

Software Showcase, October 7, 2008

Fedex Institute of Technology, Video Conference Center

Agenda

11:30-11:35	Introduction of President Raines <i>Kevin Boggs, Director of Technology Transfer and Research Development</i>
11:35-11:45	Welcome and Opening Remarks <i>Dr. Shirley Raines, President, the University of Memphis</i>
11:45-12:15	Lunch
11:45-12:00	Welcome to the FedEx Institute <i>Dr. Doug Hurley, Chairman</i> <i>Mr. Shaye Mandle, Executive Director, FedEx Institute of Technology</i>
12:00-12:15	Introduction to Showcase, Audience Introductions <i>Kevin Boggs</i>
12:15-2:30	Presentations
2:30- 3:00	Break
3:00-4:30	Presentations
4:30-5:00	Final Discussion, Next Steps

Presentations

Novel and Powerful Method of Non-Invasive EEG Monitoring to Dramatically Improve Advanced Prosthetics and Next-Generation Gaming Peripherals

Robert Kozma, Ph.D.

Computers which can read and respond directly to brain waves are no longer in the realm of science fiction. Potential applications for brain-machine interaction are enormous. Here we highlight two: advanced prosthetics and computer gaming peripherals. Laboratories world-wide have demonstrated that animals can complete complicated tasks by signals originating from their cerebral cortex. However, this generally requires the use of surgically implanted devices. Clearly, broad application of this technology in humans will depend on noninvasive electrodes. Early proof of concept of such devices controlling prosthetics and computer graphics has been achieved. Unfortunately, achieving the full potential of this technology has been hampered by the serious problem of high noise that is generated as signals travel through the skull.

This new technology provides a unique solution to the problem of meaningful signal extraction from a high noise environment. It uses a dynamic logic model-based signal processing method. This method has been applied successfully in various signal processing and imaging areas and can be used with existing hardware platforms.

Dr. Kozma and his co-inventor Dr. Leonid Perlovsky, have data that shows for the first time that electrophysiological markers of cognition can be accurately detected after they have passed through the skull. The basis of this technology is covered in patent application serial number 12/56,237, entitled "Methods of Detection of Propagating Phase Gradients Using Model Field Theory of Non-Gaussian Mixtures". Exclusive field-of-use rights are available for licensing.

Fast Learning for Simultaneous Recurrent Neural Networks

Robert Kozma, Ph.D.

Cellular neural networks (CNNs) are a parallel computing paradigm similar to neural networks, with the difference that communication is allowed between neighboring units only. Typical applications include image processing, analyzing 3D surfaces, solving partial differential equations, reducing non-visual problems to geometric maps, modeling biological vision and other sensory-motor organs which have the potential to replace traditional computer chip architecture.

CNNs have been developed over the past twenty years by scientists such as Chua and Roska at UC Berkeley. A serious hurdle to broad implementation of this technology has been the ability to efficiently assign a numerical "weight" value to each cell on the chip. The technology from Dr. Kozma and his colleague Dr. Paul Werbos should provide the solution to overcome that hurdle. The technology provides a machine learning algorithm that gives these cells the ability to learn the appropriate weight 100 times faster than is currently possible.

This technology will for the first time make machine learning feasible. The invention is covered in patent application serial number 12/156,164, entitled "Methods of Improved Learning in Simultaneous Recurrent Neural Networks". Exclusive field-of-use rights are available for licensing.

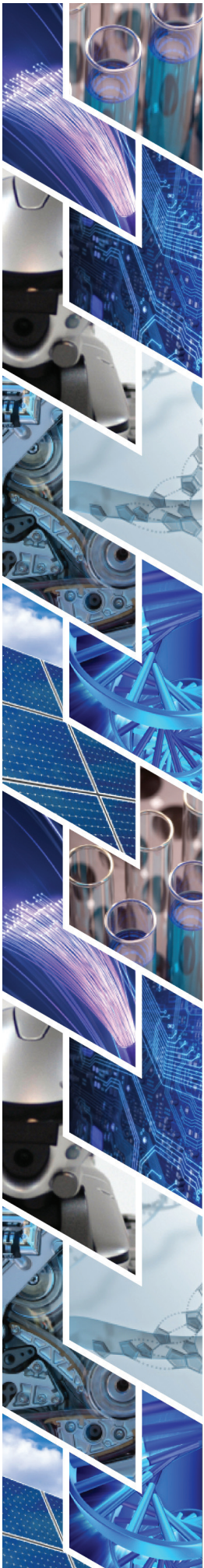
Password Immunizer

Dipankar Dasgupta, Ph.D.

