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CRITO Research Review

Total Information Awareness

Sharad Mehrotra Examines How Technology Can Make Disaster Response More Efficient

A devastating earthquake has just struck Southern California, sending residents into a panic and forcing local government agencies into overdrive.

Suddenly, there are hundreds of injuries. Power stations and hospitals are in different states of disrepair. People who would normally provide information to help government agencies deal with the situation are having trouble making contact due to downed power and phone lines.

UCI's Professor Sharad Mehrotra has looked at scenarios such as these - including earthquakes, disease outbreaks and organized terrorism - for his technology research. He is investigating ways technology can be improved and used more efficiently, to collect data; to connect different sources of information and agencies; and to observe patterns that can warn of natural disasters - such as an earthquake or flood - or human attacks, such as terrorism.

Professor Mehrotra of the School of Information and Computer Science spoke about his research on April 3 during CRITO Hour, a lunch-time session featuring informal lectures. Professor Mehrotra entitled his talk "The Role of Information Technol-

ogy in Responding to the Unexpected." The problem today, according to Professor Mehrotra, is that current systems fail to link different sources of information together. These systems should collect more information and filter it more efficiently. The fire department doesn't know what the police department knows, which in turn doesn't know what the witnesses on the scene know.

Professor Mehrotra has looked at technology that collects and filters conversations from noisy environments. Its use is among the practices that Professor Mehrotra advocates should be more widespread but that have already begun to emerge on a limited basis. For example, local police were able to pull conversations from the noisy environment at the last Super Bowl in San Diego.

Such technology could also be more widely used to capture voice conversations among field workers during a disaster and provide valuable information to improve responses. Some types of information could trigger an alarm and automatically disseminate valuable information to diverse groups.

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The Techno Home

CRITO recently helped play host to the Home Oriented Informatics & Telematics (HOIT) conference. The spring conference was organized by UCI Professor **Alladi Venkatesh** and focused on technology used in homes. The event was an opportunity for scientists and industry leaders to present the latest innovations and talk about the ways these advances are affecting people's lives.

On the innovations front, developers and architects are working on rooms with walls that collapse with the push of a button to accommodate homeowners' evolving needs. With another trend, people are looking at ways to automatically monitor patients' health conditions, such as asthma, from home, said Professor Venkatesh, who organized the event at UC Irvine.

"Most of the technologies in the last 30 to 40 years are time-saving or labor-saving devices," he said. "Now they are looking at space saving."

Some companies are developing "smart homes" with appliances, televisions and even room configurations that adapt to their owners' wishes. Televisions will know ahead of time what people want to watch.

Companies such as Intel and Microsoft are working on this type of product and sent representatives to speak at the three-day conference, said Professor Venkatesh. Other companies are developing appliances that can "talk" to each other. He explained that these types of innovations were discussed at the conference. "If you start cooking, the dishwasher will start getting ready".

The fourth annual event was attended by 90 people from all over the world. Microsoft was the primary sponsor. Other sponsors included Cal-IT2, UCI Office of Research, the Graduate School of Management, CRITO, Project POINT and IFIP.

While some experts focused on the gadgets of tomorrow, many more talked about the sociology of today: the ways families and individuals are using technology at home and how it affects their friendships and sense of community. Some researchers are studying segments such as older or younger users.

Industry professionals say they use research results, like those discussed at the conference, to guide their companies.

"We have an interest in seeing that new

product development is informed by the latest research," said Herman D'hooge of Intel. "It's important for us to understand those impacts so that we can make products that are useful."

He said that mingling during breaks was also very useful. He got names of potential consultants and built relationships with other companies for possible future collaborations.

"In a very short amount of time you can get basic information on who's doing what," he said of the conference, which featured more than four dozen speakers.

Over time, the use of technology at home is evolving.

"There is a convergence of technology," said Pam Heath of Microsoft during a presentation. "People are having the same experience with different devices. There's a bridge between work and home."

For more information on Professor Venkatesh's work and home telematics, visit <http://www.crito.uci.edu/noah/>

Industry Advice

CRITO held its twice-yearly Industry Advisory Board meeting June 12 and 13 at The Center Club in Costa Mesa. Industry representatives and sponsors meet with CRITO researchers and students once in the summer and once in the winter to go over current projects and make recommendations for funding upcoming projects.

Industry representatives included **John Harms** of the Boeing Company; **John Gantz** and **Carol Glasheen** of IDC; **Phil Tierney** of Intel; **Nick Vitalari** of Technology Solutions Company; and **John Gartska**, **Dave Cammons** and **Sue Higgins** of the US Department of Defense. Other representatives from IBM and Microsoft cast their votes remotely. The next IAB meeting will be held January 29-30, 2004.

For more information about CRITO's corporate partner program, contact Karen Walsh at (949) 824-1323 or kmwalsh@uci.edu.

