UMIACS
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InterConnections

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Contents

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UMIACS Professor Jim Hendler co-invents the "next web"

A law enforcement officer who uses Google to ask the query "total coca crop in Peru" gets about 178,000 documents in response – to find the number he wants, he has to spend several minutes going through these documents and manually extracting this number. If Jim Hendler, a professor in Computer Science and UMIACS had his way, this user would get the answer in one word. No searching. No browsing. Just the answer, straight up.

Hendler, and his collaborator, Tim Berners-Lee (who, incidentally, invented the World Wide Web) have invented a new web paradigm called the Semantic Web. While today's web pages provide coding that allows browsers to display the data, the Semantic Web will allow tomorrow's browsers to make semantic sense of the data. This in turn will allow web browsers to offer an increasing array of services to consumers. Hendler and Berners-Lee have jointly authored a number of articles on the Semantic Web, including the cover article in a 2001 *Scientific American* article, and have recently received a large grant from the National Science Foundation to explore new and different ways the Semantic Web can be deployed.

"The Semantic Web is sometimes hard to explain," said Hendler. "While it coexists with the current Web and expands its capabilities, it is also a 'next generation' technology in the sense of bringing many new capabilities beyond what the Web can do now. For example, there are many kinds of information that are accessible through the Web, but which can't really be searched for, browsed or queried, the way text pages can. The Semantic Web will bring new capabilities in organizing and accessing data and databases, multimedia archives and products, and new services to the Web."

Dr. Jim Hendler

A major innovation in the Semantic Web is the creation of machine readable vocabularies, called ontologies, for the Web. First started by Hendler and his students in the early 1990s, Web Ontologies have gone from what Hendler calls "a crazy research dream" to one of the newest standards released by the World Wide Web Consortium (W3C), an organization of over

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Director's message


UMIACS Director V.S. Subrahmanian

I am pleased to report that UMIACS faculty have made a tremendous surge forward in the second half of 2005. UMIACS' sponsored research funding soared to over $22 million in FY 2005 – the highest ever. This surge in funding was complemented by the creation of an exciting new laboratory within UMIACS and external awards and recognitions showered on many of our faculty members and students.

I am pleased to announce the creation of the Laboratory for Computational Cultural Dynamics (LCCD) – Professor Dana Nau will serve as its first Director. LCCD's overall goal is to build computational tools to understand how groups in foreign countries "think" and how these foreign groups act based upon the cultural context within which they reside. The creation of LCCD has profound implications for national security where there is interest in understanding how terror groups think and act, for global health where simple sociological interventions can often prevent the spread of diseases, and in trying to bring about social change by identifying the social, political, economic, cultural and religious drivers that are preventing the desired change. Computational research areas that will contribute directly to LCCD's goals include database systems, artificial intelligence, game theory, reasoning with uncertainty, document management, classification methods, and graph theory. LCCD held an International Working Group Summit on March 24 to bring together researchers from diverse communities in a bid to understand these problems. LCCD is working with a mix of political scientists, sociologists, computer scientists, economists, sociologists, anthropologists, and health care professionals in their bid to bring about such change.

I am also pleased to announce some major awards. Allison Druin has been named by President Bush to the National Commission on Libraries and Information Science (NCLIS), while Ashok Agrawala has been elected a Fellow of the AAAS. A team of students and faculty from UMIACS won the best student paper award at the 2005 Supercomputing Conference (SC '05). Steven Salzberg, who heads the Center for Bioinformatics and Computational Biology, and has published a highly visible paper in Nature recently, has become one of the most sought after speakers on the potential flu pandemic – over the last few months he has been interviewed by the Philadelphia Inquirer, Sirius Satellite Radio, Voice of America, and local radio and TV channels WJLA and WTOP. There are numerous other awards and honorable mentions that our faculty have won during the latter half of 2005 that are listed in further detail in this newsletter.

Last, but not least, UMIACS is pleased to welcome Professor Rance Cleaveland (full Professor CS/UMIACS) to our faculty. Professor Cleaveland comes to us from SUNY Stony Brook where he built up an international reputation in concurrency and verification. His Concurrency Workbench is one of the best known toolkits for verifying the correctness of concurrent programs. Professor Cleaveland will also serve as Executive Director of the Fraunhofer Center for Experimental Software Engineering in College Park. We hope to strengthen our already strong ties to Fraunhofer during his tenure as Director.

