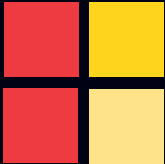




**University of Maryland Institute for Advanced Computer Studies**





**University of Maryland Institute for Advanced Computer Studies**

## **Promoting Excellence in Interdisciplinary Research and Education in Computing**

- UMIACS' programs are led by distinguished faculty, many of whom hold joint appointments in Computer Science, Electrical and Computer Engineering, Linguistics, Geography, Philosophy, Business, Education, the College of Information Studies, and the College of Life Sciences.
- UMIACS has nationally well-known research programs addressing fundamental issues at the interface between computer science and other disciplines.
- Major research and educational activities are conducted through UMIACS Centers and Laboratories and supported by a state-of-the-art computing infrastructure that includes high-speed networking, a variety of high-end computing machines, and over 400 workstations and PCs.
- UMIACS' environment is enriched by a strong outreach program including close collaboration with industry and government laboratories on focused research projects and the organization of seminars and workshops in emerging technology areas.

# Sponsored Research



Computer Vision and Graphics

Parallel and Distributed Computing

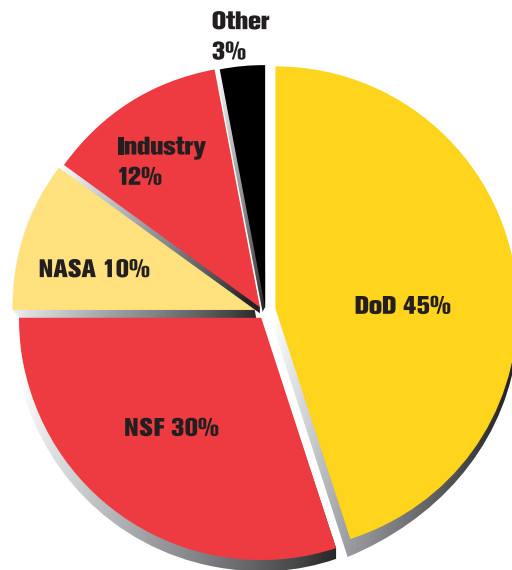
Natural Language Processing

Information Visualization and Educational Technologies

Multimedia and Internet Computing

Software Engineering

Core Computer Science:  
algorithms, artificial intelligence,  
computer security, databases,  
networks, operating systems, and  
scientific computing



**ANNUAL RESEARCH FUNDING**  
**\$15 MILLION**



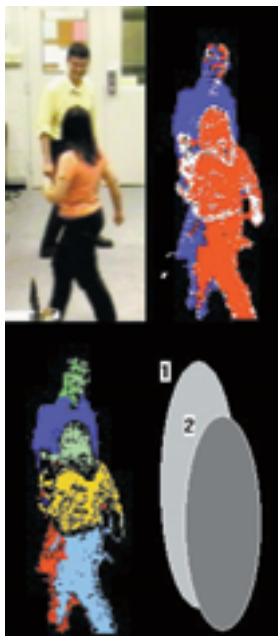
## UMIACS Centers

UMIACS Centers enable faculty to work on common interdisciplinary themes that are pursued through several major sponsored research programs. One or more laboratories are typically affiliated with each Center.

### Center for Automation Research

The Center for Automation Research (CfAR) conducts research on computer vision, graphics, image and video understanding, and robotics through three constituent laboratories.

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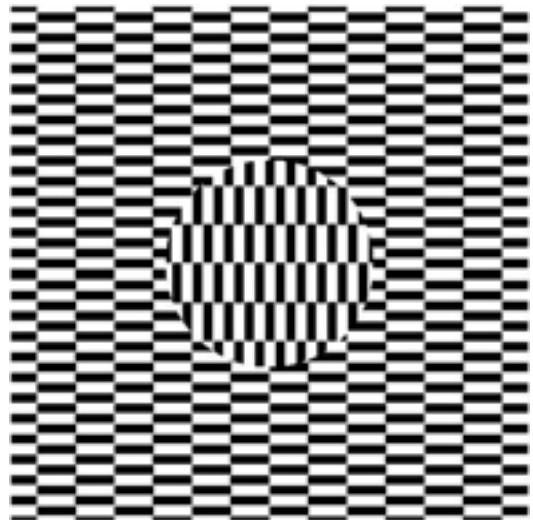


Tracking of people in groups: Input image (upper left); assignment of foreground pixels to people (upper right); segmentation of each person into parts (lower left); and occlusion model showing relative positions (lower right).

### Computer Vision Laboratory

The Computer Vision Laboratory was established in 1964 and is widely regarded as one of the top computer vision labs in the world. Research areas include computational theories of visual perception, virtual and augmented reality, navigation and object recognition, surveillance of human activities, image and video databases, spatial data structures, and geometric foundations of image analysis.

