



## **AIPR 2010: From Sensors to Sense Cosmos Club, Washington DC October 13-15, 2010**

Many pattern recognition applications are developed with little feedback or knowledge of the sensor providing the input image. Sensors are often designed with little consideration for the computer algorithm that must process the information provided by the sensor. The interaction between Sensors and image processing algorithms (Sense) must be better understood if computer vision is to become as robust as human vision.

The Applied Imagery Pattern Recognition Workshop promotes and encourages the interdisciplinary interchange of ideas. The purpose of the annual AIPR workshops is to bring together researchers from government, industry, and academia in an elegant setting conducive to technical interchange across a broad range of disciplines.

**The abstract due date has been extended until July 1 2010. Abstracts are being accepted for both oral and poster presentations. Send abstracts (150 - 300 words) and inquiries to:**

Elmer (Al) Williams  
Integrated Design Services  
The Pennsylvania State University  
149 Hammond Building  
University Park, Pa 16802

Phone: 814-863-3854  
Fax: 814-865-6663  
alwilliams@enr.psu.edu

Written papers will be required for accepted works and will be published in the AIPR Proceedings. The AIPR Home Page can be found at <http://www.aipr-workshop.org/>.

AIPR is sponsored by the IEEE Computer Society Technical Committee on Pattern Analysis and Machine Intelligence, and is organized by the AIPR Workshop Association with generous support from Booz-Allen and Cybernet.

# AIPR 2010 Keynotes

Tomaso Poggio will be our keynote speaker on Wednesday October 13, 2010.

**Biography:** Tomaso Poggio investigates learning theories that can be applied to both understand the brain and build intelligent machines. Tomaso Poggio is a computational neuroscientist whose recent work focuses on the processes by which the brain learns to recognize and categorize visual objects. His work is important not only towards understanding higher brain function, but also for the mathematical and computer applications of statistical learning. Poggio is Eugene McDermott Professor in the Department of Brain and Cognitive Sciences and at the Artificial Intelligence Laboratory. He is also Co-Director of the Center for Biological and Computational Learning and was appointed Investigator immediately after the establishment of the McGovern Institute in 2000. He joined the MIT faculty in 1981, after ten years at the Max Planck Institute for Biology and Cybernetics in Tübingen, Germany. He received a Ph.D. in 1970 from the University of Genoa. Poggio is a Foreign Member of the Italian Academy of Sciences and a Fellow of the American Academy of Arts and Sciences.

## Learning in Brains and Machines

Tomaso Poggio

*Center for Biological & Computational Learning*

*McGovern Institute*

*Computer Science and Artificial Intelligence Laboratory*

*Department of Brain and Cognitive Sciences*

*Massachusetts Institute of Technology*

Learning is the gateway to understanding intelligence in biological organisms and to reproducing it in machines. I will introduce modern learning theory and sketch some of its recent successes in solving key problems in computer vision by using techniques such as regularization in Reproducing Kernel Hilbert Spaces. I will then discuss two recent developments in the mathematics of learning, in part suggested by progress in neuroscience. The first consists of results about conditions for predictivity of online learning algorithms. The second development deals with hierarchical architectures different from classical “kernel machine” algorithms. I will describe a new attempt (with S. Smale, L. Rosasco and A. Wibisono) to develop a mathematics for hierarchical kernel machines – centered around the notion of a recursively defined “derived kernel” – and directly suggested by the neuroscience of the visual cortex.

Stephen M. Kosslyn will be our keynote speaker on Thursday October 14<sup>th</sup>, 2010.

**Biography:** Stephen M. Kosslyn is Dean of Social Science and John Lindsley Professor of Psychology at Harvard University and Associate Psychologist in the Department of Neurology at the Massachusetts General Hospital. He received a B.A. from UCLA and a Ph.D. from Stanford University, both in psychology. His original graduate training was in Cognitive Science, which focused on the intersection of cognitive psychology and Artificial Intelligence. Faced with limitations in those approaches, he eventually turned to study the brain, and played a role in founding the field of Cognitive Neuroscience. His research has focused primarily on the nature of visual mental imagery, visual perception,

and visual communication, and he has authored or coauthored 11 books and over 300 papers on these topics. Kosslyn has received the American Psychological Association's Boyd R. McCandless Young Scientist Award, the National Academy of Sciences Initiatives in Research Award, the Cattell Award, a Guggenheim Fellowship, the J-L. Signoret Prize (France), an honorary Doctorate of Science from the University of Caen (France), and election to Academia Rodinensis pro Remediatione (Switzerland), the Society of Experimental Psychologists, and the American Academy of Arts and Sciences.

