UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE | Department of Mathematics

Departmental PhD Thesis Exam

Thursday, Sept.12th, 2024 at 2:00 p.m. (sharp)
via Zoom / BA6183

PhD Candidate : Jinhui Li

Supervisor : Luis Seco

Thesis title : Advanced Optimization Techniques in Dynamic Portfolio Strategies, Pair Trading, and Carbon Dioxide Emission Modeling

Abstract

AI technologies are revolutionizing the world at a very fast pace. I believe that in the future, they can revolutionize math research as well. In this thesis, we developed novel portfolio construction models that integrate Bayesian Markov Switching Models with clustering algorithms, designed to optimize dynamic portfolio strategies. Additionally, we introduced a Multi-modal Temporal Relation Graph Learning framework to discern pair trading patterns, and an optimization framework incorporating Support Vector Machine regression and Principal Component Regression to refine carbon dioxide emission forecasting. Detailed convergence analyses were conducted for both the Bayesian Markov Switching Model and the MTRGL framework, ensuring that these models efficiently reach stable solutions. These methodologies have demonstrated superior risk-adjusted returns, improved trading pattern recognition, and enhanced accuracy in emission modeling, showcasing the transformative potential of AI-driven optimization and mathematical models in quantitative finance and sustainability.