THE UNIVERSITY OF CHICAGO | **THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS**

Computational and Applied Mathematics Colloquium

Joint colloquium with the Department of Statistics

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On flows and diffusions: from the many-body Fokker-Planck equation to stochastic interpolants

THURSDAY, January 18, 2024, at 4:00PM
Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

Given a stochastic differential equation, its corresponding Fokker-Planck equation is generically intractable to solve because its high dimensionality prohibits the application of standard numerical techniques. In this talk, I will exploit an analogy between the Fokker-Planck equation and modern generative models from machine learning to develop an algorithm for its solution in high dimension. The method enables the computation of previously intractable quantities of interest, such as the entropy production rate of active matter systems, which quantifies the magnitude of nonequilibrium effects. I will then highlight how insight from the Fokker-Planck equation facilitates the development of a new class of generative models known as stochastic interpolants, which generalize state of the art diffusion models in several key ways that can be leveraged to improve practical performance. Along the way, I will argue that methods from machine learning offer a compelling solution for many fascinating high-dimensional mathematical problems that are currently out of reach with more traditional computational tools.