Temple University Mathematics Colloquium

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will speak on

Stimulus space topology and geometry from neural activity

ABSTRACT: We construct our understanding of the world solely from neuronal activity generated in our brains. How do we do this? Many studies have investigated how the electrical activity of neurons (action potentials) is related to outside stimuli, and maps of these relationships – often called receptive fields – are routinely computed from data collected in neuroscience experiments. Yet how the brain can understand the meaning of this activity, without the dictionary provided by these maps, remains a mystery. I will present some recent results on this question in the context of hippocampal place cells – i.e., neurons in rodent hippocampus whose activity is strongly correlated to the animal's position in space. In particular, we find that topological and geometric features of the animal's physical environment can be derived purely from the activity of hippocampal place cells. Relating stimulus space topology and geometry to neural activity opens up new opportunities for investigating the connectivity of recurrent networks in the brain. I will conclude by discussing some current projects along these lines. This is joint work with Vladimir Itskov (Columbia, CTN).

Monday, 9 February 2009
Lecture at 4:00 pm
Coffee, tea, and refreshments from 3-5 pm
Room 617, Wachman Building
Department of Mathematics