The Ersatz Brain Project: A Brain-Like Computer Architecture for Cognition

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ABSTRACT
The Ersatz Brain Project is an attempt to develop programming techniques and software applications for a brain-like computing system. Its brain-like hardware architecture design is based on a select set of ideas taken from the anatomy of mammalian neo-cortex. In common with other such attempts it is based on a massively parallel, two-dimensional array of CPUs and their associated memory. The design used in this project (1) uses an approximation to cortical computation called the network of networks which holds that the basic computing unit in the cortex is not a single neuron but groups of neurons working together in attractor networks; (2) assumes connections and data representations in cortex are sparse; (3) makes extensive use of local lateral connections and topographic data representations, and (4) scales in a natural way from small groups of neurons to the involvement of entire cortical regions.

The resulting system computes using techniques such as local data movement, temporal coincidence, and the formation of discrete “module assemblies.” Software for such a system becomes a curious blend of techniques, some reminiscent of analog computers and some of a more familiar, more discrete kind.

Successfully developing a brain-like computing system would suggest that we know something important about both the cerebral cortex and the way it works to produce complex behavior. There are also potential practical applications if the project is successful.

ABOUT THE KEYNOTE SPEAKER
Prof. James A. Anderson has been a member of the faculty of Brown University since September, 1973. He is now Professor in the Department of Cognitive, Linguistic and Psychological Sciences. He was Chair of the Department of Cognitive and Linguistic Sciences from 1993 to 1998 and in 2000-2001.

Dr. Anderson has published extensively in the area of computational models for cognition and memory and computational neuroscience. He is currently working with colleagues from industry and Brown on the “Ersatz Brain Project” a design for a massively parallel “brain-like” computer. His work has received support from the National Science Foundation [NSF], the Office of Naval Research [ONR], the Air Force Research Laboratory [AFRL] (Rome, NY) and the Defense Advanced Research Projects Agency [DARPA].

Dr. Anderson is the author of many books and journal articles. Books include Introduction to Neural Networks”, “Neurocomputing”, Volumes 1 and 2 and “Talking Nets: An Oral History of Neural Network Research”, all from MIT Press, Cambridge, MA. Dr. Anderson has a B.S. in physics (1962) and a Ph.D. in physiology (1967), both from the Massachusetts Institute of Technology. He has had postdoctoral fellowships at UCLA (1967-1971) and Rockefeller University (1971-1973), as well as a senior fellowship at the University of California, San Diego (1979).