UCI cognitive scientist on team tapped to create large-scale artificial brain

Computerized brain will help researchers bridge gap between man and machine

Neural computing power is about to increase exponentially in the research lab of cognitive neuroscientist Jeffrey Krichmar. The new UCI assistant professor is part of a research team headed by HRL Laboratories in Malibu, Calif. that was recently awarded a multi-million dollar, multi-year grant to fund development of an electronic brain with functional and cognitive capabilities similar to the brain of a small mammal.

The project is one of three being funded by the Defense Advanced Research Project Agency's (DARPA) Systems of Neuromorphic Adaptive Plastic Scalable Electronics program, or SyNAPSE. The goal of the SyNAPSE program is to bridge biology and electronics and establish a new paradigm for creating more intelligent machines that can interact with, react to, and actually learn from their environments. Research teams led by Hewlett Packard and IBM were also among those to receive funding from the program.

The HRL team with whom Krichmar is involved will begin with a model developed at the Neurosciences Institute in San Diego that mathematically represents how synapses and neurons in the brain work together to perform cognitive functions. Using this algorithm, the researchers will develop nanotechnology-based hardware and software that will result in a large-scale electronic brain capable of performing functions such as visual perception, planning, decision-making and navigation. Once completed, the electronic components of the artificial brain will number one hundred million neurons and one trillion synapses, equivalent to the brain of a small mammal.

"The result will be one of the most complex machines ever constructed, and it will push the limits of state-of-the-art computational and hardware techniques," says Krichmar whose background in computational sciences and software engineering has included work on Raytheon Corporation's PATRIOT Missile System and IBM's Federal Systems Division Air Traffic Control system. His more recent neurorobotics research at UCI can be seen in CARL, a brain-based robot who moves autonomously, and adapts its behavior in response to different color cues and rewards. CARL's electronically engineered brain is equivalent to 50,000 neurons and one million connecting synapses - a network that has one million times fewer synapses than the proposed artificial brain Krichmar and the HRL research team are working to develop.

"It's a thrill to be a part of a team that includes some of the best computational scientists, hardware engineers, and neuroscientists in the world," says Krichmar.

The multi-year, multi-phase project begins with development and testing of the synaptic hardware which must be demonstrated by July 2009. Future phases focus on architecture, simulation and virtual environment testing. By the end of the program, a complete electronic brain will be demonstrated.