Password authentication is very critical for secure access to company servers as it verifies the identity of computer users and processes. The Password Immunizer is a powerful bio-inspired tool that creates the AntiPion Protection Shield and can run in all types of authentication servers, and filter out invalid access requests. Compared to existing password protection products, it is more reliable and can improve e-business security.

Artificial immune systems are highly distributed systems based on the principles of the biological system. This is a new and rapidly growing field offering powerful and robust information processing capabilities which can learn new information, recall previously learned information, and perform pattern recognition in a highly decentralized fashion. Similarly, negative authentication systems can provide a robust solution in immunizing any password system.

Patent application serial number 12/171,962, entitled "A Negative Authentication System For A Networked Computer System". Exclusive field-of-use rights are available for licensing.



Development of text-mining tools for analysis of genomic data

Ramin Homayouni, Ph.D.

Advances in genomic technologies enable researchers to rapidly identify large sets of genes associated with specific diseases or experimental conditions. However, analysis and interpretation of genomic data pose a major challenge to researchers and limit the usefulness of genomic technologies in advancing scientific discovery. To assist biomedical researchers, we have developed a series of text-mining tools that automatically extract gene related information from the published scientific literature, which is growing at a staggering rate. Previously, we developed a novel algorithm and software (SGO – Semantic Gene Organizer©) to retrieve and rank genes with respect to any query based on information in Medline database. SGO is a unique tool which prioritizes results and assists in generation of new hypotheses. Recently, we extended this work by developing a new method and software (GCAT – Gene-set Cohesion Analysis Tool) to evaluate the overall functional coherence of gene sets obtained in genomic experiments. GCAT provides a robust and objective method to evaluate the functional significance of gene sets, thereby allowing investigators to reduce the common problem of false discovery in genomic applications. Lastly, another tool (FAUN – Feature Annotation Using Non-negative Matrix Factorization) has been developed in collaboration with Dr. Michael Berry at the University of Tennessee to categorize genes and to automatically determine their relationships from the biomedical literature. It is expected that these novel text-mining tools will assist genomic researchers and ultimately facilitate scientific discovery in the current post-genomic era.

This technology is being developed in Dr. Homayouni's lab in collaboration with Computable Genomix. CG is glad to discuss investment opportunities.

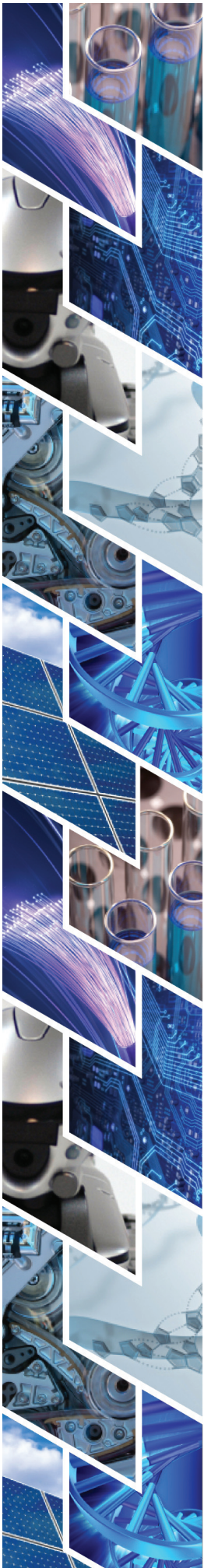
Management of Bioinformatics Data and Tools

Vinhthuy Phan, Ph.D.

The sequencing of genomes from many organisms has led to an explosion in bioinformatics data. The data, however, is only useful if researchers in industry and academia can extract meaningful information from it, which they can then use in their efforts to understand diseases and screen drug candidates. These researchers often need to use several different types of software tools to manage and analyze the broad array of bioinformatics data. This variety of software itself is leading to management optimization problems. We have developed a system called Bioinformatics Tools and Data Management System (BioTDMS), to address these issues. BioTDMS comes in a self-contained package, using open-source technologies. It allows researchers to build Web servers for bioinformatics tools easily, at the same time providing a platform so that data and tools can be managed properly. Applications of BioTDMS include the management of data built around a specific set of tools dedicated to a specific research problem, or a platform to compare different tools that address a particular problem.

