable of sampling the plenoptic function, in which case the problem of making 3D models becomes linear. These principles have led researchers to develop two families of new cameras, Argus eyes and polydioptric eyes.

Detection and Tracking of Moving Humans

A group led by Prof. Larry Davis (Computer Science/UMIACS) has investigated the use of kernel density estimation techniques in real-time visual surveillance and monitoring. They have shown how a variety of low- and intermediate-level vision problems—from background modeling and detection to tracking—could be robustly and efficiently addressed using efficient algorithms for the construction and evaluation of such probabilistic models. Color appearance models for people are constructed using kernel density estimation techniques. These models can



Construction of two color appearance models using kernel density estimation.



then be used in conjunction with occlusion modeling to segment small groups of people into individuals.

The single-camera-based work has been extended to a multi-perspective framework. Prof. Davis' group has shown how one can combine wide baseline stereo analysis, general-purpose color segmentation, background modeling, and Kalman filter tracking into a unified Bayesian framework for building appearance models and tracking multiple people in cluttered environments.

To persistently track people and vehicles in a large area of interest, distributed imaging sensors have to be employed. Researchers encounter two major challenges here: automatically calibrating a camera network with multiple arbitrarily placed cameras and finding correct target associations between video streams from different cameras when multiple targets are present simultaneously. Using sequential Monte Carlo (SMC) techniques, researchers have been able to solve the camera network self-calibration problem. The posterior distributions of relative position and orientation of the cameras can be represented by related sample and weight sets. CfAR researchers have also developed an algorithm to solve the problem of target association or target cross-sensor hand-over.

Human Identification at a Distance

Prof. Chellappa's group's early work on gait recognition involved computing the width of the outer contour of the binarized silhouette of a walking person as the image feature. In this method, a set of exemplars that occur during a walk cycle is chosen for each individual and a continuous Hidden Markov Model (HMM) is trained. This methodology serves to compactly capture structural and dynamic features that are unique to an individual. Extensive experiments have shown the performance to be good. For the purpose of recognition, certain parts of the body appear to be more favorable than others.

In another study, Prof. Chellappa's group examined the spatio-temporal pattern generated by the width feature for different walkers. Matching the sequences of width vectors corresponding to any two individuals can capture the differences in gait. A method based on a Dynamic Time Warping (DTW) algorithm, popular in speech recognition, is used to compensate for the variability in the walking speed, reflected in the number of frames for each gait cycle. Experiments with many data sets show that this method has the potential for serving as a filter. Prof. Davis' team has developed an eigengait-based approach for the identification of gaits, and has shown how models for periodic motion analysis can be adapted to the problem of recognizing individuals based on their gait. They have also studied methods for computing and utilizing cadence and stride for gait recognition.

The eigengait and HMM methods for gait-based human recognition assume that the humans walk in a fronto-parallel manner. In real applications, such restrictive walking patterns are not realistic. Recently, researchers have completed two approaches for handling wide variations in walking directions. One of the approaches uses the image-based visual hull approach to generate side views of walking humans from arbitrary directions. Image-

based visual hull approaches require at least four views of calibrated images to produce satisfactory results. Another approach uses a cardboard model of humans at a distance and generates side views of humans walking in arbitrary directions. Width vector calculated from such side views can be fed into HMM or eigengait methods.

Robust Face Recognition From Video

Human recognition from video requires solving two tasks, recognition and tracking, simultaneously. This leads to a parameterized time series state space model, representing both the motion and identity of the human. Sequential Monte Carlo algorithms can be developed to identify humans in video. However, in outdoor environments, the solution is more likely to diverge due to pose and illumination variations. Prof. Chellappa's group has developed a robust algorithm for tackling this problem by incorporating the constraint of temporal continuity in the observations and multiple galleries. Two cases have been

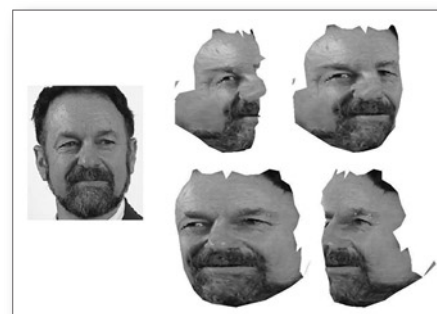


Top: Face gallery images of size 48x42 pixels. Bottom: Sample frame in one probe video. The actual face size ranges from approximately 20x20 in the first frame to 60x60 in the last frame.

considered: still gallery and video probes as well as video gallery and video probes. Experimental results demonstrate significant improvements over the CONDENSATION counterpart of the algorithm.

