Department of Mathematics and Statistics Colloquium

Predicting Neural Network Dynamics via Graphical Analysis

Job Candidate

Abstract: Networks of neurons in the brain often exhibit complex patterns of activity that are shaped by the intrinsic structure of the network. For example, spontaneous sequences of neural activity have been observed in cortex and hippocampus, and patterned motor activity arises in central pattern generators (CPGs) for locomotion. In this talk, we will focus on a simplied neural network model known as Combinatorial Threshold-Linear Networks (CTLNs) in order to understand how the pattern of neural connectivity, as encoded by a directed graph, shapes the emergent nonlinear dynamics of the corresponding network. We will see that important aspects of these dynamics are controlled by the stable and unstable fixed points of the network, and show how these fixed points can be determined via graph-based rules. We also present an algorithm for predicting sequences of neural activation from the underlying directed graph, and examine the effect of graph symmetries on a network's set of attractors.

Thursday, February 1 at 3:50 in Roop 103

Refreshments at 3:30