BioTDMS can be customized to address many different user-centric applications beyond the field of bioinformatics. Built on top of a popular content management system, BioTDMS embraces the principle that data and tools can be viewed as "structured content" and that users' participation is essential to the system. Many existing social networks and online user-centric services such as YouTube and flickr fit this model.

BioTDMS is a customizable self-contained software package. Exclusive field-of-use rights are available for licensing.



Autotutor

Arthur Graesser, Ph.D.

AutoTutor is an intelligent tutoring system that helps students learn by holding a conversation in natural language. AutoTutor appears as an animated agent that acts as a dialog partner with the learner. The animated agent delivers AutoTutor's dialog moves with synthesized speech, intonation, facial expressions, and gestures. Students are encouraged to articulate lengthy answers that exhibit deep reasoning, rather than to recite small bits of shallow knowledge. It may take 50-100 turns between the student and computer tutor for the collaboration to converge on a good answer. For some topics, there are graphical displays, animations, and interactive simulation. One version of AutoTutor is sensitive to learner emotions by tracking facial expressions, speech parameters, body posture, and the dialogue history. Over 15 experiments have been conducted with AutoTutor to help students learn Newtonian physics, computer literacy, and scientific reasoning. AutoTutor improves learning by nearly one letter grade compared with reading a textbook for an equivalent amount of time. Funding for AutoTutor has come from National Science Foundation, Institute of Education Sciences, and the Department of Defense.

There are authoring tools for developing AutoTutor modules on new subject matters in a short amount of time. Nonexclusive field-of-use licenses are available, with the option for contracts to the University of Memphis to ensure reliable development of AutoTutor dialogues for new subject matters.

Coh-Metrix

Arthur Graesser, Ph.D.

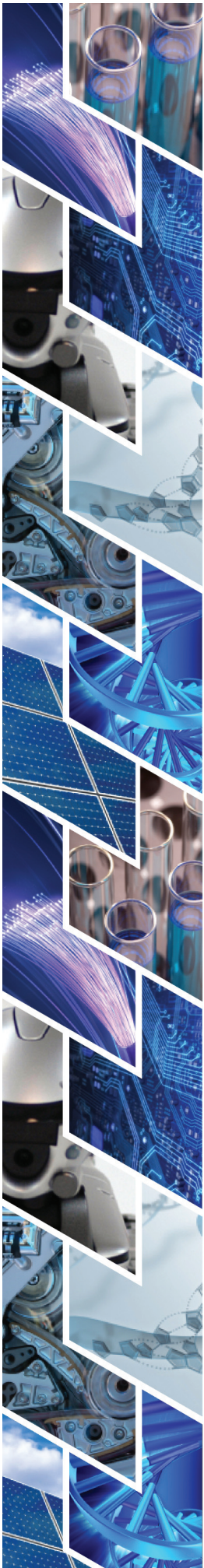
Coh-Metrix a computational tool on the web that produces dozens of measures of the linguistic and discourse characteristics of text. The texts may be printed documents or transcripts of oral discourse. After the user of Coh-Metrix enters a text into the Web site, it prints out dozens of measures of the text. Coh-Metrix was designed to move beyond standard readability formulas because they rely exclusively on word length and sentence length. The Coh-Metrix measures span multiple levels of language and discourse. Some measures refer to characteristics of individual words, but the majority of the Coh-Metrix indices include deeper or more processing-intensive algorithms that analyze syntax, referential cohesion, semantic cohesion, and dimensions of the situation model. Coh-Metrix is the only computer facility available to the public for free that analyzes language and discourse on a broad set of components at multiple levels.