3D Modeling from Video

Recovery of 3D scene structure and motion (SfM) from a monocular image sequence has been an active research area in computer vision for decades. Prof. Chellappa's group has adopted the optical flow paradigm for modeling the motion between the frames of the video sequence. They have shown how the statistics of the errors in the input motion estimates are propagated through the 3D reconstruction algorithm and affect the quality of the output.



A frame from the original video (left) and novel synthesized views generated from the 3D model constructed from the video (right).

Continued on page 7



UMIACS Researchers Win Three NSF ITR Awards

Researchers in UMIACS continue to achieve success in winning awards through the Information Technology Research (ITR) program of the National Science Foundation (NSF). In the latest round of Small ITR awards, the NSF awarded funding to three projects led by UMIACS faculty. The NSF established the ITR program in 2000 to preserve the United States' position as the world leader in information technology and its applications.

Search Interfaces for Biodiversity Informatics

Led by Prof. Ben Bederson (Computer Science/UMIACS), this project will build information retrieval interfaces for the rapidly expanding but virtually unstudied domain of biodiversity databases. An understanding of the nature and magnitude of biological diversity is fundamental to the most pressing environmental and conservation debates. The databases with which Bederson will be working contain organism-related information such as distribution, taxonomy, natural history, and conservation data.

The project will combine information visualization techniques and rapid feedback dynamic query interfaces, coupled with an aggressive approach of working with representative users at all levels, from design through evaluation. Using zoomable interfaces to visually accommodate highly interconnected data, the tool will allow users to navigate through multiple hierarchies.

Researchers will develop a searching interface for these databases for domain-novice adult users. These interfaces will combine scientific and "folk" understanding of the subject matter. Finally, the team will evaluate the newly developed interfaces and compare them with existing interface models in the domain of biodiversity.

Efficient Solutions of the 3D Helmholtz Equation

This project, led by Nail Gumerov (UMIACS), will focus on improving scientific computing used to model phenomena encountered in a variety of areas, including electromagnetics, acoustics, and biology. Researchers will develop improvements to the fast multipole method (FMM) for solving the Helmholtz equation and other problems related to these phenomena. Discretizations of the partial differential equations yield large systems of algebraic equations for which both direct and iterative solution techniques are expensive. In solving these larger problems, the team will try to achieve better designs as well as elucidation of new physics and biology.

Researchers on this team have derived exact expressions for the translation and rotation of multipole solutions of the

Helmholtz equation, which enable fast computation via simple recursions. They also have obtained very promising results on the properties of the translation operators that enable the creation of tighter error bounds. Based on these and other successes, the project team will develop software for solution of different problems using the FMM. To encourage its implementation in a variety of areas and by a large number of practitioners, the team will provide significant documentation of the software and publish it in accessible peer-reviewed forums.

In addition to Dr. Gumerov, the team includes Drs. Ramani Duraiswami (UMIACS), Howard Elman (Computer Science/UMIACS), Dianne O'Leary (Computer Science/UMIACS), and Isak Mayergoz of Electrical and Computer Engineering.

