The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Options Dynamic Hedging and Optimal Order Execution with Reinforcement Learning

By

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ABSTRACT

In this thesis, we present two applications of reinforcement learning models in the financial domain. The first study focuses on the dynamic hedging of financial derivatives, where a reinforcement learning algorithm is designed to minimize the variance of the delta hedging process. In contrast to previous research in this area, we incorporate uncertainty estimation technology to measure the uncertainty of the agent's decision, which further reduces unnecessary wear and tear in the hedging process and control model overconfidence that may lead to significant losses. Numerical experiments show the superiority of our strategy in Monte Carlo simulations and S&P 500 option data. The second study is about optimal order execution, where a large order is split into several small orders to maximize the implementation shortfall. Based on the diversity of cryptocurrency exchanges, we attempt to extract cross-exchange signals by aligning data from multiple exchanges for the first time. Unlike most previous studies that focused on using single-exchange information, we investigate the impact of cross-exchange signals on the agent's decision-making in the optimal execution problem. Experimental results show that cross-exchange signals can provide additional information for the optimal execution of cryptocurrency to facilitate the optimal execution process.

Date : **20 July 2023, Thursday**

Time : **9:00 am**

Venue : **Room 2463 (Lifts 25/26)**

Thesis Examination Committee:

Chairman	:	**Prof. Fei SUN, CBE/HKUST**
Thesis Supervisor	:	**Prof. Can YANG, 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).