Contact: Dr. Yiannis Aloimonos  
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Moving this pattern produces different apparent motion in the inset and the background. The reason is the inherent difficulty of any vision system to deal with statistical bias. See, Ferrell et al, Vision Research, 40, 2000, 77-96.

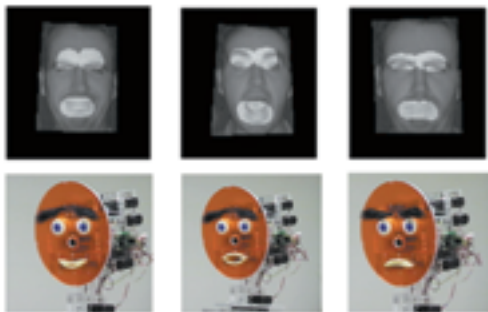


Screen shot from the SAND Spatial Browser illustrating the area to the east of University of Maryland towards Annapolis

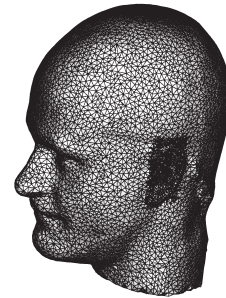
### Keck Laboratory for the Computational Modeling of Visual Movement

The Keck Laboratory includes a suite of conventional and biologically inspired sensors that are simultaneously used to view various human actions and interactions, and automatically generate graphical models of those actions that can be used to see the actions from new viewpoints.

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V-toy tracks and mimics facial expressions

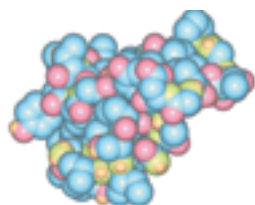


Left: High resolution of head with detail of ear; Right: Black and white rendering of head and ear

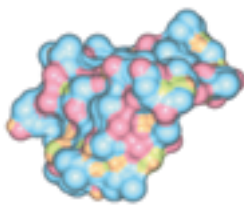
### Autonomous Mobile Robotics Laboratory

Two active research areas are currently being pursued in the Autonomous Mobile Robotics Laboratory. In traditional robotics, the main focus is on intelligent control of goal-based robotics and motion planning. Recent research has evolved into the development of new ways for designing constructive robots and new perspectives of the roles of robotics in education and entertainment. With collaborators (elementary school children, artists, computer scientists, educators, and engineers), a robotic story telling environment called PETS (Personal Electronic Teller of Stories) has been created in which children write stories, construct robotic animals, describe emotions, and direct the robots to become actors in their narratives.

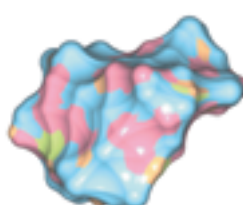
Contact: Dr. Jim Hendler  
301-405-2696, [hendler@cs.umd.edu](mailto:hendler@cs.umd.edu)



Atoms as Van der Waals spheres



Surface for probe-radius 1.4Å  
(radius of the water molecule)



Surface for probe-radius 5.0Å



Surface for probe-radius 10.0Å

Studying the changes in the solvent-accessible molecular surface for Crambin with changes in the radius of the probe. Images by the GVIL lab.

### Center for Bioinformatics and Computational Biology

This new Center is advancing research and education in computational biology through the establishment of well-funded and nationally visible research programs that are at the interface between biological and computational sciences. Participating faculty come from a variety of backgrounds including computer science, mathematics and statistics, molecular biology, and biochemistry. Initial research programs focus on the area linking functional genomics and proteomics. In particular, faculty are developing advanced visualization and high-performance techniques and tools to analyze biological data and model protein structures.

Contact: Dr. Joseph JaJa  
301-405-6722, joseph@umiacs.umd.edu

### Fraunhofer Center for Experimental Software Engineering

The Fraunhofer Center for Experimental Software Engineering is the world-leading center for applied research and technology in experimental software engineering. The Center works with companies, agencies and organizations to evaluate their development practices, recommend improvements, and provide training and direct support. Companies use techniques such as data collection, characterization, and feedback to build learning organizations and better understand their software business. Local experience and knowledge are accumulated and analyzed continually to help meet near and long-term business goals.

