Ph.D. Dissertation Defense

Candidate:	Yang Li
Degree:	Doctor of Philosophy
School/Department.:	School of Business / Financial Engineering
Date:	Thursday, August 14, 2025
Time:	9:00 – 10:30 am
Location:	Virtual(https://stevens.zoom.us/j/96916925538)
Title:	Generative Models for Algorithmic Trading with Superior Reasoning
Chairperson:	Dr. Steve Yang, Financial Engineering, School of Business
Committee Members:	Dr. Zhenyu Cui, Financial Engineering, School of Business
	Dr. Zachary Feinstein, Finance/FE, School of Business
	Dr. Chihoon Lee, Information Systems, School of Business

Abstract

The three essays presented in my dissertation examine the application of advanced generative AI techniques to financial market modeling and high-frequency trading. They explore flow matching-based imitation learning for adaptive market making, optimal execution under stochastic volatility, and byte-level generative modeling of orderbook dynamics.

The first essay, "FinFlowRL: A Flow Matching Policy Induced Imitation Learning Framework for Adaptive Stochastic Control in Finance" presents a two-stage approach combining flow matching-based imitation learning with reinforcement learning to enhance market-making strategies. Initially, it pre-trains a meta-policy using MeanFlow with specialized experts (AS, GLFT, PPO) optimal for different market conditions. FinFlowRL then employs a lightweight noise policy optimizing adaptability with fewer parameters than full end-to-end training. Extensive evaluations show FinFlowRL consistently outperforms individual experts, delivering higher Sharpe ratios and returns. Its innovative action-chunking method addresses market non-Markovianity, exhibiting robustness to sudden price shifts.

The second essay, "FlowOE: Imitation Learning with Flow Matching for Optimal Execution under Heston Volatility and Concave Market Impacts" addresses executing large orders in dynamic markets, improving traditional models like Almgren-Chriss. FlowOE leverages flow matching-based imitation learning from diverse market-specific expert strategies, utilizing the Shortcut policy for significant computational efficiency. Evaluations in stochastic volatility and nonlinear market impacts environments reveal FlowOE's superior performance, significantly reducing implementation shortfalls and risk compared to benchmarks (TWAP, VWAP) and calibrated experts.

The third essay, "ByteGen: A Tokenizer-Free Generative Model for Orderbook Events in Byte Space" introduces a groundbreaking approach modeling market dynamics from raw 32-byte binary data, removing biases from tokenization and manual feature engineering. Employing an adapted H-Net architecture with dynamic chunking and hybrid Mamba-Transformer blocks, ByteGen effectively replicates key market distributions. Trained on extensive CME Bitcoin futures data, ByteGen demonstrates exceptional flexibility and competitive performance, enabling new possibilities in high-frequency financial modeling without predefined schemas.