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FINAL REPORT

ONR Grant N00014-96-1-0528
Woods Hole Workshop on Computational Neuroscience
May 1, 1996 to April 30, 1997

Summary

The Woods Hole Workshop on Computational Neuroscience
was held at the Marine Biological Laboratory on August 26 to August
31, 1996. Twenty-two investigators attended the workshop on the
computational functions of nervous systems. The topics in
computational neuroscience that were discussed included neural
systems for learning and long-term memory, non-classical responses of
cortical neurons, and active perception. In addition, some members of
the workshop lectured in the concurrent Computational Neuroscience
Course at the Marine Biological Laboratory, and students taking the
course were invited to attend the workshop. The Workshop was
highly successful at bring together experimentalists and computational
neuroscientists for intense discussions at the forefront of
computational neruoscience.

Workshop themes

The Workshop fostered close contacts between experimenters
and modelers interested in achieving a functional description of
nervous systems. A copy of the Workshop Schedule is attached in the
appendix. A few of the themes that were explored during the week
included;

1. Active perception Several talks reported recent advances in
our understanding of visuo-motor systems. . The motor system is used
by animals to control the flow of sensory input, which is a form of
active perception. David Kleinfeld presented work on the rat
somatosensory system showing that movement of the whiskers take
active part in sensory processing. Andrew Schwartz showed that the
velocity of the arm as well its direction of motion is represented in the
motor cortex.

2. Neural systems for memory and attention. The brain is also
capable of internally directing computational resources at different
sensory streams and different sensory cues, which affect the
information that is stored in long-term memory. Robert Desimone
and John Reynolds presented recordings from the temporal cortex and
the frontal cortex of monkeys showing that correlates of attention and
memory were apparent in the pattern of activity in large neural

populations. John Maunsell showed that the responses of neurons in the motion processing areas of cortex were strongly modulated by attention when multiple targets were present at the same time. Wolfram Schultz showed that dopamine cells in the brainstem of the monkeys carry information about the predicted reward value of sensory stimuli, which could be important for reinforcement learning.

3. Non-classical surrounds in the visual cortex. The discovery by John Allman that the responses of neurons in the visual cortex could be modulated by visual stimuli outside the classical receptive fields of cortical neurons has been extended by several laboratories. Karl Zipser presented research showing that a late response of cells in extrastriate visual cortex was strongly modulated by surface relationships in the non-classical surround.

Workshop participants

Twenty-two investigators participated in the Workshop, about equally divided between experimentalists and neural modelers. The addresses of the participants are given in the appendix.

John Allman, Caltech
Richard Andersen, Caltech
Dana Ballard, Rochester University
William Bialek, NEC Research
Bruce Cumming, Oxford
Joel Davis, ONR
Robert Desimone, NIH
Bard Ermentrout, Univ. Pittsburgh
David Kleinfeld, AT&T Bell Labs
John Maunsell, Baylor
Fred Miles, NIH
John Reynolds, NIH
Wolfram Schultz, Fribourg, Switzerland
Andrew Schwartz, Neurosciences Institute, San Diego
Terrence Sejnowski, UCSD/Salk
Haim Sompolinsky, Hebrew University, Israel
Leland Stone, NASA Ames
Nicholas Swindale, Univ, British Columbia, Canada
Michael Stryker, UCSD
David Tank, AT&T Bell Labs (Lucent)
Karl Zipser, MIT
Steve Zucker, McGill University

Organization of the Workshop

Each participant was allowed 90 minutes to present a new finding, including discussion. Two general sessions were held each day, one the morning from 9 AM to 12 Noon, and the second in the evening from 7 PM to 10 PM. Each sessions included two presentations, one from an experimentalist, and one from a theoretician. The afternoons were free to allow the participants to form small groups for lunch and other activities. These activities included interactions with the students in the summer course; a picnic organized by Robert Bosler, a resident of Woods Hole, and a student-faculty volleyball game. The special environment in Woods Hole, which is a major summer research center in neurobiology and has great physical beauty, has given the workshops a perfect setting and created an ideal place for cross disciplinary interactions to occur.

Interactions with other activities at MBL

The Workshop was held concurrently with the last week of the Methods in Computational Neuroscience Summer Course, a 4 week lab course that attract the best students interested in modeling the nervous system from the biophysical to the systems levels. Several of the workshop participants gave tutorial lectures to the students, including Richard Andersen, Haim Sompolinsky, David Kleinfeld, David Tank, Steve Zucker and Terrence Sejnowski. In addition, students were able to attend workshop lectures that were on topics that were of direct interest to their research goals. Thus, the Workshop had an educational function as well as a provide the participants with the opportunity to exchange information about their research.

Support

In addition to support from the ONR, the workshop was also supported by NASA, through the MBL's Center for Advanced Studies in the Space Life Sciences.