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Dr. Marv Zelkowitz  
301-405-2690, mvz@cs.umd.edu

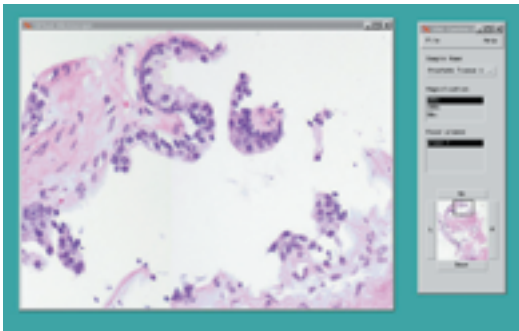
# UMIACS Laboratories



## Laboratory for Parallel and Distributed Computing

Established in 1985 to support research in parallel and distributed systems, with an emphasis on software environments, tuning and performance tools, algorithms, scientific computing, and large-scale applications. Current computational resources include an IBM SP2, a large DEC Alpha SMP cluster, a combined IBM SP multiprocessor and archiving system, a 64-processor Linux cluster, and a large SUN SMP. Recent focus of the Laboratory for Parallel and Distributed Computing has been on large-scale, data-intensive applications such as those arising in internet, earth science, and biomedical applications.

Contact: Dr. Joseph JaJa  
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The Virtual Microscope user interface

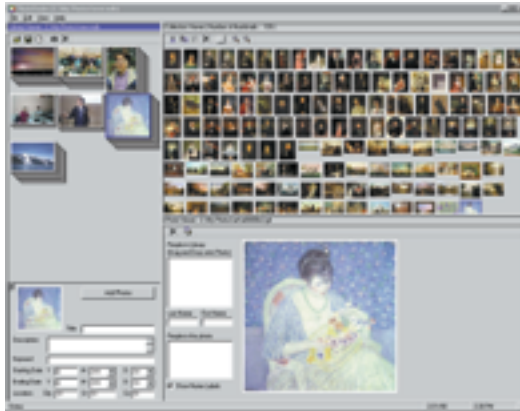
## Language and Media Processing Laboratory

The Language and Media Processing (LAMP) Laboratory focuses on the integration of two research themes. The first deals with the analysis and processing of multimedia information sources including documents, images, and video. The second deals with cross language applications, including machine translation, information retrieval, and foreign language tutoring. The lab includes a document and video management infrastructure as well as a number of software packages for scanning, OCR, image manipulation, video storage and retrieval, and multilingual processing.



Office Activity Recognition and Filtering

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Dr. Amy Weinberg, 301-405-6444/6748,  
weinberg@umiacs.umd.edu



PhotoFinder, a program for managing collections of digital images



Searchkids interface for letting children search databases

### Human-Computer Interaction Laboratory

Founded in 1983, the Human-Computer Interaction Lab (HCIL) conducts research on advanced user interfaces and their development processes. Interdisciplinary research teams study the entire technology development life-cycle which includes initial technology design, implementation issues, and evaluation of user performance. This work has developed new theories, methodologies, and technologies. Current work includes new approaches to

information visualization, interfaces for digital libraries, multimedia resources for learning communities, zooming interfaces (ZUIs), technology design methods with and for children, and instruments for evaluating user interface technologies.

Contact: Dr. Ben Bederson  
301-405-2764, bederson@cs.umd.edu

### The Maryland Information and Network Dynamics Lab

The Maryland Information and Network Dynamics (MIND) Lab is a joint university, private industry, and federal agency initiative designed to foster new large scale computer science projects. Its scope includes wireless networking, information services and information-centric applications, networking infrastructure and services, and information assurance and security.



Contact: Dr. Ashok Agrawala  
301-405-2525, agrawala@cs.umd.edu

### Distributed Systems Software Laboratory

The Distributed Systems Software Laboratory provides a testbed for developing and testing system software to support parallel and distributed computing. Recent projects have included evaluating active networking systems, developing new OS policies to exploit fine-grained workstation idle intervals for parallel computation, and the development of



Active Harmony resource aware programming environment. The lab's infrastructure includes a network of commodity personal computers connected by a high speed LAN.

Contact: Dr. Jeff Hollingsworth  
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### Laboratory for Computational Linguistics and Information Processing



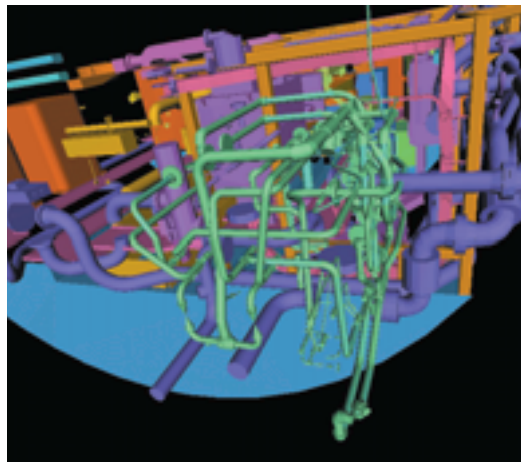
The Laboratory for Computational Linguistics and Information Processing (CLIP) conducts research in natural language processing, machine translation, cross-language information filtering, retrieval and topic detection, parallel text acquisition and annotation, foreign language acquisition and evaluation software, architectures for wide-area query processing, query optimization for heterogeneous information servers, and source discovery and selection on the World Wide Web.