Visual Illusions

...continued from back cover

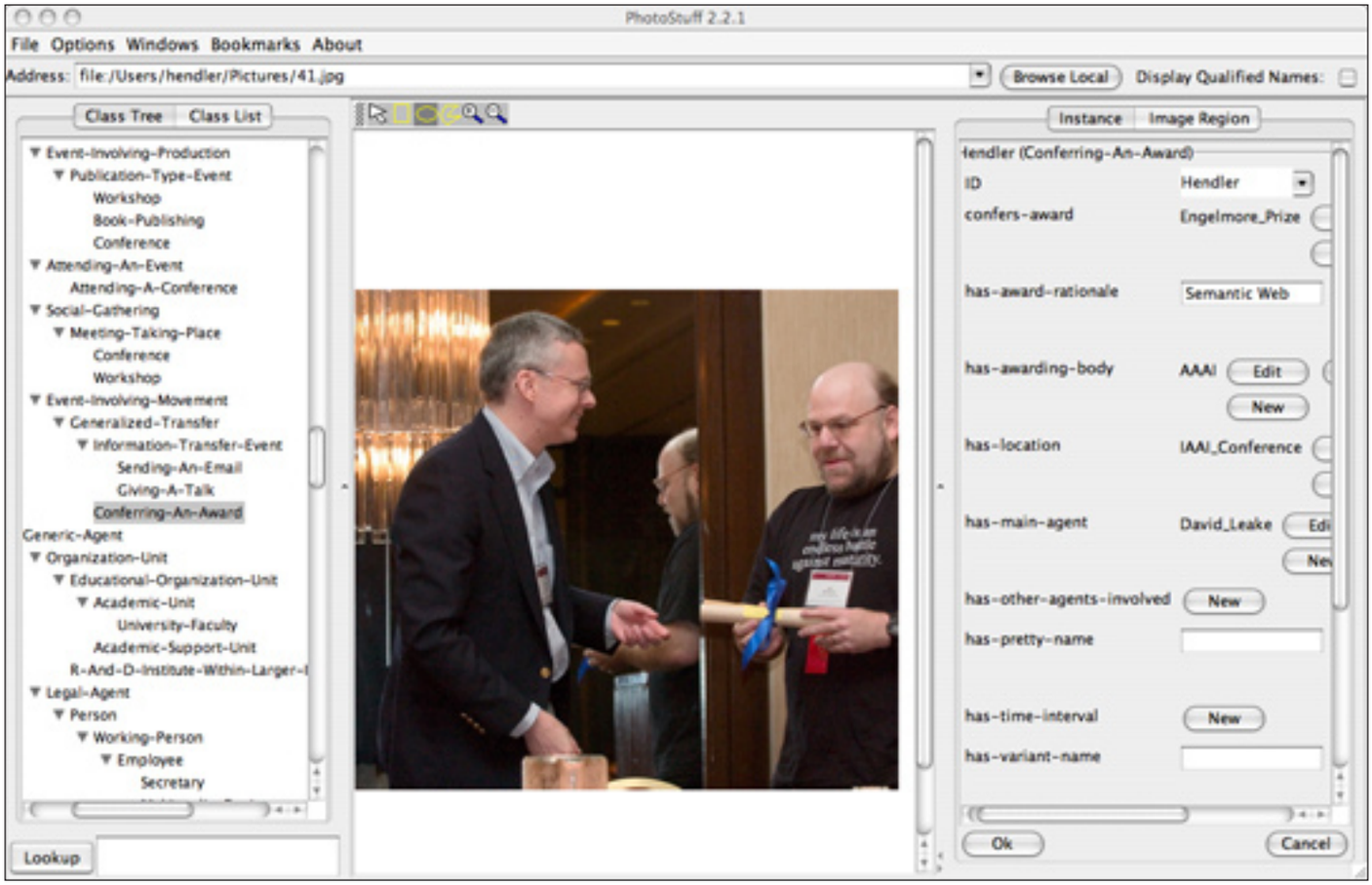
sions are due to the statistics of visual computations. The vision system, like any other system, has to process data which is noisy. Computationally, many problems in vision, such as finding image motion, are estimation processes. Due to the presence of noise, the estimated and the actual value are different. In statistical terms, there is systematic error, or bias. This bias leads to an erroneous perception, and thus optical illusions are perceived. For example, in Figure 1, the image motion estimated in the surround is different from the image motion estimated in the center part. As a result, the difference between the two motions is seen as motion of the inset relative to the surround. The bias occurs with any visual estimation; under average conditions it is not large enough to be noticeable, but illusory patterns are such that the bias is highly pronounced.

Fermüller continues to work along the lines of this newly formed interdisciplinary research that aims to use mathematical and computational tools to investigate the workings of perception. Assuming that the human vision system is pretty much optimal, we can ask questions of what the best ways in statistical, computational or numerical terms are to solve a problem. Illusions are an ideal tool; they produce maximal error and they can be used as inspiration as to what these computations are, and computational theories can be tested through parametric variations of illusory patterns.

C. Fermüller, and H. Malm. "Uncertainty in Visual Processes Predicts Geometrical Optical Illusions." Vision Research (44) 2004, 727-749.

Hendler invents 'next web'

...continued from page 1



A sample of the Semantic Web, the photograph of Dr. Hendler receiving the Englemore award is annotated with a web ontology.

400 organizations working to develop Web standards. "The Web ontology language, OWL, has been the result of the work of researchers, supported by DARPA in the US and the IST program in the European Union, industrial players and government. It was exciting to see the language grow from our research in to part of an internationally recognizable standard, now supported by some of the biggest Information Technology companies in the world," said Hendler, who, along with a colleague from Holland, co-chaired the W3C working group that developed the OWL standard.

The new NSF grant, for which Hendler is the Principal Investigator supported by Berners-Lee and other MIT professors, is for a project called the "Policy Aware Web." The goal of this project is to use Semantic Web technologies not just to make more information more widely sharable, as has been the focus to date, but to explore how these technologies can be used to control access and privacy on the Web. As more information is made available, this grant focuses on how it can be better protected and controlled.

In the past few years, the Semantic Web has gained international acceptance in the business world, but at the same time has opened up new research opportunities in Computer Science and beyond. There are now at least two annual Semantic Web conferences which continue to grow yearly, a major academic journal in the area, and a number of recent PhD theses on the topic. In 2002, Maryland graduated the first PhD student in the world to specialize in the Semantic Web. This year there were closer to 50 who completed doctorates in the US, Europe, Asia and South America, and there were over 200 active students who attended the International Semantic Web conference from all over the world.

"It is gratifying to have been involved in a technology that has near term potential for applications as recognized by industry, but also opens up challenging new problems for researchers in the CS areas of Artificial Intelligence, Database and Architecture in Computer Science, as well as in biology and life sciences and other scientific disciplines," said Hendler, "I can't wait to see how things change over the next few years as the technology really comes of age."

More information about Dr. Hendler and the Semantic Web can be found at http://www.cs.umd.edu/users/hendler/.

Global Land Cover Facility Uses Satellite Imagery to Assess Damage from Hurricane Katrina