Digital Resource Profiling for Wide Area Applications

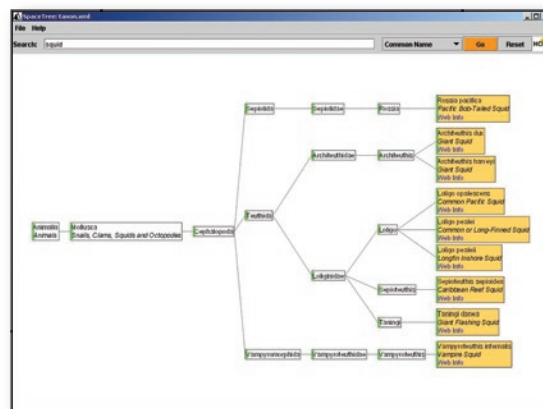
Wide area applications utilize a WAN infrastructure, such as the Internet, to connect a federation of hundreds of servers, typically content providers, with tens of thousands of clients. Such applications, while promising in their scope and impact, face significant challenges. For example, the unpredictable behavior of sources over a dynamic WAN may result in a wide variability in access latency (end-to-end delay). Similarly, as cached resources become obsolete, the staleness of delivered information and services may vary.

In this project, led by Prof. Louiqa Raschid (Business/UMIACS), researchers will undertake a comprehensive study of the changing behavior of digital resources over time and across different applications, when accessed via the dynamic WAN. Their objective

is to develop appropriate resource profiles to characterize this behavior. They will then use these profiles to customize service and information delivery to clients, considering both application semantics and the noisy WAN environment.

The corresponding algorithms will explore the trade-offs between end-to-end latency and data obsolescence for different application requirements. Research results will aim to establish a consistent framework for profiling and to determine to what extent profiling can be used in improving clients' availability to resources. Formal results developed in the theoretical study will be evaluated on large-scale applications. Collaboration with Corporation for National Research Initiative (CNRI) Handle protocol developers will provide a test-bed for a large-scale study.

Other collaborators include Profs. Avi Gal, Technion, Israel and Vladimir Zadorozhny, University of Pittsburgh.



The search interfaces that researchers are developing will allow users to navigate easily through a wealth of information related to biodiversity.



UMIACS Partners with National Archives and SDSC to Develop a Federated Persistent Archive

The National Archives and Records Administration (NARA) is America's national record keeper. Both the government and the public rely on NARA's ability to provide ready access to evidence that documents citizens' rights, official actions, and the national experience. A major challenge facing NARA is the management and archiving of electronic records that are currently being generated at a phenomenal rate. A joint partnership between NARA, the San Diego Supercomputer Center (SDSC), and UMIACS has been established to design and test an architecture for a federated persistent archive, which can



NARA needs to preserve information while still making it readily accessible. This joint partnership will develop tools to help achieve these goals.

address the requirements of large scale and long term archiving of electronic records. The Principal Investigator from the University of Maryland is Prof. Joseph Jaja, Director of UMIACS and Professor of Electrical and Computer Engineering.

In addition to providing efficient access to users anywhere, anytime, a persistent archive has to preserve the records as long as they are needed. This implies in particular that any architecture for a persistent archive has to easily accommodate technology evolution, and has to reduce the risk from natural disasters such as flood, tornado, fire, and earthquakes. One way to accommodate these requirements is to maintain copies of all digital data collections at geographically distributed sites, which introduces issues related to data management across independent administration domains. Note that data replication across distributed sites allows the testing of new technology at one site, while the prior technology continues to manage the digital archive at the second site.

The main approach pursued by this partnership involves the use of grid technologies to enable distributed ingestion, replication, and management of electronic records for a federated persistent archive. The major related research issues include:

- Management of data and catalog replication across multiple sites
- Phased installation of new technology
- Reliability assessments to demonstrate integrity of each site
- Management of distributed data ingestion
- Management of authentication and authorization systems across separate administration domains
- Scalability of infrastructure for managing millions of records

- Automation of archival processes (accession, description, arrangement, preservation, and access)

In particular, the persistent archive requires software infrastructure to support interoperability between different implementations of ingestion, management, and access components. The initial design, studied through an earlier project, makes use of grid technologies to support interoperability to access heterogeneous systems distributed in space as well as interoperability between old and new versions of technology.

