



THE UNIVERSITY OF CHICAGO

Department of Statistics

SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

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Statistical Physics of Inference with Hidden Variables

THURSDAY, April 14, 2016 at 4:30 PM
133 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

I will discuss two related problems where statistical physics provides a new perspective on the role of hidden variables in statistical inference. (1) Recently it has become possible to directly measure the simultaneous activity of large populations of neurons, allowing one to study the properties of the collective neural code. When translating the observed response distributions into the language of statistical physics, these systems appear poised near a unique critical point, where the extensive parts of the entropy and energy are exactly equal. Here we present analytical arguments and numerical simulations showing that such critical behavior naturally arises in systems with unobserved random variables, such as a common input stimulus to a neural population, that affect the observed degrees of freedom. We then test whether this mechanism is at work in the spiking output of the retina. (2) Next we turn to deep learning, a popular subfield of machine learning where recent performance on tasks such as visual object recognition rivals human performance. We present recent work relating greedy training of deep belief networks to a form of variational real-space renormalization. This connection may help explain how deep networks automatically learn relevant features from data and extract independent factors of variation. Finally, we demonstrate the utility of modern real-space renormalization methods in a supervised setting.

Organizers:

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