http://www.landcover.org

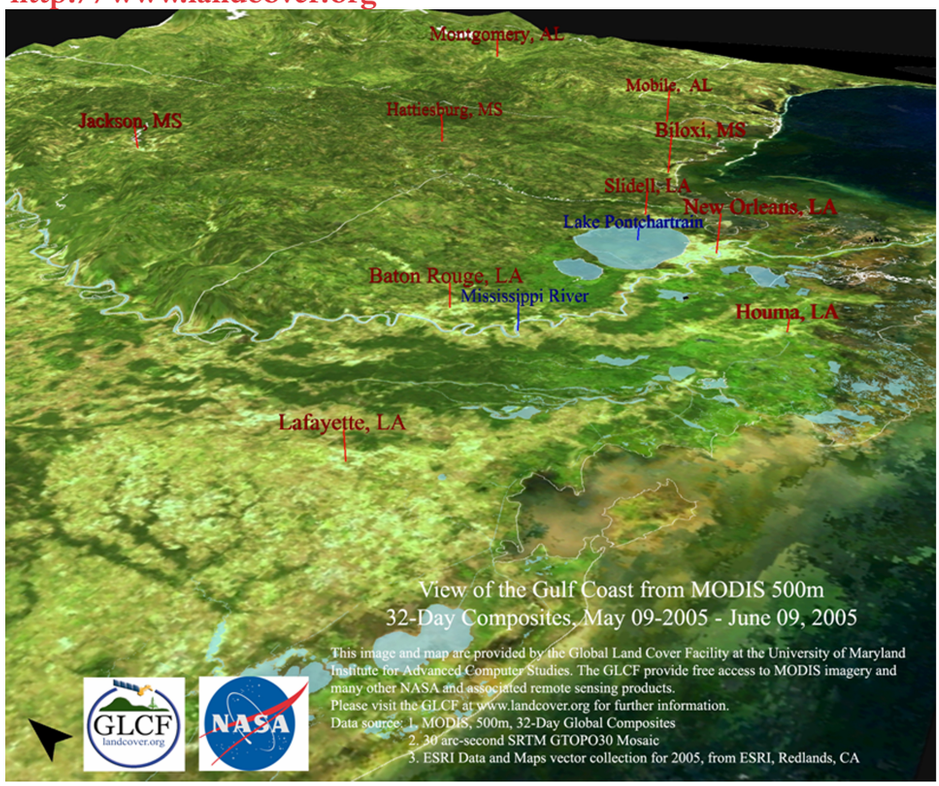


Figure 1. Composites from the Moderate Resolution Imaginng Spectroradiometer MODIS)

The Global Land Cover Facility (GLCF), a center within UMIACS, has worked extensively on the assessment of the impact of Hurricane Katrina. Hurricane Katrina, part of the 2005 June 1 – November 30 Atlantic Hurricane Season, became one of three hurricanes to peak at Category 5 strength (over 156 mph and a storm surge over 18 feet). Katrina made landfall as a Category 1 hurricane in Florida and then again as a Category 4 hurricane in Louisiana, flooding most of New Orleans. As a result of breaches in the levee system, over 1300 people died in the hurricane, there was extensive environmental impact and fiscal damages are assessed at between $70 and $130 billion dollars, making Katrina the most costly natural disaster in American history.

The Global Land Cover Facility was asked by the NASA Science Mission Directorate to participate in a NASA-wide effort to utilize a variety of satellite imagery to visualize the pre- and post-Katrina affected area. Figure 1 utilizes surface reflectance composites from the Moderate Resolution Imaging Spectroradiometer (MODIS)[1] to visualize the area where Katrina made landfall. The composite is also draped over a 30 arc-second digital elevation model (DEM). Figure 2 utilizes a mosaic created from the higher-resolution Landsat ETM+ instrument to visualize the same region. Note the proximity of the populated areas (pink) to the coastline. GLCF has also developed products to visualize the topography of the region with the low-lying land clearly visible in green. They have also developed a Vegetation Cover Conversion (VCC)[2] product which can display areas of persistent flooding resulting from the hurricane. In addition to conversion along the barrier islands, there was significant impact on the land cover in and around Lake Ponchartrain.

The future of satellite imaging of hurricanes is perhaps not just in portraying hurricane impact but also in vulnerability assessment and the mitigation of future damages. This is not accomplished easily and such efforts require further research, modeling, the support of a network of stakeholders and, perhaps most of all, the incorporation of research results into receptive decision support systems. That said, NASA has provided room for such efforts as reflected in its "12 Applications of National Priority". Science has a role to play in the prevention of tragedies such as Hurricane Katrina and the GLCF will continue to be part of it.

These products and their data inputs were utilized by FEMA and the Department of Homeland Security for recovery purposes. In addition to these Hurricane Katrina materials, data and products are openly available for Hurricane Rita and the 2004 tsunami through the GLCF web site.

[1]Townshend, J.R.; DeFries, R.; Hansen, M.; Sohlberg, R.; Carroll, M.; DiMiceli, C. MODIS 32-Day Composites, May 09 2005 to June 09 2005. College Park, Maryland: The Global Land Cover Facility.

[2]Carroll, M.L., DiMiceli, C.M., Townshend, J.R.G., Sohlberg, R.A., Hansen, M.C., DeFries, R.S.. 2004. 250m MODIS Vegetation Cover Conversion. College Park, Maryland: The Global Land Cover Facility.

Figure 2. Mosaic from Landsat ETM+

Fraunhofer Center Pioneers Research in Software Engineering

http://fc-md.umd.edu/fcmd/

UMIACS has close connections with a number of research centers affiliated with the University of Maryland. This article spotlights one of these: the Fraunhofer USA Center for Experimental Software Engineering (CESE).

CESE is an applied research institute devoted to the study of software engineering. The Center has two key components to its mission: to conduct original research into new ways for improving the development and deployment of software, and to act as an agent for transferring proven software-development technologies into practice. Besides UMIACS, CESE has affiliations with the Computer Science (CS) Department at the University of Maryland and the Institute for Experimental Software Engineering (IESE) at the Technical University of Kaiserslautern in Germany.

The Center's Executive and Scientific Director is Professor Rance Cleaveland, who also serves as a full professor in the CS Department and has an appointment at UMIACS. Professors Vic Basili and Marv Zelkowitz, also from the CS Department and UMIACS, hold positions as chief scientists. CESE also employs seven other PhD researchers and eight other members of the technical staff. Research expenditures in 2005 totaled approximately $2.5 million.

Within the general discipline of software engineering, CESE focuses its research efforts on the following areas: quantitative techniques for assessing the quality of both software and software-development processes; mechanisms for capturing and reusing the lessons learned during software-development projects; software process improvement; techniques for validating software correctness; methods for assessing and improving software safety and reliability; and approaches to modeling and analyzing software architectures and embedded systems. CESE staff have worked internally and with collaborators in UMIACS, the CS department, and IESE on research projects relating to these topics, with the support of funding from the National Science Foundation, NASA, various defense agencies, the German government and numerous private companies.

CESE uses contract work with both public agencies and private-sector companies to fulfill the technology-transfer component of its mission. The Center has ongoing projects with several US defense agencies, NASA and local technology firms devoted to improving the methods used by these organizations for improving software development and acquisition. CESE staff have particular expertise helping organizations obtain qualifications for their software-development processes on the Capability Maturity Model Integration (CMMI) scale developed by the Software Engineering Institute at Carnegie Mellon University.