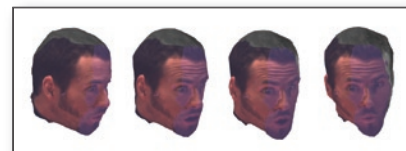
The first major phase of this project is to set up a pilot system for a persistent archive linking disk caches and storage systems at SDSC, UMIACS, and NARA. This pilot system will use the Storage Request Broker (SRB), developed by SDSC, as the data handling system, augmented by the policies and procedures to manage migration to new information tagging standards, new media, and new storage systems. During the first year, several terabytes of NARA-designated data collections will be ingested, registered, and replicated among the three sites. During the succeeding years, as the pilot system grows substantially in size, the main research issues mentioned above will be studied, and solutions will be tested on the pilot system. ☺

CfAR Research Update

Continued from page 5

The team has developed an algorithm that obtains a robust 3D model of a human face by fusing two-frame estimates using stochastic approximation theory and then combines it with a generic face model in a Markov chain Monte Carlo optimization procedure.

Prof. Aloimonos, using his new theory on constructing new sensor configurations, has developed an algorithm for extracting more accurate models of a dynamic world. The figure below shows different novel views of a talking head reconstructed from multiple video sequences using dynamic multi-resolution subdivision surfaces.



Recognition and Lighting

Prof. David Jacobs (Computer Science/UMIACS) has developed new methods for face recognition from still images by studying the interaction between lighting variations and recognition. The new recognition algorithms have come about through a clear understanding of how to recognize Lambertian and non-Lambertian objects that have known structure and how to recover the 3D structures of objects using images taken under various complex lighting conditions. ☺



New UMIACS Faculty

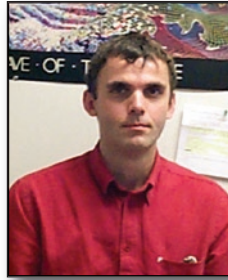
François Guimbretière

François Guimbretière joins the University of Maryland as an Assistant Professor with appointments in the Department of Computer Science and UMIACS. He earned his Ph.D. and M.S. degrees in computer science from Stanford University in 2002 and 1997, respectively.

Guimbretière's research interests focus on developing new fluid interaction interfaces for computers. These types of interfaces will both give access to computing resources during the creative process and be the foundation for successful casual human-computer interactions for ubiquitous computing appliances. He built the Stanford Interactive Mural, an example of this type of interface, and developed and tested two applications for it, a Mathematica front-end and a digital brainstorming tool.

Guimbretière is interested in pursuing similar methods to achieve a fully digital design environment. He sees emerging technology, like powerful tablet computers and digital pens, as tools that can be used to develop new fluid interaction appliances.

More information on Guimbretière's research is available at <http://www.cs.umd.edu/~francois>.



David W. Jacobs

David W. Jacobs is a new Associate Professor with joint appointments in UMIACS and the Department of Computer Science. Previously, he was a senior research scientist at the NEC Research Institute.

Jacobs' research focuses on human and computer vision, specifically in the areas of object recognition and perceptual organization. His recent work has also addressed problems in multimedia, face recognition, structure-from-motion, and machine learning, including building models of human memory.

Since 1999, he has served as an Associate Editor of *IEEE Transactions on Pattern Analysis and Machine Intelligence*. In addition to serving on program committees for numerous conferences related to computer vision, Jacobs co-chaired the Third IEEE Workshop on Perceptual Organization in 2001.

Jacobs earned his master's and Ph.D. degrees in computer science from the Massachusetts Institute of Technology in 1988 and 1992, respectively.

See <http://www.cs.umd.edu/~djacobs> for more information about Jacobs' research.



Michael Hicks

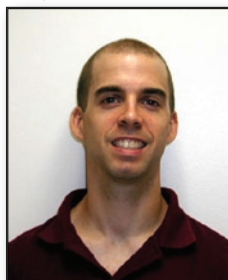
Michael Hicks joins the University of Maryland as an Assistant Professor with appointments in the Department of Computer Science and UMIACS.

Hicks' research explores how novel tools, techniques, and infrastructures can be used to develop software and systems with greater flexibility, reliability, and security. His research bridges the areas of programming languages and systems, in that he frequently applies or develops language-based technology to solve systems problems.

Hicks is a designer of Cyclone, a C-like systems programming language that affords low-level control over memory and data layout but is nonetheless safe. He is the codesigner of MediaNet, a distribution network for streaming data whose chief novelty is its use of local and global schedulers to manage user-defined quality-of-service issues. Hicks is also co-developing a formal framework for exploring dynamic software updating, a process in which programs are upgraded with new code as they run.

