THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Statistics Colloquium

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"The unreasonable effectiveness of negative association"

Monday November 13th, 2023, at 11:30 AM
Jones 303, 5747 S. Ellis Avenue
Refreshments will be served before the seminar at 11:00 am in Jones 303.

Abstract

In 1960, Wigner published an article famously titled "The Unreasonable Effectiveness of Mathematics in the Natural Sciences". In this talk we will, in a small way, follow the spirit of Wigner's coinage, and explore the unreasonable effectiveness of negatively associated (i.e., self-repelling) stochastic systems far beyond their context of origin. As a particular class of such models, determinantal processes (a.k.a. DPPs) originated in quantum and statistical physics but have emerged in recent years to be a powerful toolbox for many fundamental learning problems.

In this talk, we aim to explore the breadth and depth of these applications. On one hand, we will explore a class of Gaussian DPPs and the novel stochastic geometry of their parameter modulation, and their applications to the study of directionality in data and dimension reduction. At the other end, we will consider the fundamental paradigm of stochastic gradient descent, where we leverage connections with orthogonal polynomials to design a minibatch sampling technique based on data-sensitive DPPs; with provable guarantees for a faster convergence exponent compared to traditional sampling. Principally based on the following works:

[1] Gaussian determinantal processes: A new model for directionality in data, with P. Rigollet, Proceedings of the National Academy of Sciences, vol. 117, no. 24 (2020), pp. 13207--13213 (PNAS Direct Submission)

[2] Determinantal point processes based on orthogonal polynomials for sampling minibatches in SGD, with R. Bardenet and M. Lin Advances in Neural Information Processing Systems 34 (Spotlight Paper at NeurIPS 2021)

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