"CESE's ability to work both on research and tech-transfer projects places it in a unique position to positively influence both research and practitioner communities," said Professor Cleaveland. "Our researchers get to see, and work on, real-world problems, and our tech-transfer specialists know about, and contribute to, cutting-edge research."

Besides its research and technology-transfer projects, CESE maintains an active student intern program, hosting students from Germany and from the University of Maryland. Cleaveland noted that there are anywhere from 2 to 6 students at a time working in the Center.

CESE was founded in 1998 and is a member of the German-based network of Fraunhofer research institutes. Worldwide, there are over 60 such institutes in all areas of applied science and engineering, with combined research expenditures of over 1 billion euros ($1.2 bn). Besides CESE, the US has four other Fraunhofer Centers: the Center for Laser Technology (CLT) in Plymouth, Michigan; the Center for Manufacturing Innovation (CMI) in Boston, Massachusetts; the Center for Molecular Biotechnology (CMB) in Newark, Delaware; the Center for Coatings and Laser Applications (CCL) in East Lansing, Michigan.

CESE is located one block away from the University of Maryland campus, at 4321 Hartwick Road Suite 500, College Park MD 20742, USA.

Additional information is available from Frank Herman at 301.403.2705 or fherman@fc-md.umd.edu.

UMIACS Receives Three New DARPA Awards for Language Technology

The University of Maryland will play a central role in the largest program for fundamental research on language technology ever created. The program, Global Autonomous Language Exploitation (GALE), draws together research efforts in speech processing, machine translation, information extraction, information retrieval, and automated summarization that had previously been pursued as separate efforts.

The program also includes a new emphasis on user modeling, a requirement to handle a diverse range of informal genres (such as talk shows and blogs), and a strong focus on system integration. Maryland researchers are members of all three of the large research teams around which the program is organized, with Bonnie Dorr, Mary Harper, and Doug Oard each serving as Principal Investigator for one subcontract. In addition to UMIACS, researchers from four campus units are involved in the program: the Center for Advanced Study of Language (Mary Harper, Judith Klavans), Computer Science (Bonnie Dorr), Information Studies (Jimmy Lin, Doug Oard), and Linguistics (Philip Resnik, Amy Weinberg).

Work in GALE at the University of Maryland builds on approximately 18 years of continuous support for computational linguistics within UMIACS. GALE has set new and ambitious performance targets in a number of key human language applications. Speech data will need to be automatically annotated with structural and meta-information; in addition, accurate transcription and annotations will be needed for downstream applications. In machine translation, the goal is to produce accurate and fluent English renditions of information in other languages, whether that information originated in writing or in speech. In summarization, the goal is to automatically generate reports that present salient content in a way that highlights the credibility of, and contradictions between, different sources. In what DARPA terms "distillation," the goal is to automatically generate reports that satisfy the user's information needs, adapting to the user's knowledge and intent in seeking the information. At the level of evaluation and system integration, the goal is to shape component development and system integration efforts through regular exposure to the needs and abilities of real users.

Doug Oard is the UMD PI for a collaboration with the IBM T. J. Watson Research Center (as lead), Brown, CMU, Johns Hopkins, Pittsburgh, Columbia, and Stanford. Efforts will focus on machine translation, user modeling, summarization, and user-centered evaluation. Philip Resnik will lead the machine translation work, Bonnie Dorr leads the work on summarization, and Doug leads the work on user modeling.

Mary Harper is the UMD/Purdue PI in a collaboration with SRI International (as lead), University of Washington, Berkeley, Columbia University, NYU, HNC/Fair Isaac, and University of Massachusetts. Her work as a member of this team will focus primarily on parsing and annotation technology for spoken documents, and on adapting methods to work in Mandarin and Arabic.

Bonnie Dorr is the UMD PI for a collaboration that also includes BBN Technologies (as lead) and USC/ISI. Her work as a member of this team will focus primarily on models of speech and translation, including areas such as disfluency, punctuation insertion, language models for speech, and semantic-oriented frameworks for machine translation.

As the University of Maryland's primary center for interdisciplinary research in information technology, UMIACS provides a unique venue for collaboration at the scale required by projects such as GALE. Together with the Center for Advanced Study of Language (http://www.casl.umd.edu/), the thirty faculty, postdocs and graduate students of the Computational Linguistics and Information Processing Laboratory (http://www.umiacs.umd.edu/research/CLIP/) at UMIACS form one of this nation's premiere research teams in a field that is increasingly being recognized as a key technology with important cultural, commercial, and security implications.

Dr. Rita R. Colwell recieves Order of the Rising Sun, Gold and Silver Star

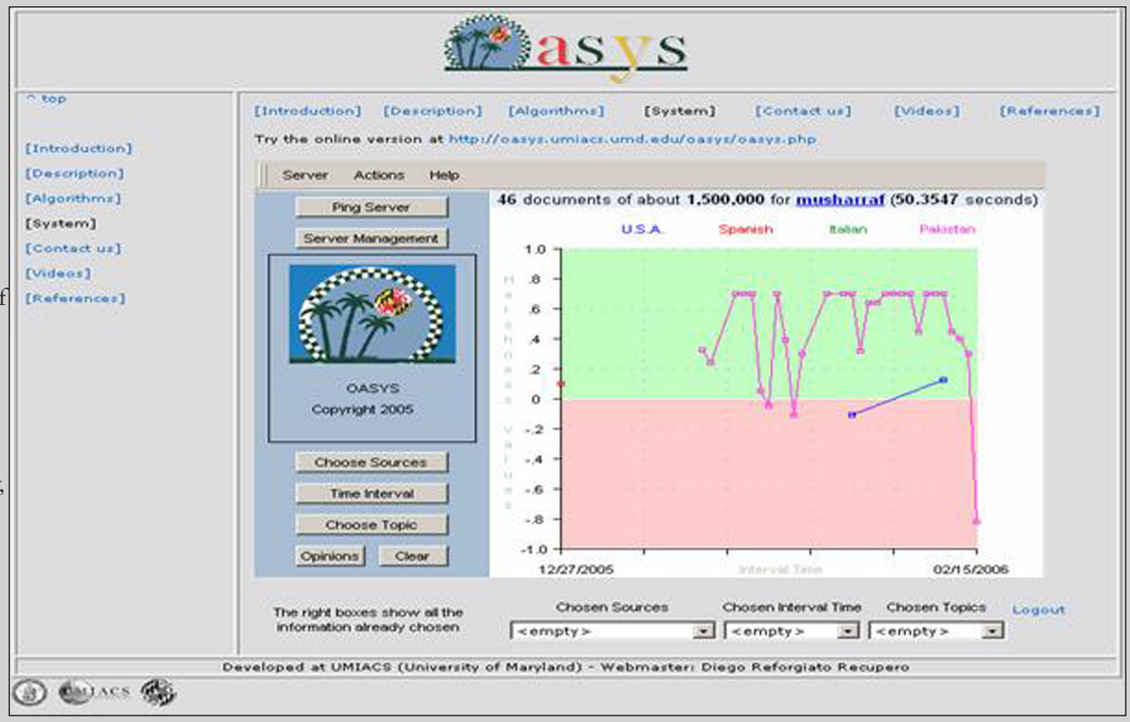
Dr. Rita R. Colwell, Distinguished Professor at the Center for Bioinformatics and Computational Biology (CBCB) has received the Order of the Rising Sun, Gold and Silver star, a highly prestigious decoration from Japan. Established in 1875, the award is granted for the performance of remarkable public service. The Gold and Silver Star is the second highest rank in the Order; there are a total of six ranks. The Gold and Silver Star is awarded to individuals of a Ministerial rank.