## **HN (Human-Natural) Interfaces**

S. M. Kosslyn

To be effective, information conveyed by a user interface must be understood effortlessly, which requires building interfaces to take advantage of the strengths of the human mind and brain while avoiding falling prey to their weaknesses. In this talk I review a set of principles that is based on fundamental properties of the human mind and brain, and show how these principles can guide construction of user interfaces. I show examples of errors that occur when each of the psychological principles has not been respected. These errors occur surprisingly frequently in visual information displays, as the results of a study of a stratified sample of PowerPoint presentations demonstrates. The talk not only characterizes and documents these errors, but also shows how they can be avoided or repaired. The key to clear information displays is to understand that the user is a human being, and we humans have specific kinds of minds and brains.

Julia Erdley will be our keynote speaker on Friday October 15, 2010.

**Biography:** Ms. Julia Erdley is the Deputy to the Science Advisor with the Joint IED Defeat Organization (JIEDDO). She is an Electrical Engineer with nearly 20 years of experience in Science and Technology development in support of the Department of Defense. Prior to joining JIEDDO, she worked at the Applied Research Laboratory at the Pennsylvania State University where she conducted research and development in signal processing and autonomous systems with application to torpedo guidance and control.

Ms. Erdley holds both a bachelor's and master's degree in Electrical Engineering from the Pennsylvania State University. She currently has temporary residence in Arlington, VA, but permanently resides in State College, PA with her husband, Todd, and son, Alan.

### **“Image Processing Challenges in Counter-IED”**

Ms. Julia Erdley

Deputy to the Science Advisor with the Joint IED Defeat Organization

On Thursday evening our Dinner Speaker will be David Luebke.

**Biography:** David Luebke helped found NVIDIA Research in 2006 after eight years on the faculty of the University of Virginia. Luebke received his Ph.D. under Fred Brooks at the University of North Carolina in 1998. His principal research interests are GPU computing and real-time computer graphics. Luebke's honors include the NVIDIA Distinguished Inventor award, the NSF CAREER and DOE Early Career PI awards, and the ACM Symposium on Interactive 3D Graphics "Test of Time Award". Dr. Luebke has co-authored a book, a SIGGRAPH Electronic Theater piece, a major museum exhibit visited by over 110,000 people, and dozens of papers, articles, chapters, and patents.

## **"Democratizing Supercomputing: The Surprising Story of GPU Computing"**

Dr. David Luebke  
Director of Research  
NVIDIA Corporation

We used to think of the CPU as the "brains" of a computer, but most computers today pack a second chip with far more computational horsepower called the GPU: a chip designed to calculate and display the pixels on the screen. In fact, modern GPUs have emerged as the world's most successful parallel architecture. The GPUs that consumers buy to play video games provide a level of massively parallel computation that was once the preserve of supercomputers like the MasPar and Connection Machine. For example, NVIDIA's latest chips, code-name "Fermi", have up to 512 cores running over sixteen thousand threads and capable of performing well over a trillion math operations per second. The raw computational horsepower of these chips has expanded their reach well beyond graphics. Today's GPUs not only render video game frames, they also accelerate physics computations, video transcoding, image processing, astrophysics, protein folding, seismic exploration, computational finance, astronomy - the list goes on and on.

How did this happen? Why would a peripheral grow into a processing powerhouse found everywhere from medical clinics to radiotelescopes to supercomputers? Why the graphics card and not the modem, or the mouse? In this talk I will discuss the evolution of GPUs from fixed-function graphics accelerators to general-purpose massively parallel processors. I will briefly motivate GPU computing, demonstrate some applications in image processing and image synthesis, and explore the transition that GPUs represent in massively parallel computing: from the domain of supercomputers to that of commodity "manycore" hardware available to all.

## *AIPR 2010 will include the following Sessions*

Near Sensor processing using multiple images.

**Session Chair:** John Caulfield Cyan Systems

Algorithms and Mega-Data Integration for Decision Making in Medical, DoD, and Other Communities.

**Session Chair:** Larry Clarke NCI and Bob Bonneau AFOSR

Integrated Sensor-Collected Intelligence

**Session Chair:** Franklin Tanner Raytheon

Sensor-aware Image Analysis Algorithms and Methods

**Session Chair:** Jim Aanstoos Mississippi State University

Biologically-inspired sensor technology, such as new hardware motivated by biological principles

**Session Chair:** Paul McCarley Eglin AF

Synergy between humans and computers: Systems or techniques which exhibit a joint process where the human and machine sensors and computer vision algorithms each contribute to the overall solution

**Session Chair:** John Irvine Draper Laboratory and Murray Loew George Washington University

Sensing and analysis of color, motion, and three-dimensional information

**Session Chair:** Jeff Kretsch BBN Technologies

Cognitive Processing in Human Brains

**Session Chair:** Mark Happel Johns Hopkins APL

**Registration Reminder:** All attendees of the 2010 AIPR Workshop including authors must register for the workshop. Please visit our registration information section on our web site at [www.aipr-workshop.org/](http://www.aipr-workshop.org/) for details on registering for the conference.