Contacts: Dr. Bonnie Dorr  
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Dr. Louiqa Raschid  
301-405-6747, louiqa@cs.umd.edu

### Graphics and Visual Informatics Laboratory

The Graphics and Visual Informatics Laboratory addresses fundamental issues to improve the efficiency and usability of visual computing applications in science, engineering, and medicine. Research interests cover end-to-end solutions involving design of data structures for rapid access across memory and network hierarchies, influence of heterogeneous display and rendering devices over the visual computing pipeline, techniques for reconciling realism and interactivity for very large datasets, and visual data mining and information visualization from content-rich datasets. Current driving applications are proteomics and mechanical CAD.

Contact: Dr. Amitabh Varshney  
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Closeups of pipes in the Auxiliary Machine Room of the submarine dataset from Electric Boat Division of General Dynamics



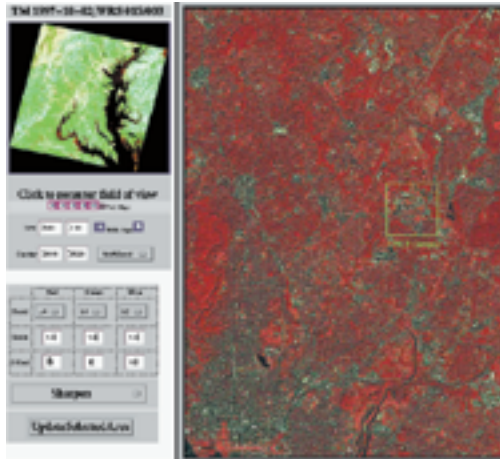


## The Global Land Cover Facility

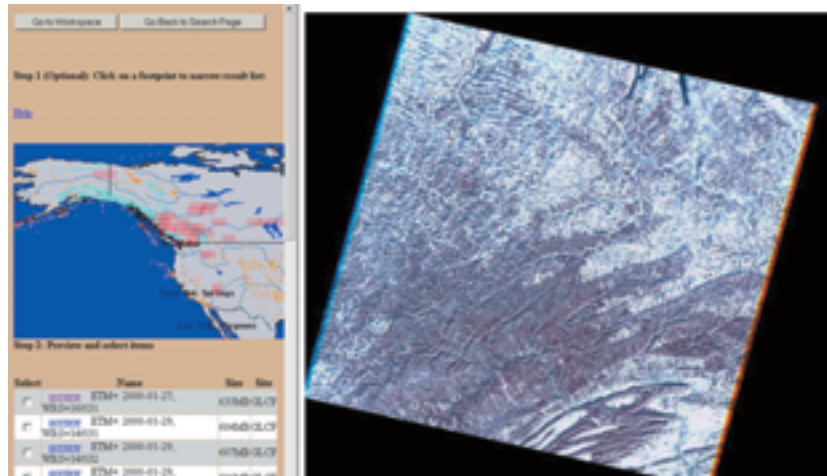
The Global Land Cover Facility (GLCF) provides novel land cover products and computer science technologies in support of advanced research in Earth System

Science. The GLCF is part of the NASA-supported Earth Science Information Partnerships, a federation of collaborating laboratories and data centers offering enhanced satellite data sets and services to the Earth Science community and other users such as schools and businesses. Researchers at the GLCF are addressing the processes underlying land cover dynamics and land-atmosphere interactions, as well as developing computer science technologies in data storage and management, visualization, information discovery, and mining of large-scale distributed geospatial data.

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Dr. Joseph JaJa, 301-405-6722,  
[joseph@umiacs.umd.edu](mailto:joseph@umiacs.umd.edu)



RGB pseudo color composite over the University of Maryland (enclosed in box) collected by the Landsat



Downloading Landsat Enhanced Thematic Mapper Data: The GLCF provides dynamic access to over 5,000 Landsat satellite images through an internet map server. The map server allows querying by geospatial events such as earthquakes or carbon emission. The image shown is a preview of an 185km x 175km satellite acquisition.

# Partnerships with National and International Research Centers



UMIACS has established several long-term partnerships, including:

- The National Partnership for Advanced Computational Infrastructure (NPACI) led by the San Diego Supercomputer Center and supported by the NSF. UMIACS faculty are participating in four thrust areas: Programming Tools and Environments, Data Intensive Computing, Earth Systems Science, and Resources.
- The Laboratory for Telecommunications Sciences (LTS), a major collaborative center between the Department of Defense, industry, and academia. University of Maryland work focuses on a broad research program dealing with fundamental and applied research in the design, performance, and management of distributed heterogeneous networks.
- The Army Research Lab Collaborative Technology Alliances involving research in advanced sensors, sensor fusion, image analysis, artificial intelligence, and computer vision algorithms for the navigation of vehicles over rugged terrain.



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