Dr. Colwell was one of only 4 non-Japanese nationals to be awarded this honor for 2005, and the only US citizen. She was recognized for her contributions to the advancement of science and technology cooperation

Dr. Rita R. Colwell

UMIACS Starts New Lab To Model Behavior of Cultural Groups

http://www.lccd.umiacs.umd.edu



UMIACS Director V.S. Subrahmanian announced the opening of the Laboratory for Computational Cultural Dynamics (LCCD) whose main goal is to develop the computational infrastructure required to understand the behavior of organized groups in foreign countries. According to Subrahmanian, "the need to understand the behavior of social, political, economic, paramilitary, religious, terrorist and other entities around the world, and to formulate policies that effectively influence this behavior has never been greater. Most data about such groups is stored in vast document collections. LCCD has been, and will continue to, develop the techniques required to extract key facts about such groups, identify and understand the cultural, financial, supervisory and other relationships between groups and group members. LCCD has developed the methods required to automatically quantify the intensity of opinions held by these groups on a myriad of topics, and will focus on automatic means to identify the correlations between the actions taken by these groups and their quantitative levels of belief, opinions, and socio-economic-political-military conditions prevailing in their homeland."

Professor of Computer Science Dana Nau, who will serve as the first Director of LCCD, went much further. "We propose to develop experimental policy platforms that can be used to formulate policies that achieve a desired goal in real time. Our systems will try to find policies that will achieve a given goal with maximal probability. They will also support policy experts in assessing the impact of policies they may be considering. The system will support viewing, modifying and understanding the repercussions of policies they may be contemplating. LCCD is a unique collaboration between computer scientists, sociologists, political scientists, economists, and anthropologists."

LCCD builds on a list of software products already developed by LCCD scientists – a system called STORY to extract key relationships between entities from multilingual text documents (STORY's capabilities were highlighted by *ComputerWorld* magazine in their September 12 issue), a system called OASYS to quantify the intensity of opinion on a given topic in a set of text documents (e.g., newswires, blogs, chats), and sophisticated algorithms to create and deploy training video games based on real world data. According to Dr. Marvin Weinbaum, a former State Department official who currently is affiliated with both LCCD and the Middle East Institute in Washington, DC, "LCCD's focus on gathering vast quantities of real time data about targets of interest to the intelligence community and then building accurate models of behavior on top of such real time data will be a huge asset to the DoD and intelligence community."

To accomplish these tasks, LCCD has developed a seasoned team of computer scientists as well as professionals with hands on counter-terrorist experience. These include General Felipe W. Gutierrez Rodas who has extensive experience fighting the Shining Path and Tupac Amaro terrorist movements in Peru, and Mr. Shahmahmood Miakhel who served as Deputy Minister for the Interior in Afghanistan between 2003 and 2005 and negotiated the release of the UN hostages in Afghanistan in 2004. According to Mr. Miakhel, "LCCD is developing the key technologies needed to support counter terrorist and counter drug investigators around the world. Their electronic database of knowledge about groups in the Pakistan Afghanistan borderlands is amongst the best I have seen."

Dr. Rance Cleaveland II

W. Rance Cleaveland II joins UMIACS Staff as Executive Director of The Fraunhofer Center for Experimental Software Engineering

W. Rance Cleaveland II is one of the few people on the UMIACS faculty who can actually lay claim to being a Maryland native: he was born in Baltimore at Johns Hopkins Hospital in 1961, although his family subsequently moved away, and he grew up in Chattanooga, Tennessee. After graduating from Duke with BS degrees in Mathematics and Computer Science, he went to Cornell University, where, as a contemporary of Professor Bill Pugh, he earned his MS and PhD in Computer Science in 1985 and 1987, respectively. He then spent two years as a postdoctoral fellow at the University of Sussex, in Great Britain, before starting his academic career at North Carolina State University in 1989, where he received tenure and was promoted to associate professor. A move to SUNY Stony Brook followed in 1998 (where he was a contemporary of Professor Amitabh Varshney) and three years later he co-founded a company, Reactive Systems Inc., to commercialize some of his research in embedded software design automation. This past summer Professor Cleaveland came to the University of Maryland where he is a full professor in the Computer Science Department and Executive Director of the Fraunhofer Center for Experimental Software Engineering.

Professor Cleaveland was a 1991 recipient of a National Young Investigator award from the National Science Foundation and a Young Investigator award from the Office of Naval Research. In 1994 he won the Alcoa Engineering Research Achievement award from North Carolina State and IFIP Working Group 2.1 elected him a member in 1998. He is author of more than 100 published articles.

Dr. Cleaveland's interests lie in the areas of formal modeling and validation of software systems. His research contributions have been in the areas of model-checking algorithms and tools; algebraic techniques for modeling real-time and probabilistic systems; mathematical approaches to software architecture; and automated techniques for software testing. He also has a strong interest in embedded software development. "I see embedded software as one of the great frontiers in computing," he says. "Virtually every device that uses electricity now contains software, and building software-development methods, algorithms and tools and techniques for use by embedded-system engineers will have tremendous beneficial impacts for industry and society."