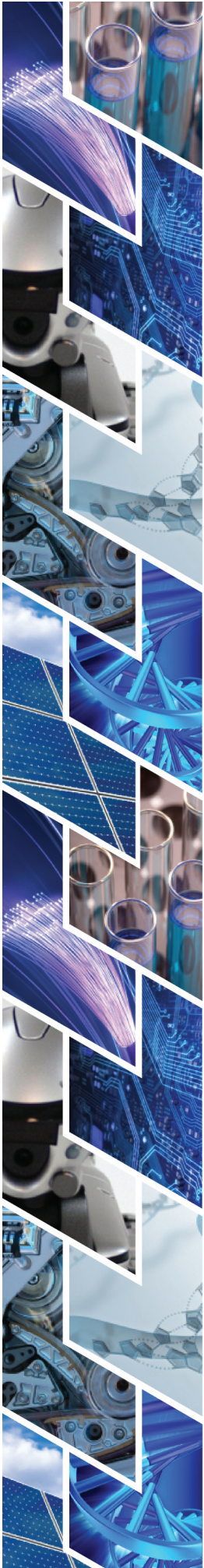
Coh-Metrix is a computer facility on the web or desktop that analyzes texts on several dozens of measures of text cohesion, sentence complexity, word characteristics, and readability. Approximately 50 published studies have validated the predictive power of Coh-Metrix measures in text analysis. Contracts with University of Memphis can be established to analyze large corpora of texts.

ARIES (Acquiring Research Investigative and Evaluative Skills)

Arthur Graesser, Ph.D.

ARIES teaches college students scientific critical thinking by holding a conversation with two animated pedagogical agents. One agent is an expert on scientific inquiry and serves as a knowledgeable tutor. The other agent is a fellow student, but could potentially take on other roles. During the training sessions with ARIES, students read an electronic textbook and periodically hold a conversation with the agents. Sometimes a case study is presented on the screen that describes an experiment which may or may not have a number of flaws with respect to scientific methodology. A 3-way conversation transpires between the human student, the tutor agent, and the student agent. The human students interact with both agents by holding mixed-initiated "trialogs" in natural language. The agents give the students texts to read, pose diagnostic questions and problems, give hints and feedback, encourage question-asking, answer questions posed by the student, and monitor the student's progress.





ARIES helps students learn by holding a dialog between the human learner and two animated conversational agents (a tutor agent and another student agent). ARIES has been shown to help college students learn critical scientific reasoning, with outcomes that are substantially superior to students reading a text for an equivalent amount of time. ARIES is embedded in an electronic text environment, with game features and multimedia. ARIES is currently being developed in a research collaboration between University of Memphis, Northern Illinois University, and Claremont Graduate School. The Co-owners of this technology have been in discussions and will work jointly to provide a single point-of-contact for licensing.

Guru

Andrew Olney, Ph.D.

Guru is currently under development. Dr. Olney and collaborators at the U of M and Rhodes College were awarded a \$1.86MM grant to support their work on this exciting project. Guru will be an expert computer tutor that will model the strategies and dialogue of expert human tutors. It is a logical progression from AutoTutor, which models the strategies and dialogue of novice human tutors.

Guru could have a big impact on city schools in Memphis and elsewhere in Tennessee and beyond. Initially, it will seek to improve educational outcomes on the Tennessee Gateway Science Test, which high school students must pass in order to receive a diploma.

Ninth grade students in Memphis City Schools will participate in the research.

The primary research method is a design research using the Integrative Learning Design Framework (ILDF), which will be used to integrate evaluation of Guru's artificial intelligence components with usability data collected during student evaluations. These evaluations will include think-aloud protocols and eye tracking studies.

Guru is an early-stage project (with a world class academic lineage). The University will file appropriate IP protection and make it available for field-of-use licensing.

Distributed Remote Intelligent Visualization Environment (DRIVE)

Qishi Wu, Ph.D.

We developed a Distributed Remote Intelligent Visualization Environment (DRIVE) to streamline the entire scientific discovery process of simulation, storage, transport, analysis, visualization, and computational steering in distributed network environments in an effortless, automatic and optimal manner.

Within DRIVE, a scientist can conveniently launch a simulation with a set of steerable parameters through a web-based Graphical User Interface (GUI) on a designated remote high performance computing facility. Upon the completion of simulation at each time step, the data set will be automatically transferred to a group of strategically selected computing nodes with the highest throughput possible for various processing purposes including visualization, and the final computing results will be delivered on the fly to the participating members in the collaborative research team. The scientist is also provided with the capability of making any on-line changes to the simulation and computing control parameters simultaneously, which take effect immediately on the remote supercomputer and computing nodes.

Proof of concept data for DRIVE has been achieved after preliminary implementation. It is run on a Linux platform and has been tested with work stations, P.C. clusters and high performance storage systems at Oak Ridge National Laboratory.

Systems Testing Excellence Program

Jasbir Dhaliwal, Ph.D.

