THE UNIVERSITY   **OF HONG KONG**

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

On the binary perceptron

Miss Shuangping Li
Princeton University

Abstract

We consider the binary perceptron model, a simple model of neural networks that has gathered significant attention in the statistical physics, information theory and probability theory communities. For the symmetric binary perceptron model, we establish that the partition function of this model, normalized by its expected value, converges to a lognormal distribution. As a consequence, this allows us to establish several conjectures for this model, including contiguity, sharp threshold and strong freezing conjectures.

The strong freezing property further points to an interesting phenomenon that is not present in sparse constraint satisfaction problems: on the one hand, the perceptron model is conjectured to be typically hard; on the other hand, efficient algorithms have been shown empirically to succeed in finding solutions, suggesting that such algorithms find atypical solutions. We establish formally such a phenomenon for both the symmetric and asymmetric binary perceptrons. We show that at low constraint density, there exists a subdominant connected cluster of solutions with almost maximal diameter, and that an efficient multiscale majority algorithm can find solutions in such a cluster with high probability. This is based on joint works with Emmanuel Abbe and Allan Sly.

Date:	May 4, 2022 (Wednesday)
Time:	10:00 – 11:00am (Hong Kong Time)
Venue:	ZOOM: https://hku.zoom.us/j/
	Meeting ID: 913 6532 3891
	Password: 310656

All are welcome