Vibha Sazawal Helps Programmers Make Better Decisions

Companies release upgrades of software with astonishing frequency. Yet, the process of making these upgrades can pose a formidable economic challenge to the companies involved: how can upgrades be made in a timely manner at a relatively low cost? Vibha Sazawal, who will join the Computer Science and UMIACS faculty in Spring 2006 may have the answer. To her, "the most interesting challenges in software engineering research involve helping average, error-prone programmers make better decisions."

Professor Sazawal, who received her PhD in Computer Science at the University of Washington will bring with her a wealth of experience in how to develop the computational tools required to make programmer's write better. In a world where programs are constantly being upgraded by vendors, and where programmers are able to move easily from one company to another, there is a strong need for tools that allow a new programmer to rapidly and accurately upgrade another programmer's work.

Dr. Vibha Sazawal

Dr. Sazawal's *Design Snippets* tool is a state of the art tool based on a clear articulation of the design principles that support upgrades and modifications. *Design Snippets* are scoped design representations created using static analysis of code. The content of a snippet allows the designer to articulate how the design principles are tied to the actual code. When a new programmer taking over a project views a body of pre-existing code, the snippet gives her a clear idea of how the code fits into the overall design of the product.

While at the University of Washington, Dr. Sazawal also created and taught a course entitled "Women, Computing and Collaborating," to help address the problem of gender under-representation in computer science. In the course, funded by an Intel Foundation grant, students worked in teams, got a chance to be creative, and learned about programming (with Lego robots), hardware and algorithms. Professor Sazawl believes the course, which continues to be taught, was successful, but she says "I learned that recruitment is very hard and involves a lot of factors. I think the course I created is a key part of the recruitment solution, but it's only one part." We are pleased to welcome Dr. Sazawal to the campus and look forward to working with her on her endeavors. She can be contacted by email at vibha@cs.umd.edu.

News in Brief

Professor Ashok Agrawala, of the Computer Science department, has been elected a fellow of the AAAS.

Associate Professor Ben Bederson was featured on the Kojo Nnamdi Show on WAMU as part of a discussion on WIKIs. The show can be found at: http://www.wamu.org/programs/kn/06/02/21.php#10383

The National Endowment for the Humanities has listed the International Children's Digital Library on EDSITEment (http://edsitement.neh.gov) as one of the best online resources for education in the humanities. Congratulations to UMIACS faculty Ben Bederson and Allison Druin, as well as the entire ICDL team on this impressive accomplishment.

Professor Rama Chellappa has been named the Minta Martin Professor of Engineering in the Clark School of Engineering. This is a 5-year appointment in honor of Professor Chellappa's outstanding research and leadership.

UMIACS Professor Rita Colwell was inducted into the Royal Swedish Academy of Sciences. She was also awarded the *Order of Rising Sun, Gold and Silver Star.* Please see related article on page 6.

Daniel DeMenthon has become a program manager for computer vision, at the National Science Foundation. Daniel has been a research faculty member at UMIACS for over a decade. He has been working with the Laboratory for Language and Media Processing (LAMP). Much of his work has focused on topics in video processing, including video surveillance, summarization, indexing and retrieval. Daniel will continue to work at UMIACS part-time, while overseeing the computer vision effort at the NSF.

Jim Hendler, Director of UMIACS' Joint Institute for Knowledge Discovery was named the recipient of the third Robert Engelmore Memorial Award by the American Association for Artificial Intelligence. The award, presented at the Innovative Applications of Artificial Intelligence conference in July, honored Hendler for "two decades of technical and government leadership in artificial intelligence, as well as pioneering research on agent-based systems and the Semantic Web."

A paper by UMIACS researchers Lorin Hochstein, Jeff Carver, Forrest Shull, Sima Asgari, Victor R. Basili, Jeffrey K. Hollingsworth and Marvin V. Zelkowitz won the award for best paper by a student lead author at the SC'05 conference in Seattle.

A paper by UMIACS scientists Sarit Kraus and V.S. Subrahmanian (together with Y. Zhang of the University of Manchester) was the most highly rated paper at the 2005 IEEE International Conference on Multiagent Security and Survivability.

Dianne P. O'Leary received an honorary Doctor of Mathematics degree from the University of Waterloo at their convocation in October 2005. The degree recognizes her "outstanding contributions to research and education in the mathematical and computer sciences," and her "leadership and promotion of women in the field." She also gave the commencement address.

Professor Jack Minker is the recipient of the 2005 ACM/AAAI Allen Newell Award. The citation says this award is "for his fundamental contributions to the fields of deductive databases, logic programming, artificial intelligence, and, more generally, logic-based methods in Computer Science and for his truly unprecedented role in organizing and stimulating scientific discourse."

David Mount won the CMPS Teaching Award, in recognition of his efforts in teaching the course CMSC 131. This is the Computer Science department's introductory course in object-oriented programming in Java, taken by all incoming freshmen.

Steven Salzberg, Director of the Center for Bioinformatics and Computational Biology, was interviewed by radio (WTOP, Voice of America) and TV (WJLA) stations concerning the potential hazards of bird flu. The Philadelphia Inquirer also ran an op-ed piece on the topic.

Professor Hanan Samet's new book, *Foundations of Multidimensional and Metric Data Structures*, has just been published by Morgan Kaufmann. The book includes a complete survey of multidimensional and geometric data structures. It also includes implementation details that will be of interest to application designers in a host of fields, such as computer graphics, computer vision, geographic information systems, and spatial databases.

Two projects headed by UMIACS Director V.S. Subrahmanian received honorable mentions (of a total of 20) in the Computerworld Horizon Awards for "especially cutting-edge technologies from research labs and companies that are 'on the horizon'". One, the Interactive Maryland Platform for Agents Collaborating Together (IMPACT), provides resources that help develop interoperable agents in an application independent way. The second, the STORY project, aims to extract information from heterogeneous data sources and use it to create coherent stories in multiple languages.

Assistant Professors Francois Guimbretiere, Jonathan Katz, and Atif Memon were awarded NSF CAREER awards which recognize the early development of teacher-scholars whose work will likely position them as future leaders in their fields.

