The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Integrating Multiple Structured Data with AI for Medical Images and Financial Markets

By

Mr. Jiafa HE

ABSTRACT

This thesis explores the potential of AI techniques to solve challenging problems in two different domains: medical imaging and high-frequency trading. In the first part of the thesis, we focus on the challenge of extracting and segmenting 3D blood vessels from CT images, which is crucial for the diagnosis of vascular diseases. We propose a hybrid representation learning approach that combines CNNs and a point-cloud network to capture both local appearances and global geometry of vessels. Our approach provides an efficient, fully-automatic, and template-free approach to centerline extraction from 3D images, and outperforms traditional and CNN-based baselines. In the second part, we address the challenge of developing effective market making strategies in high-frequency trading. We propose a deep reinforcement learning approach that fuses tick-level data with periodic prediction signals to develop a more accurate and robust market making strategy. Our approach outperforms existing methods in profitability and risk management in cryptocurrency markets.

Date :	**18 Jul 2023, Tuesday**	
Time :	**2:00 pm**	
Venue :	**Room 4504 (Lifts 25/26)**	

Thesis Examination Committee:

Chairman	:	Prof. Nevin Lianwen ZHANG, CSE/HKUST
Thesis Supervisor	:	Prof. Can YANG, MATH/HKUST
Member	:	Prof. Dong XIA, MATH/HKUST
Member	:	Prof. Yang XIANG, MATH/HKUST
Member	:	Prof. Ruohan ZHAN, IEDA/HKUST
External Examiner	:	Prof. Yuanyuan LIN, Department of Statistics / The Chinese University of Hong Kong

(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).