Professor Mehrotra emphasizes that emergency response teams should have access to as much information as possible to give them the best chance of saving lives in situations when time is critical. Even collaborations that provide news media's helicopter video footage of emergencies could prove helpful by providing more information.

"A response delayed is a response denied," Professor Mehrotra said.

His efforts and the work of professionals like him apply to events as diverse as terrorist attacks, disease epidemics and oil spills. In some cases, problems can be grouped together in a "cascading crisis": An earthquake can cause a hazardous spill and terrorists can exploit a system vulnerability to create panic and escalate the situation.

The concept of total information awareness has become more prominent since September 11. The government is working on using technology to trigger alerts, and increasingly, patterns of behavior gathered by computers are going to make people suspects.

"At some level the response is common across the board," Professor Mehrotra said. "You can plan for it all you want, test for it. Every time you have a crisis there is always something novel or different about it."

The differences can come in the types of agencies that get involved, he said. For example, the U.S. Center for Disease Control and Prevention would get involved in the event of a bio terrorist attack and local police would join forces with the FBI. A large forest fire would involve different agencies.

One problem, according to Professor Mehrotra, is that existing systems currently used to handle everyday situations may fail during a catastrophe. What's more, many existing systems

cannot be reconfigured to make them capable of capturing and distributing the volume of information needed in an emergency.

He supports using rugged, wearable computers and reconfigurable, mobile networks that can be brought into crisis sites and that seamlessly integrate with existing systems and allow for data transfer over backbone networks.

He advocates using mediation architectures to overcome differences in systems' schema, semantics and scale of data.

The goal is to develop algorithms for continuous monitoring of selected entities, with automatic detection of significant changes in behavior. Statistical techniques can help people draw conclusions about similar events given that there is often

limited information about any single event, especially early on.

Professor Mehrotra has ideas about how technology should be used and the types of improvements that need to be brought to response and monitoring systems, but he's also aware of the challenges ahead. There are massive amounts of data to be collected from disparate sources: the actual events, news wires and reports from observers, for

example. The process of collecting and categorizing that information will need to be refined for years to come.

PowerPoint slides on his research can be found at <http://www.crito.uci.edu/critohrsarch.asp>



April 3, 2003 CRITO Hour with Professor Mehrotra

Faculty researcher John Mooney

Step into Professor John Mooney's office at CRITO and you'll see evidence of something that's keeping the Irish native in Southern California, besides excellent research opportunities: his family. His four year-old daughter, Chiara, sometimes visits his office and tries to



draw enough pictures during the visit to fill every available space within her reach. The UC Irvine campus where CRITO is located is near her grandparents' home, a factor that influenced Mooney to return with his wife to the UC Irvine Graduate School of Management, where he received his PhD in business administration with an emphasis in information systems. He met his wife, Angela Tripoli, at GSM. Mooney teaches information technology, an emphasis of the MBA and doctoral programs at GSM. In addition to moving closer to his wife's family, he was also eager to return to CRITO to work with faculty who supervised him while he was completing his graduate degree.

Professor Mooney got his undergraduate degree in computer science from University College, Dublin. He returned there to teach for a year, until a teaching award allowed him to take a sabbatical. He came back to UCI in January 2001 as a visiting professor at the Graduate School of Management and as a CRITO researcher. Professor Mooney will leave in the fall to take an Associate Professor position at Pepperdine University's Graziadio School of Business and Management. He was hired at Graziadio to expand and reorganize its small information systems group but will also continue as an associate of CRITO.

Professor Mooney currently is working on two research projects at CRITO. One compares the business process reengineering fad of the early 1990s with the more recent e-business transformation trend. In another project he looks at how Web services enable IT flexibility and business agility. Professor Vijay Gurbaxani and he were recently awarded a grant to launch a new study into the process and information integration challenges associated with business process outsourcing.

Professor Mooney is known not only for his compassion for his family but also for his sensitivity to graduate students' needs. In addition to his scholarly research, he is willing to help students with extracurricular activities. He recently was applauded loudly for singing in an MBA-student adaptation of *Les Miserables*, which portrayed business school during a poor economy.

"He was very willing to try anything," said MBA student Katherine Thornton, who helped put on the production. "His comment to me was that he always tries to participate in any student events when asked."

Although he will be based primarily at Pepperdine, Mooney will continue to contribute with his solid research and winning personality as a CRITO faculty associate.

CRITO mourns the passing of former Critonian Rob Kling on May 15, 2003 -- a friend, colleague and scholar.



Research Updates

Jennifer Gibbs, Sr. Research Fellow at CRITO, received the W. Charles Redding Dissertation Award from the International Communication Association. She was given a \$200 check from the Redding Endowment at ICA's national conference in San Diego.

