The University of Chicago
Department of Statistics

Seminars for Fourth Year Ph.D. Students

YIBI HUANG

Department of Statistics
The University of Chicago

Precise Capacity Analysis in Binary Networks with Multiple Coding Level Inputs

TUESDAY, March 10, 2009 at 3:00 PM
110 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

We compute the retrieval probabilities of a Hebbian learning model with binary neurons and synapses. This provides more accurate predictions than the signal-to-noise ratio techniques used previously. The main tool is the analysis of the field induced by a learned pattern on a neuron as a Markov chain that evolves with the learning process. An alternative prediction formula using a normal approximation yields equally accurate predictions, but depends on a detailed computation of the covariances between the synapses which we develop here. These covariances had been ignored in previous analyses. In addition, we are able to extend the results to patterns with multiple coding levels, in contrast to most eariler work that has assumed patterns have on average a fixed coding level. Dealing with multiple coding levels requires the introduction of a simple inhibition in the dynamics whose magnitude depends on the coding level statistics of the pattern population. The inhibition enables the setting of a neural threshold that yields stable retrieval of learned patterns of the different coding levels, using asynchronous network dynamics. Retrieval is also robust to significant noise in the inputs.

Information about building access for persons with disabilities may be obtained in advance by calling Kelly Macias at 773.834.5169 or by email (kmacias@galton.uchicago.edu).