The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Generative Modeling and Unnormalized Sampling in Machine Learning

By

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ABSTRACT

This thesis explores the theoretical aspects of generative AI and unnormalized sampling, focusing on optimization challenges in probabilistic spaces. It introduces a first-order algorithm for efficient unnormalized sampling, utilizing unique discretization strategies and adaptive distance metrics suitable for complex target distributions. Other key findings include tackling the difficulties posed by multi-modal distributions in generative modeling and sampling. The study introduces two innovative approaches: (1) Using variational inference to address transport challenges in conditional contexts, and (2) Implementing a reverse SDE process for transitioning from multi-modal to Gaussian distributions, demonstrating their effectiveness through theoretical and empirical analysis. Additionally, the work applies these sampling techniques to complex systems like two-layer neural networks and non-convex min-max problems, converting them to convex systems in probabilistic terms. This showcases the crucial role of generative model theories in both practical and theoretical applications.

Date : 30 November 2023, Thursday

Time : 3:30 pm

Venue : Room 4472 (Lifts 25/26)

***Thesis Examination Committee*:**

Chairman	**:**	**Prof. Chii SHANG, CIVL/HKUST**
Thesis Supervisor	**:**	**Prof. Tong ZHANG, MATH/HKUST**
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(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).