Hicks received his master's degree and Ph.D. in computer and information science from the University of Pennsylvania and his bachelor's degree from Pennsylvania State University.

More information about his research can be found at <http://www.cs.umd.edu/~mwh/>.



Jonathan Katz

Jonathan Katz comes to the University of Maryland as an Assistant Professor with a joint appointment in the Department of Computer Science and UMIACS. Previously, he was a postdoctoral scientist at the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS).

Katz's research interests lie in cryptography and network security. His Ph.D. thesis addresses the design of efficient and provably secure protocols preventing "man-in-the-middle" attacks. As part of this work, he developed the first efficient and provably secure protocol for password-based authentication. This protocol is resilient to off-line dictionary attacks, making it suitable even when short, easily guessed passwords are involved. Recently, his research showing weaknesses in a widely used e-mail encryption program received widespread attention from the press (see related story on page 3) and led to a refinement of the current standard.

Katz received his Ph.D. in computer science from Columbia University in 2002. He holds master's degrees in computer science and chemistry, also from Columbia, degrees in mathematics and chemistry from the Massachusetts Institute of Technology.

More information about his research can be found at <http://www.cs.umd.edu/~jkatz>.





Faculty News

Victor Basili

- Best Paper Award: “Replicating Software Engineering Experiments: Addressing the Tacit Knowledge Problem” (with Forrest Shull, Jeff Carver, and Jose Maldonado), First International Symposium on Empirical Software Engineering in Nara, Japan, October 2002.

Shuvra Bhattacharyya

- Keynote Lecture: “Software Synthesis for Digital Signal Processing,” Advanced School for Computing and Imaging Conference, Lochem, The Netherlands, June 2002.

Manoj Franklin

- Published Book: *Multiscalar Processors*, Kluwer Academic Publishers, Boston, October 2002.

Lise Getoor

- Invited Presentation: “Learning Statistical Models from Relational Data,” University of Alberta, Edmonton, Canada, spring 2002.
- Invited Presentation: “Selectivity Estimation using Probabilistic Models,” University of Alberta, Edmonton, Canada, spring 2002.
- Invited Lecturer: “Learning Structured Statistical Models,” Information Sciences Institute, summer 2002.
- Invited Tutorial: “Learning Statistical Models from Relational Data,” Summer School on Relational Data Mining, Helsinki, Finland, August 2002.
- Invited Participant at the nineteenth workshop in the Machine Intelligence series founded by Donald Michie in 1965. The workshop was held at Imperial College at Wye, September 2002.

James Hendler

- Keynote Speech: “The Semantic Web: what it can do for you,” INFO-TECH 2002, Kobe, Japan.
- Chair of the International Advisory Board for the new journal, *Web Semantics*, published by Elsevier North-Holland.
- United States Air Force “Exceptional Civilian Service Medal.”

Joseph Jaja

- Invited Speaker to the EOSDIS Data Access Technology Workshop, October 2002.

Doug Oard

- Associate Editor for *ACM Transactions on Information Systems*.

Dana Nau

- Best Paper Award: “On the Complexity of Plan Adaptation by Derivational Analogy in a Universal Classical Planning Framework” (with Tsz-Chiu Au and Héctor Muñoz-Avila), Sixth European Conference on Case-Based Reasoning, Aberdeen, Scotland, September 2002.

Don Perlis

- Invited Talk: “Theory and Application of Self-Reference: Logic and Beyond,” at PhiLog (Danish Philosophical Logic Association), Copenhagen, Denmark, October 2002.

Philip Resnik

- Invited Talk: “Supervised Learning without Annotated Data,” Microsoft Research, Redmond, Wash., October 2002.

Ben Shneiderman

- Published Book: *Leonardo’s Laptop: Human Needs and the New Computing Technologies*, MIT Press, Boston, 2002.
- Advisory Editor for *Information Visualization*.