DARPA Funds High Performance Computing Systems Program

The development of High-Performance Computing (HPC) programs (codes) is crucial to progress in many fields of scientific endeavor. However, HPC machines are difficult to program. They typically consist of hundreds to thousands of processors and in order to use them effectively, a given programming problem must be programmed so that all of these processors work in parallel. Effective programmers for these HPC machines are rare because HPC code development requires individuals who are both experts in the HPC architecture and in the application domain. These problems will only increase in the future as tougher problems are attacked and more powerful (yet likely more difficult to program) HPC machines are created.

Most current research focuses on improving the execution performance of HPC codes. However, to avoid potential problems in the future, insight is needed into the process by which codes are created in the first place. Understanding the process by which effective development of HPC codes currently happens, and where the problems and bottlenecks are is critical. This would not only allow future research into improving development of the high-payoff problems and provide the most useful support, but may also improve our knowledge of good practices for HPC development that can be passed along to novices.

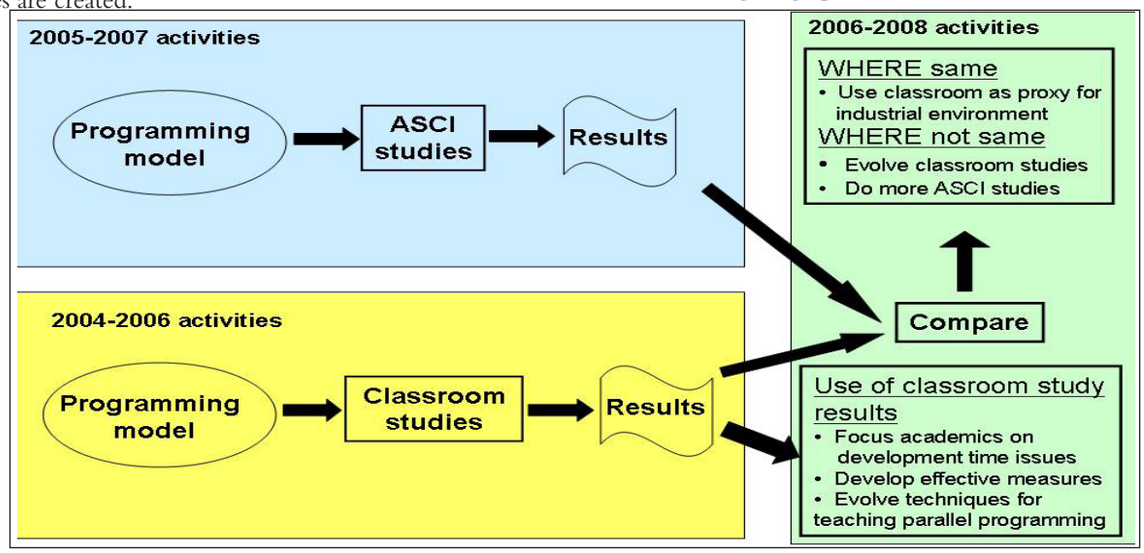
In order to investigate these questions, DARPA has funded the High Productivity Computing Systems (HPCS) project. In this project several vendors are competing to develop a new generation of HPC machine with both performance and productivity as goals. This new machine will operate in the peta-flop range – 1,000 billion floating point operations per second. In addition to the vendor teams, DARPA has created a Development Time team. This team is a collaboration among researchers experienced in empirical studies of software engineering (i.e., the work practices required for production of quality software so far studied in non-HPC domains) and researchers in the area of HPC itself. At the University of Maryland, Professor Vic Basili, along with Professors Jeff Hollingsworth and Marvin Zelkowitz, are leading the Development Time Working Group of the HPCS project in order to better understand the dynamics of producing HPC codes.

For the past two years the university team, which also includes post-doc Sima Asgari, PhD candidates Lorin Hochstein and Taiga Nakamura, and several other students, have been studying the development of HPC codes in various distributed computing classes both at the university and elsewhere, including MIT, University of Southern California, University of California Santa Barbara, University of California San Diego and Mississippi State University. By capturing data from each student's compilation and execution, along with a log handed in by each student of his activities, a picture emerges of how development proceeds.

The team has mostly been looking at two major approaches: MPI (Message Passing Interface) and OpenMP (a shared memory multiprocessing standard). Collected data shows that students have generally been able to achieve better speedup (using more of the multiple processors' capabilities) with OpenMP, and that MPI programs have a larger expansion factor (increased code to develop parallel versions of their programs). MPI programs also generally take more effort to complete.

The goal is to eventually understand how professional programmers develop these programs. The Development Time Team is starting to develop studies of professional programmers in selected university HPC laboratories and the goal is to move into professional applications within the next year to see how well the results from the student environment carries over to professional development.

The figure briefly describes the team's long range plan:



1. For the past two years the team has been working with about a dozen university classes in several universities across the country.

2. For the next two years the team will develop similar studies with a few of the Accelerated Strategic Computing Initiative (ASCI) university research centers.

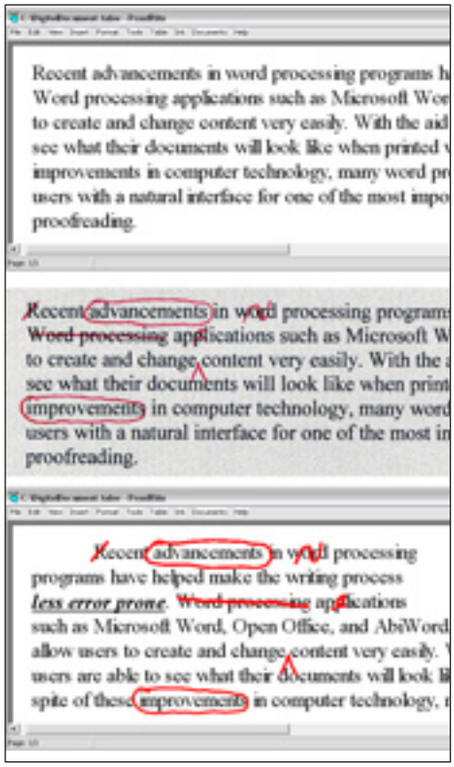
3. They then will compare the results to see if the student data accurately reflects what professional programmers are producing. If so, they can use the students as proxies for professional programmers for studying other aspects of HPC workflows. If not, they will need to perform additional studies with the ASCI organizations.

