STATISTICS SEMINAR

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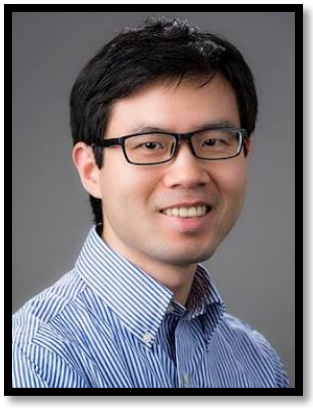

TITLE:

Understanding and accelerating statistical sampling algorithms: a PDE perspective

Abstract: A fundamental problem in Bayesian inference and statistical machine learning is to efficiently sample from probability distributions. Standard Markov chain Monte Carlo methods could be prohibitively expensive due to various complexities of the target distribution, such as multimodality, high dimensionality, large datesets, etc. To improve the sampling efficiency, several new interesting ideas/methods have recently been proposed in the community of machine learning. Among them the Stein variational gradient descent has been very popular in many machine learning applications, whereas its theoretical analysis is very little understood.

In the first part of the talk, I will focus on the scaling limit analysis of interacting particle dynamics of the Stein variational gradient descent. More specifically I will show that the macroscopic limit of the Stein variational gradient descent particle dynamics can be described by a nonlinear and nonlocal PDE. The gradient flow structure and long time convergence of the PDE will also be discussed. These analytical results justify rigorously the Stein variational gradient descent as a sampling algorithm.

In the second part of the talk, I will introduce a new birth-death dynamic and discuss its acceleration effect when applied to the classical Langevin diffusion. At the PDE level, the birth-death accelerated Langevin dynamics corresponds to a linear Fokker-Planck equation supplemented by a nonlocal birth-death term. I will discuss the gradient flow structure and the convergence to the equilibrium of solution to the PDE. As a remarkable feature, the asymptotic rate of convergence to the equilibrium for the PDE is independent of the potential barrier, in contrast to the exponential dependence in the case of the Langevin diffusion. The accelerating behavior of the proposed birth-death dynamics is demonstrated by some analytical and numerical examples.

Speaker:
Yulong Lu

Research Assistant Professor
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Time & Place:

Wednesday,
October 30, 2019
4:00, Room 140 Bardeen
Cookies & Coffee @ **3:30**, Rm 1210 MSC

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