Neuroscience Pioneer to Receive Top Engineering Award in San Diego

February 15, 2008

Doug Ramsey

A pioneer in artificial intelligence and neural networks at the University of California, San Diego has been selected by the San Diego chapters of professional engineering societies for their top honor of 2008.

On Feb. 22, Robert Hecht-Nielsen will accept the Outstanding Engineer award, presented annually by the San Diego County Engineering Council (SDCEC). The organization brings together the San Diego chapters of IEEE, American Institute of Aeronautics and Astronautics (AIAA), and many other technical societies.

The award ceremony will be held at the Joan Kroc Institute for Peace and Justice at the University of San Diego. It is one of numerous events in San Diego, including at UCSD, scheduled as part of National Engineering Week 2008.

The Outstanding Engineer award recognizes a practicing engineer who has made recent outstanding contributions to the field of engineering. Hecht-Nielsen believes the Outstanding Engineer award honors his presentation and publication last year of "Confabulation Theory" (Springer-Verlag 2007)-the culmination of a lifetime of work on the mechanism by which thinking is carried out in humans and animals. "For forty years my goal has been to understand the fundamental mechanism of thought," said the author. "This search led to a unified 'confabulation theory' of cognition that explains the mechanism of thought."

How thinking works has puzzled scientists for millennia-from Aristotle's studies on human thought (published in 350 B.C.), to recent computational neuroscience research. Hecht-Nielsen's Confabulation Theory now presents the scientific and engineering communities with what he calls the "first comprehensive and complete theory of cognition," a theory that he believes can shed extensive light on the design of the brain. "Seeing the detailed process of thinking in action," said Hecht-Nielsen, "it is clear that thinking is starkly alien in comparison with past concepts in neuroscience, computer science, and so on."

Confabulation Theory postulates that the human brain's cerebral cortex is divided into about 4,000 separate, small modules; each an individual 'thought processor'. Modules are manipulated in groups, like muscles, to carry out thinking. What thinking involves is taking a starting set of 'assumed facts' (e.g., sensory inputs) and then producing a set of conclusions based upon these starting facts. Billions of learned axonal knowledge links exist within each adult human's cerebral cortex, and often millions of these are used during a single, massively parallel, thought process that takes place in less than a second.

The basic information processing operation carried out by each module is called confabulation. Usually, many confabulations are being carried out in parallel, utilizing millions of knowledge links. The effect of each knowledge link being used is to transmit excitation to specific groups of neurons. During confabulation, those neuron groups with low levels of excitation are slowly shut off, leaving the most excited groups to compete with each other. In the end, each module involved in a thought process has one neuron group active (its confabulation conclusion) and all other neuron groups shut off. (For more details on what the theory involves, go to http://www.calit2.net/newsroom/release.php?id=1234.)

Hecht-Nielsen envisions that by 2100, human toil will have permanently ended; he argues that hundreds of billions of confabulation theory-based intelligent machines would do all work that humans choose not to do. "By 3000, humans and their intelligent machines will have spread throughout the Milky Way galaxy," he said, forecasting that "by the year 20,000, humans and their intelligent machines will be intervening to eliminate unnecessary life-form suffering, strife and tragedy throughout the millions of billions of galaxies of the entire universe."

Professor Hecht-Nielsen is Director of the Confabulation Neuroscience Laboratory in the California Institute for Telecommunications and Information Technology (Calit2) at UC San Diego. He is also Adjunct Professor of electrical and computer engineering in UCSD's Jacobs School of Engineering, where he has taught a popular, year-long graduate sequence on neurocomputing since 1986. This course now serves as an introduction to the neuroscience, and technological applications, of confabulation theory.

That same year, he co-founded HNC Software (originally Hecht-Nielsen Neurocomputer Corporation), one of San Diego's early high-tech success stories. HNC went public in 1995 and then merged with similar-sized Fair Isaac Corporation (NYSE: FIC) in 2002. Hecht-Nielsen's UCSD Confabulation Neuroscience Laboratory is sponsored by the Office of Naval Research.

Hecht-Nielsen received his Ph.D. in Mathematics from Arizona State University in 1974. He is a Member of the Society for Neuroscience, an AIAA Member, an IEEE Fellow, recipient of the IEEE Neural Networks Pioneer Award, and a Member of the Board of Governors of the International Neural Network Society (2007-'09).

He is a founder and member of UCSD's Institute for Neural Computation, a founder of the UCSD Graduate Program in Computational Neurobiology, and has been honored with the Department of Electrical and Computer Engineering's Graduate Teaching Award.

Looking to the future, Hecht-Nielsen hopes that his recent book will spark a lot of new "integrative neuroscience research directed at answering the many scientific questions raised by confabulation theory."

Media Contact: Doug Ramsey, 858-822-5825