

Evening Meeting

# Advances in Cognitive Memory and its Applications



Dr. Bernard Widrow  
Professor of Electrical Engineering  
Stanford University

Thursday December 18, 2008  
Stanford University, Packard 101  
6:00 p.m.

SCV Chapter of the Computational Intelligence Society  
Chairman: Dr. Hamid Berenji  
Vice Chair: Maryam Naghibzadeh

## Abstract

Regarding the workings of the human mind, memory and pattern recognition seem to be intertwined. You generally do not have one without the other. Taking inspiration from life experience, a new form of computer memory has been devised. Certain conjectures about human memory are keys to the central idea. The design of a practical and useful "cognitive" memory system is contemplated, a memory system that may also serve as a model for many aspects of human memory. The new memory does not function like a computer memory where specific data is stored in specific numbered registers and retrieval is done by reading the contents of the specified memory register, or done by matching key words as with a document search. Incoming sensory data would be stored at the next available empty memory location, and indeed could be stored redundantly at several empty locations. The stored sensory data would neither have key words nor would it be located in known or specified memory locations. Sensory inputs concerning a single object or subject are stored together as vectors in a single "file folder" or "memory folder." When the contents of the folder are retrieved, sights, sounds, tactile feel, smell, etc., are obtained all at the same time. Sensor fusion is a memory phenomenon. The sensory signals are not fused, but they are simply recorded together in the same folder and retrieved together. Retrieval would be initiated by a prompt signal from a current set of sensory inputs or patterns. A search through the memory would be made to locate stored data that correlates with or relates to the present real-time sensory inputs. The search would be done by a retrieval system that makes use of auto-associative artificial neural networks. Applications of cognitive memory systems have been made to visual aircraft identification, aircraft navigation, and human facial recognition. Other applications to speech recognition and control systems are being explored.

## Biography of Bernard Widrow

Bernard Widrow received the S.B., S.M., and Sc.D. degrees in Electrical Engineering from the Massachusetts Institute of Technology in 1951, 1953,

and 1956, respectively. He joined the MIT faculty and taught there from 1956 to 1959. In 1959, he joined the faculty of Stanford University, where he is currently Professor of Electrical Engineering.

He began research on adaptive filters, learning processes, and artificial neural models in 1957. Together with M.E. Hoff, Jr., his first doctoral student at Stanford, he invented the LMS algorithm in the autumn of 1959. Today, this is the most widely used learning algorithm, used in every MODEM in the world. He has continued working on adaptive signal processing, adaptive controls, and neural networks since that time.

Dr. Widrow is a Life Fellow of the IEEE and a Fellow of AAAS. He received the IEEE Centennial Medal in 1984, the IEEE Alexander Graham Bell Medal in 1986, the IEEE Signal Processing Society Medal in 1986, the IEEE Neural Networks Pioneer Medal in 1991, the IEEE Millennium Medal in 2000, and the Benjamin Franklin Medal for Engineering from the Franklin Institute of Philadelphia in 2001. He was inducted into the National Academy of Engineering in 1995 and into the Silicon Valley Engineering Council Hall of Fame in 1999.

Dr. Widrow is a past president and currently a member of the Governing Board of the International Neural Network Society. He is associate editor of several journals and is the author of over 100 technical papers and 18 patents. He is co-author of Adaptive Signal Processing and Adaptive Inverse Control, both Prentice-Hall books. A new book, Quantization Noise, was published by Cambridge University Press in June 2008.