UMIACS Professor Bridges the Gap between Paper and Computers

François Guimbretière has a passion: how can we provide computational support to people who prefer to edit and markup documents as paper printouts and need a way to digitally save and share the information they collected on paper?

People do this all the time, argues Guimbretière who commutes to work by train.

"During my commutes, I frequently see others reading and annotating printouts of digital documents," says Guimbretière. "These could range from legal briefs and inventory descriptions to virtually anything. While printouts are easy to read and annotate in the train, back in the office, the information captured on paper is trapped in the physical world, forcing users to spend considerable time transcribing back to the original digital document."



The Paper Augmented Digital Document (PADD) system will allow users to annotate hardcopy printouts of a document with a digital pen.

To address this problem, Guimbretière, who is an Assistant Professor in UMIACS and Computer Science, has proposed a Paper Augmented Digital Document (PADD) system which lets users annotate hardcopy printouts of a document with a digital pen such as the Logitech io2 pen.

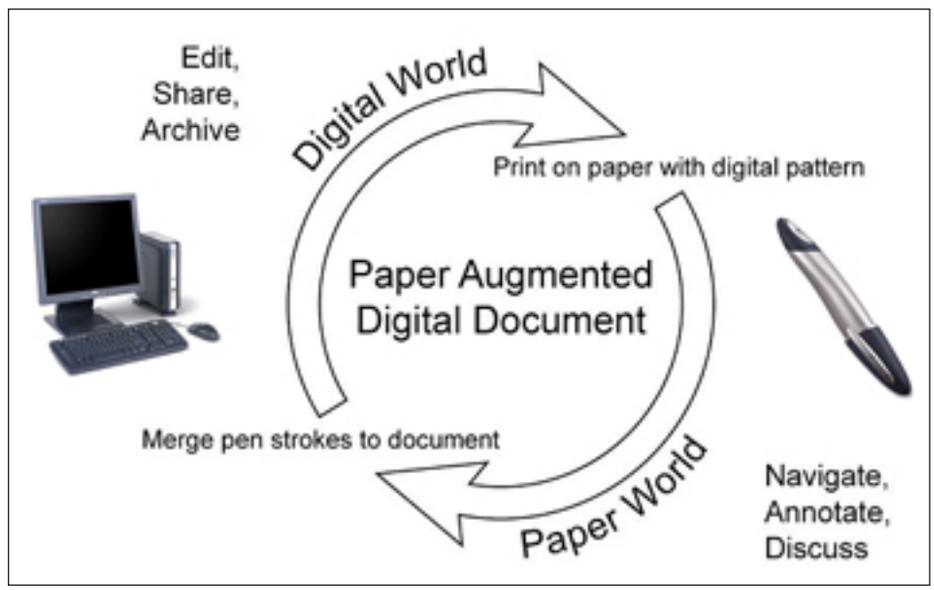
On the printout, the annotations look just like the ones made with an ordinary pen. However, by reading a digital pattern printed on the paper, the pen also captures a digital version of the annotations. Upon synchronization with a desktop or laptop, the annotations are merged into the original electronic version of the document.

The current PADD infrastructure allows users to annotate Acrobat documents on paper, or to capture and process proofreading marks in a paper augmented word processor: ProofRite.

Guimbretière is exploring classroom applications based on an extension of the University of Washington Classroom Presenter. Students will be able to transfer the annotations they have made on slide printouts directly to their teacher's tablet PC.

Dr. François Guimbretière

Guimbretière is also exploring how the PADD system can help designers and architects document the design process by capturing initial sketches as well as annotations made on drawings and rapid prototyping 3D models.



An illustration of how the PADD system works.

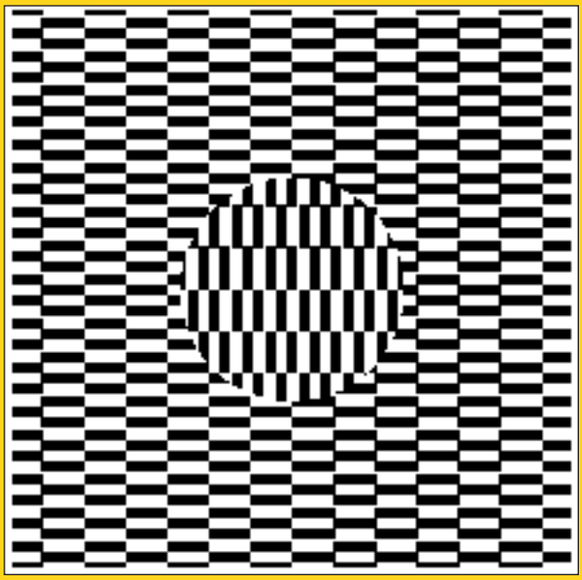


Figure 1: Pattern by H. Ouchi, discovered as an optical illusion by L. Spillman.

Looking at Visual Illusions with Mathematical Eyes

http://www.cfar.umd.edu/users/fer/optical/

Cornelia Fermüller has been studying problems of visual navigation in Computer Vision and Robotics for over ten years. Her focus has been on the interpretation of visual motion, or in engineering parlance, video processing: how, through video analysis, can we come up with representations of the scene depicted in the video? A fundamental concept in motion processing is that of image matching. That is, we first need to match the corresponding points in different video frames or find the image motion. In other words, we need to track image points through the video.

A number of years ago, her attention was caught by a pattern (Fig.1) by the Japanese artist Ouchi. Jiggling the paper while focusing on the pattern produces the perception of a segmentation of the pattern into two parts, with the center part moving relative to the surrounding area. This pattern is a typical example of an optical illusion, where something that does not exist is perceived. In this case it is image motion. The human visual system fails in matching the moving images.

Optical illusions classically have been studied only by visual psychologists, whose goal is to investigate the workings of human vision. Fermüller followed her feeling that this motion illusion was not just an artifact of the way the human vision system is structured, but would reveal insights about all vision systems, both biological as well as artificial created systems, and she set out to study this illusion using computational tools. The original motivation was that an understanding of the illusion could lead to the design of better algorithms for image motion. The study of this illusion led to others, and many efforts later to the formulation of a principle that predicts a large number of optical illusions, including many well known illusory patterns. This principle rests on analyzing uncertainty in the visual field, and it shows that indeed many of these illusions are not just for humans but for any visual system. It also was the first computational theory that could account for a large number of these illusions.

The theory states that many illu-

continued on page 2...

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