香港中文大學統計學系
Department of Statistics
THE CHINESE UNIVERSITY OF HONG KONG

SEMINAR
DEPARTMENT OF STATISTICS
THE CHINESE UNIVERSITY OF HONG KONG

Diffusion Model and Sampling Algorithms

INVITED SPEAKER

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TIME

October 16, 2024 (Wed) · 2:30 pm - 3:30 pm

VENUE

ERB 803 · William M W Mong Eng Bldg 803 · CUHK

ABSTRACT

In this presentation, we explore the synergy between diffusion models and advanced sampling techniques, demonstrating how diffusion models can enhance conventional sampling methods and, conversely, how sampling innovations can improve diffusion models. We will first discuss how the reverse process of a diffusion model, particularly when combined with Diffusion Monte Carlo techniques, significantly enhances the handling of challenging target densities. By incorporating novel recursive score estimation techniques, we prove that computational complexity can be reduced to at most quasi-polynomial levels, a substantial improvement over the existing methods which often exhibit exponential complexity. Then, we will focus on the diffusion model. We show that the inference process of diffusion model can be broken down into a series of manageable sampling subproblems, where the hardness of each problem and their total numbers can be flexibility adjusted. Accordingly, we propose a reverse transition kernel (RTK) framework to implement diffusion inference, integrating well-established sampling algorithms such as the Metropolis-Adjusted Langevin Algorithm (MALA) and Underdamped Langevin Dynamics (ULD). This integration not only boosts sampling efficiency but also fortifies the theoretical convergence guarantees of the model. Lastly We will also highlight several directions for future research, aiming to continuously refine the integration of diffusion models with sampling techniques.