Aravind Srinivasan

- Invited Talk: Plenary session speaker at the Second Annual McMaster Optimization Conference: Theory and Applications (MOPTA 02), McMaster University, Canada, August 2002.
- Co-organizer of a Workshop on Random Graphs and Randomized Algorithms in Bertinoro, Italy, May 2002.
- Program Committee Member: the Thirty-Fifth Annual ACM Symposium on Theory of Computing (STOC) and for the Sixth International Workshop on Discrete Algorithms and Methods for Mobile Computing and Communications (DIALM).

Uzi Vishkin

- Invited Talk: “What to do with all this hardware? Could the PRAM-On-Chip architecture lead to upgrading the WINTEL performance-to-productivity platform?” IBM T.J. Watson Research Center, Yorktown Heights, N.Y., June 2002.

Don Yeung

- Invited Talk: “Compiler and Architecture Support for Sub-Ordinate Multithreading,” Sun Microsystems, October 2002.
- Invited Talk: “Compiler and Architecture Support for Sub-Ordinate Multithreading,” The Intel Corporation, October 2002.


Min Wu

- Published Book: *Multimedia Data Hiding* (with Bede Liu), Springer Verlag, New York, October 2002.
- Patent Issued: “Methods and Apparatus for Multi-layer Data Hiding,” US Patent 6,456,726, (issued September 2002).

Shneiderman Papers Now at UM Libraries

The papers of Prof. Ben Shneiderman (Computer Science/UMIACS) are now available to researchers at the University of Maryland Libraries’ Archives and Manuscripts Department located in Hornbake Library. The collection consists of working papers, correspondence, manuscripts, and related materials, beginning with his graduate studies at the State University of New York at Stony Brook in 1968. They illustrate his work and the emergence of the discipline of human-computer interaction.

Founding director of the Human-Computer Interaction Laboratory (HCIL), Shneiderman developed the notion of “direct manipulation,” which clarified the design principles and benefits of the emerging graphical user interfaces. This idea led directly to the invention of the embedded menu or hot link that became a key contribution to usability of the web. He has written more than 200 articles and published a number of books, most recently *Leonardo’s Laptop: Human Needs and the New Computing Technologies*.

For more information about the collection, including a complete inventory, see <http://www.lib.umd.edu/ARCV/histmss/findingaids/shneiderman/>. 



Workshops & Conferences

UMIACS and CS Co-Sponsor Distinguished Lecture Series

To inaugurate the new Computer Science Instructional Center, UMIACS and the Department of Computer Science co-sponsored a Fall 2002 Distinguished Lecture Series. The series brought six world-class speakers to the University of Maryland to present their latest research results.

Lectures in the series included: "Quantum Physics and the Nature of Computation" from Umesh Vazirani (University of California-Berkeley), "Peer-To-Peer Data Management" from Hector Garcia-Molina (Stanford University), "OceanStore: Toward Global Scale, Self-Repairing, Secure, and Persistent Storage" from John Kubiawicz (University of California-Berkeley), "Immersive Virtual Reality for Scientific Visualization" from Andries Van Dam (Brown University), "Embedded Devices: The Impact on Optimizing Compilers" from Mary Lou Soffa (University of Pittsburgh), and "Navigating Audio Like Text: Browsing and Searching Voice-mail Messages" from Julia Hirschberg (ATT Labs).

Corporate sponsors of the Distinguished Lecture Series include: Hughes Network Systems, Microsoft, America Online, and Fujitsu. ☺

Audio User Interfaces Team is All Ears

The team behind the project to create audio user interfaces for the visually impaired and the sighted held a kick-off meeting this fall. The project, funded by an Information Technology Research award from the National Science Foundation, brings together scientists from a wide variety of disciplines. For more information about this project, see the spring 2002 issue of *InterConnections*. ☺



Standing (left to right): Bob Massof (Johns Hopkins University), Elena Grassi (ISR), Shihab Shamma (ISR), Dmitry Zotkin (Computer Science), Shirin Hasan (Johns Hopkins University), Ramani Duraiswami (UMIACS). Sitting (left to right): Barbara Shinn-Cunningham (Boston University), Ben Shneiderman (Computer Science/UMIACS), Larry Davis (Computer Science/UMIACS).

