

Workshop on Computational Neuroscience

February 23rd – 24th, 2007

Recently there has been great progress in the study and modeling of neural activity in biological systems. This is an area with tremendous challenges, both because of the scale of the problems (billions of neurons) and the lack of specific knowledge of the details of the processes that underlie the biology. This week, the Department of Mathematics, the Department of Psychology and the Program in Applied Mathematics are sponsoring an informal workshop on computational neuroscience. On this coming Friday and Saturday (February 23-24) speakers from the psychology department of the University of Arizona and from the Courant Institute will present recent results showing what mathematics and computation can bring to this important area, as well as presenting the current state of the art. Friday's presentations will start at 12 Noon and will be devoted to results of current research, while Saturday's sessions (from 9AM-12 Noon) will be devoted to discussions about future directions for this research and opportunities for collaboration

All are invited to attend the sessions and discussions. The detailed schedule is below.

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Hosted by:

Program in Applied Mathematics, Department of Mathematics,
and the Arizona Center for Mathematical Sciences
University of Arizona

An informal workshop to build ties between the Computational Neuroscience groups at the University of Arizona and the Courant Institute for Mathematical Sciences, NYU, will be held on February 23rd and 24th. The program will begin at noon on Friday, February 23rd with an introductory talk for graduate students and end with working sessions during the morning of Saturday, February 24th.

Schedule for Friday, February 23rd

12:00 – 1:00pm, Invited Talk/Applied Mathematics Brown Bag Seminar,
Math 402

“Making Models of the Brain”

Jean-Marc Fellous, Dept. of Psychology/Applied Mathematics, UA

Abstract: I will review the basic levels of neural modeling, from the McCulloch-Pitts neurons to detailed biophysical models of single neurons. I will discuss the three major features of successful models: Biological soundness, explanatory and predictive powers. Examples of computational models will be given to illustrate these points. This lecture is meant to introduce newcomers to computational neuroscience, in preparation for the lectures that will be given during the workshop.

1:30 - 2:30pm, Invited talk, Math 402

“Causality and Coding in the Cortex”

Adi Rangan, Courant Institute for Mathematical Sciences, NYU

Abstract: Many cortical areas respond to different stimuli in different ways. For example, within the locust olfactory cortex, distinct odors generate reproducibly distinct activity profiles. I will present a new way to examine the coding properties of such a system, and illustrate several features of this new method.

2:45 – 3:30pm, Invited talk, Math East 241

“Systems-level neural modeling of learning and decision making”

Michael Frank, Dept. of Psychology, UA

Abstract: The basal ganglia and frontal cortex interact intimately to facilitate adaptive action plans while suppressing those that are less adaptive. The dynamics of this circuitry in reinforcement learning and decision making have been explored via a series of inter-related computational models. The models suggest distinct neurobiological mechanisms associated with (a) action selection; (b) learning the probability of an action leading to reward; (c) holding in mind graded values of reinforcement magnitude in working memory; and (d) dynamic modulation of

decision thresholds. I will present novel predictions arising from these models that have been confirmed in experiments with multiple patient populations, pharmacological manipulation, neuroimaging and genetics.

3:30 – 4:00pm, Math 401N
Pre-Colloquium tea

4:00 – 5:00pm, Applied Mathematics Colloquium, Math 501

“One model, one regime, and many phenomena”

David Cai, Courant Institute for Mathematical Sciences, NYU

Abstract: We will present our large-scale computational modeling of the primary visual cortex (V1). In particular, we will discuss network mechanisms underlying spatiotemporal dynamics associated with spontaneous on-going activity of the V1 and the line-motion illusion --- which is the illusory motion sensation from a static cue of a flashed stationary square quickly followed by a stationary bar. Related issues, such as kinetic theory of neuronal network dynamics, will also be addressed.

Schedule for Saturday, February 24th

9:00 – 12:00 noon: discussion sessions and working groups, Math East 241