The International Journal of Customer Relationship Management is reprinting a 2001 CRITO paper entitled "Customer Relationship Management". The article was written by CRITO Associates **Paul Gray** and **Jongbok Byun** of Claremont Graduate University and is being reprinted as a series of three papers. The first installment was scheduled to appear in the April-May issue of the journal. <http://repositories.cdlib.org/crito/business/199>

CRITO Associate **Hank Becker** delivered Paper I – "Sampling and Over-Sampling in Survey Research" - at the April meeting of the American Educational Research Association in Chicago. In the paper, he spells out a sampling strategy that over represents teachers most likely to use technology in interesting ways. The strategy still follows national probability sampling framework, enabling researchers to present descriptive statistics about the prevalence of different practices. By systematically over representing teachers who are most likely to use computers in creative ways, the research can provide answers to more specific questions about leading-edge practices and help guide future policy and practice. Contact Professor Becker at hjbecker@uci.edu for a copy of the paper.

In a recent article, CRITO Associate **Imran Currim** explained how professionals can improve on using supermarket scanner data to segment markets. He proposed using a stopping rule other than the "Bayesian Information Criterion" currently used in academia and industry. In another article, Professor Currim quantified the improved accuracy achieved when predicting customer behavior using both behavior and background characteristics rather than either criterion alone. Both papers were written with Professor **Rick Andrews** of Louisiana State University: "Recovering and Profiling the True Segmentation Structure in Markets: An Empirical Investigation," International

Journal of Research in Marketing; "A Comparison of Segment Retention Criteria for Finite Mixture Models," Journal of Marketing Research. The papers can be downloaded at <http://web.gsm.uci.edu/~currim/>

A new research paper co-authored by CRITO Associates **Ken Kraemer**, **Kevin Zhu** and PhD student **Sean Xu** has been accepted for publication by the European Journal of Information Systems. It will be published in the special edition devoted to Managing e-Business Transformation. The paper, "E-Business Adoption by European Firms: A Cross-Country Assessment of the Facilitators and Inhibitors," is scheduled to be published in December 2003. An earlier version of the paper was presented at the 23rd International Conference on Information Systems in Barcelona, where the paper also won the Best Paper Award, Conference Theme. Contact Zhu at kzhu@uci.edu for a copy of the paper.

CRITO Associate **Paul Dourish** of UCI's School of Information and Computer Science coauthored a paper that provides conceptual framework and vocabulary for understanding questions of privacy in novel interactive computer systems and environments. Professor Dourish and Professor **Leysia Palen** of the University of Colorado wrote about the framework because they saw that designers lacked good conceptual models. The article, "Unpacking 'Privacy' for a Networked World," addresses privacy as a process of boundary regulation. The paper appeared in April proceedings of the Association for Computing Machinery's Conference on Human Factors in Computing Systems, sponsored by the group's Computer-Human Interaction special interest group. <ftp://ftp.ics.uci.edu/pub/jpd/papers/2003/chi2003-privacy.pdf>

CRITO Associate **Alfred Kobsa** and PhD student **Victor Gonzalez**, both of the School of Information and Computer Science, coauthored a paper on the results of a project with visiting professor **Jinwoo Kim**. The research investigated the adoption of an information visualization system by administrative data analysts. Analysts identified a number of key benefits of the visualization systems, even though the system was not fully inte-

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grated with software tools or with its existing data analysis practices. The benefits usually occurred when analysts went beyond their routines and engaged in creative discovery. The article, "Benefits of Information Visualization Systems for Administrative Data Analysts", was presented at the 2003 Proceedings of the Sixth International Conference on Information Visualization. <http://www.ics.uci.edu/~kobsa/papers/2003-IV-kobsa.pdf>

CRITO Associates **Gloria Mark, Alfred Kobsa** and PhD student **Keri Carpenter** are publishing a paper on their model for problem solving using information visualization systems. The authors observed that system transparency can support earlier stages of the problem-solving process but found that personal support is needed in the last stage to help users translate their findings from visual to written representations. The article, A Model of Synchronous Collaborative Information Visualization, will be presented during the July Proceedings of the Sixth International Conference on Information Visualization in London.

It will also be published by IEEE Press, Los Alamitos, California. <http://www.ics.uci.edu/~kobsa/papers/2003-IV-mark-kobsa.pdf>

The paper "In Situ Requirements Analysis: A Deeper Examination of the Relationship Between Requirements Formation and Project Selection" was accepted by the Requirements Engineering 2003 conference and will be presented in September in Monterey. It was written by PhD Candidate **Mark Bergman** and Professor **Gloria Mark**.

Walt Scacchi, of CRITO and UCI's Institute for Software Research, was awarded a new, two year grant from the National Science Foundation for nearly \$450,000. The money will be used to investigate techniques for discovering, modeling, and repairing work processes and practices associated with large, open-source software development projects. Scacchi also had two book chapters accepted for publication in the book "Open Source Software Development," IDEA Publishing, 2004.



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