The Systems Testing Excellence Program (STEP) is a major interdisciplinary research initiative under the umbrella of the FedEx Institute of Technology with academic program support from the Fogelman College of Business and Economics.

The Department of Management Information Systems is leading this Program and is tasked with building up research and curricular competencies at the University of Memphis that will help position the university as a national and internationally recognized thought leader in the science of systems testing.

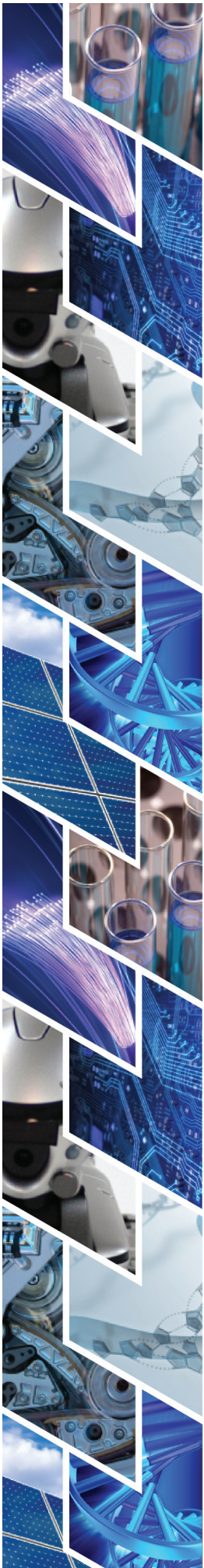
The Program defines systems testing as a strategic and interdisciplinary area of interest encompassing all aspects of the testing of business systems including hardware testing, software testing, requirements testing and the testing of business rules. At a theoretical level it encompasses all forms of validation and verification of business applications using a systems thinking approach to ensure the successful development and application of technology in business.

The STEP Program has developed an extensive array of software testing methods, consulting products, training materials and certification programs. Taken together, this Program can be employed to standardize existing corporate testing programs, audit current testing protocols, as well as train and certify new testing professionals. These include: a two step certification program for testing professionals, testing needs analysis/audit methodology for corporate IT shops, testing capabilities certification process for software development organizations, and testing skills/competencies examination for HR departments of large IT shops.

Intelligent Delivery of Learning Contents

Xiangen Hu, Ph.D.

Joint Knowledge Online (JKO) is an enterprise portal system that uses advanced distributed learning technology to deliver joint courseware and learning tools that support joint training for individuals involved in or preparing for integrated cross-enterprise operations.





Andrew Olney, Ph.D.

*Assistant Professor, Department of Psychology;
Associate Director of the Institute for Intelligent Systems*

Andrew Olney is presently an Assistant Professor in the Department of Psychology at The University of Memphis and Associate Director of the Institute for Intelligent Systems. Dr. Olney received a B.A. in Linguistics with Cognitive Science from University College London in 1998, a M.S. in Evolutionary and Adaptive Systems from the University of Sussex in 2001, and a Ph.D. in Computer Science from the University of Memphis in 2006. Dr. Olney's primary research interests are in natural language interfaces. Specific interests include vector space models, dialogue systems, unsupervised grammar induction, robotics, and intelligent tutoring systems.

Vinhthuy Phan, Ph.D.

Assistant Professor of Computer Science

Vinhthuy Phan is an Assistant Professor of Computer Science at the University of Memphis. He received his PhD in Computer Science from Stony Brook University under the supervision of Professor Steven Skiena. His general research interests are bioinformatics and bio-molecular computing focusing specifically on microarray technologies. His focus is twofold, first on refining current techniques in analyzing microarray data and second on developing novel usage of microarray technologies such as for information storage and retrieval. He has also worked on developing enabling technologies to facilitate the building of community-oriented systems. While these systems aim toward bioinformatics researchers, the technology can be customized to a wide range of applications beyond the scope of bioinformatics.

Qishi Wu, Ph.D.

Assistant Professor, Department of Computer Science

Qishi Wu received the B.S. degree in remote sensing from Zhejiang University, People's Republic of China in 1995, the first M.S. degree in geomatics from Purdue University in 2000, the second M.S. degree in system science, and the Ph.D. degree in computer science from Louisiana State University in 2002 and 2003, respectively. He has worked as a Research Associate and Research Fellow in the Computer Science and Mathematics Division at Oak Ridge National Laboratory from 2001 to 2006.