DoD-LAMP Partnership Celebrated

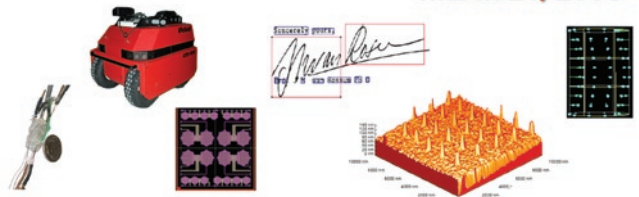


Representatives from the Department of Defense and the Language and Media Processing Laboratory of UMIACS met this spring to renew their partnership.

Maryland's SHOP2 Team Achieves Success at Planning Competition

In the AIPS-2002 International Planning Competition in Toulouse, France last April, the competitors included fourteen AI planning systems from many different parts of the world. The University of Maryland's SHOP2 planning system won one of the top four prizes. SHOP2 solved 899 planning problems, more than any other system. The members of the SHOP2 team were team leader Prof. Dana Nau (Computer Science/UMIACS), postdoctoral researcher Bill Murdock, and graduate students Tsz-Chiu Au, Okhtay Ilghami, Ugur Kuter, Dan Wu, and Fusun Yaman. ☺

Research Review Day 2003 March 21, 2003



Save the Date!

Research Review Day is a showcase of UMIACS, the Department of Computer Science, Department of Electrical & Computer Engineering, and Institute for Systems Research. The eighth annual Research Review Day will be held on Friday, March 21, 2003 in the Stamp Student Union at the University of Maryland, College Park.

For more information see <http://www.ece.umd.edu/RRD>.



Industrial Collaborations with UMIACS Continue to Grow

Partnerships and research collaborations between UMIACS and industry continue to grow at a significant rate. Industrial support to UMIACS—including cash donations and research projects funded directly by industry—totaled more than \$1.6 million in 2002, excluding the substantial software and hardware gifts received by UMIACS researchers. In addition, joint projects between UMIACS and industry funded by government agencies totaled more than \$4 million in 2002.

Industrial collaborations with UMIACS include:

- **Aerospace Corp.**
MIND Lab (*A. Agrawala*)
- **America Online**
AOL Fellowship (*B. Shneiderman*)
- **BAE Systems**
CTA: Advanced Sensors (*R. Chellappa*)
- **BBNT Solutions**
Headline Generation (*B. Dorr*)
- **Chevron Texaco**
Information Visualization (*C. Plaisant, B. Bederson*)
- **Foster Miller**
Crew Performance Analyzer (*L. Davis*)
- **Fujitsu**
MIND Lab Founding Partner (*A. Agrawala*)
- **General Dynamics Robotics Systems, Inc.**
CTA: Robotics (*L. Davis*)
Recognition in Multi-Hyperspectral Imagery (*Q. Zheng*)
- **Hitachi**
LAMP Lab Research (*D. DeMenthon*)
- **Honda**
Human Detection in Night Scenes (*L. Davis*)
- **IBM**
Shared University Research (*B. Bederson, J. Hollingsworth, D. Oard*)
- **ITT**
State of the Art Reports for the Data Analysis Center (*V. Basili*)
- **KLA Tencor**
LAMP Lab Research (*D. Doermann*)
- **Koolspan**
MIND Lab (*A. Agrawala*)
- **Lockheed Martin**
MIND Lab (*A. Agrawala*)
- **Micro Analysis & Design**
CTA: Advanced Decision Architectures (*R. Chellappa, V. Subrahmanian*)
- **Microsoft**
HCIL Research (*B. Bederson*)
- **MITRE**
CLIP and LAMP Lab Research (*D. Doermann, B. Dorr*)
- **Mitsubishi**
Computer Vision Research (*L. Davis*)
- **Object Video**
Video Monitoring, Tracking, and Classification (*Q. Zheng*)
- **Panasonic**
LAMP Lab Research (*D. Doermann*)
- **Perceptek**
MARS 2020 (*L. Davis*)
- **Raytheon**
E3D (*L. Davis, I. Weiss, R. Chellappa*)
Sustainability of NASA EOS Products (*J. Townshend*)
- **Ricoh**
HCIL Research (*B. Shneiderman*)
- **Samsung**
Wireless Security and Mobility (*W. Arbaugh*)
- **Toshiba**
HCIL Research (*B. Bederson*)

Bederson Demonstrates DateLens at Microsoft Research Summit

During the third annual Microsoft Research Faculty Summit on July 29, 2002 in Redmond, Washington, Prof. Ben Bederson (Computer Science/UMIACS) joined Microsoft Chairman and Chief Software Architect Bill Gates in a demonstration of DateLens, a scalable calendar tool for mobile devices that Bederson developed. The demonstration occurred during Gates' keynote address to the gathering, which brought together 325 faculty researchers from leading institutions worldwide.

The goal of the DateLens research project is to create one interface that uses the same source code to execute on multiple devices—such as Pocket PC, Tablet PC, and the desktop—that have different processor types, different display

resolutions, and very different interaction models. Using a fish-eye representation of dates coupled with compact overviews and search functionality, DateLens aids users in performing planning and analysis tasks and allows them to easily navigate the calendar structure. Along with Microsoft Research, Bederson's team conducted a benchmark study comparing it to the Pocket PC 2002 calendar, with results showing many advantages to the DateLens user interface.

Microsoft Research University Relations created the annual faculty summit to provide a forum for the exchange of information and ideas. During the three-day event, faculty members present their latest research during breakout sessions and view presentations from Microsoft that highlight its current research and products in development. ☺



HCIL Director Ben Bederson and Microsoft Chairman Bill Gates demonstrate DateLens project.

Awards (June - November 2002)

- Activity Detection by Video Content Evaluation - ADVICE (NSF)
L. Davis, D. Doermann
- Customizable Audio User Interfaces for the Visually Impaired and the Sighted (NSF)
R. Duraiswami, L. Davis
- Customized Audio User Interface (ONR)
R. Duraiswami
- 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
- Development of a Formal Theory of Agent-Based Computing for System Evaluation and System-Design Guidance (DARPA)
J. Horty
- Enhancing Human Understanding of NCHS Statistics (HHS)
C. Plaisant, B. Shneiderman
- Enhanced Metadata Extraction (NASA)
J. Jajá
- 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. Jajá
- Gesture-Driven Control of Spaces and Objects in Collaborative Augmented Reality (ONR)
L. Davis, Y. Yacoub
- Handling Contradictory Data with Metareasoning (Air Force)
D. Perlis
- Human Computer Interface Design (Census)
K. Norman
- Human Tracking and Verification in Video (ONR)
R. Chellappa
- Improved Algorithms (NASA Goddard)
J. Townshend
- 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
- International Children's Digital Library (NSF)
A. Druin, B. Bederson, A. Weeks
- LAMP Lab (DoD)
D. Doermann, A. Weinberg
- Metareasoning for More Effective Human Computer Dialogue (Air Force)
D. Perlis
- Model-Based Integrated Approaches for Remote Identification of Humans (ONR)
R. Chellappa, L. Davis, J. Aloimonos
- 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. Jajá, A. Sussman
- Real-Time Capture, Management and Reconstruction of Spatio-Temporal Events (NSF)
H. Samet
- Real-Time Distributed Algorithms for Visual and Acoustic Sensor Data Processing (DoD)
L. Davis, V. Subrahmanian, J. Aloimonos
- Scalable Intelligent Agent Architecture for the 21st Century Battlefield (ARL)
V. Subrahmanian, D. Nau
- Search Interfaces for Biodiversity Informatics (NSF)
B. Bederson
- Secure Wireless Infrastructure Test Bed (NIST)
W. Arbaugh, A. Agrawala
- 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. Jajá
- Using the Web as a Corpus for Empirical Linguistic Research (NSF)
P. Resnik
- Workshop on Agent Based Systems (DoD)
V. Subrahmanian
- 3D Description and Recognition of Human Activities Using Distributed Cameras (NSF)
R. Chellappa

InterConnections is published by the University of Maryland Institute for Advanced Computer Studies, UMIACS.

For additional information, visit UMIACS on the web at <http://www.umiacs.umd.edu> or contact

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