NUS Quantitative Finance Conference 2025

July 31 – August 1, 2025

UTown, National University of Singapore

Pre-Conference Event (Durian Party)

Date: 30 July 2025
Time: 4pm
Durian Party Venue: NUS Department of Mathematics, 10 Lower Kent Ridge Road, Block S17, Level 4, Singapore 119076

Program Overview

Thursday, July 31, 2025

09:00–11:00	**Session 1** Track A: Samuel Drapeau, Karthik Natarajan, Kyunghyun Park, Qikun Xiang Track B: Anna Kwossek, Binnan Wang, Chong Liu, Hao Ni Track C: Dominic Rainsborough, Lei Zhou, Florian Rossmannek, Matthias Fengler Track D: Zhaoli Jiang, Yingda Song, Chen Yang, Cong Qin
11:00–11:30	Coffee Break
11:30–12:30	**Keynote Lecture 1: Xin Guo**
12:30–13:30	Lunch Break
13:30–16:00	**Session 2** Track A: Yingda Song, Lu Chung I, Ziteng Cheng, Alessandro Boccassino Track B: Fenghui Yu, Lingyi Yang, Jasper Rennspies, Song Xuanye, Dongna Zhang Track C: Christoph Knochenhauer, Thorsten Schmidt, Helene Halconruy, Gregor Kastner, Yu-Jui Huang Track D: Yang Liu, Shuajie Qian, Hu Sang, Zeng Yuhao, Nabil Kazi-Tani
16:00–16:30	Coffee Break
16:30–18:30	**Session 3** Track A: Julian Pachschwöll, Jasper Rennspies, Ilya Archakov, Yuan Chen Track B: Philipp Schmocker, Gao Wenhan, Aniq Atiqi Rohmawati, Huansang Xu Track C: Jeonggyu Huh, Donghan Kim, Hyungbin Park, Yong Hyun Shin
19:30–	Conference Dinner (Venue: Peach Garden @ OCBC Center)

Friday, August 1, 2025

09:00–11:00	**Session 4** Track A: Xiang Yu, Zhenhua Wang, Shihao Zhu Track B: Xiaofei Shi, Seongjin Kim, Junhuan Zhang, Abdullah Mohammed AlGhazali Track C: Cheng Si, Wayne Wei Li, Xiaofei Xu, Xie Haoyu
11:00–11:30	Coffee Break
11:30–12:30	**Keynote Lecture 2: Mathieu Rosenbaum**
12:30–13:30	Lunch Break
13:30–15:30	**Session 5** Track A: Daniel Traian Pele, Ruting Wang, Hannah Lai, Yezhou Sha Track B: Nicolas Nguyen, Tao Pang, Jin Hyuk Choi Track C: Daniel Bartl, Shuoqing Deng, Bingyan Han, Fangrui Lim
15:30–16:00	Coffee Break
16:00–17:00	**Keynote Lecture 3: Min Dai**

Detailed Program Overview

Day 1 – Thursday, July 31, 2025

09:00–11:00 Session 1 (4 parallel tracks)

- Track A: Data-driven and robust optimization
  Chair: Daniel Bartl
  - Samuel Drapeau (SJTU): Carbon: Tax versus Cap-and-Trade
  - Karthik Natarajan (SUTD): Distributionally robust optimization through the lens of submodularity
  - Kyunghyun Park (NTU): Scaling Limits of Multi-Period Distributionally Robust Optimization
  - Qikun Xiang (NTU): Provably convergent stochastic fixed-point algorithm for Wasserstein barycenter
- Track B: Signature Methods in Finance
  Chair: Anna Kwossek
  - Anna Kwossek (University of Vienna): Universal approximation with Itô-type signatures
  - Binnan Wang (Peking University): Signature-Based Hedging: Theory and Simulation
  - Chong Liu (ShanghaiTech University): Higher rank signature and its applications in finance
  - Hao Ni (University College London): High-Rank PCF-GAN: High-Fidelity Financial Time Series Generation
- Track C: Advances in Quantitative Finance and Econometrics
  Chair: Matthias Fengler
  - Dominic Rainsborough (Uni SG-SGI): The Effects of Trade Policies on Country-Level Investment Decisions of Private Equity Funds
  - Lei Zhou (NUS): Debt Structure and Recovery Rates
  - Florian Rossmannek (NTU): Efficient Sobolev approximation of linear parabolic PDEs in high dimensions
  - Matthias Fengler (Uni SG): Proxy-identification of a structural MGARCH model for asset returns
- Track D: Advanced Topics in Financial Risk and Portfolio Dynamics
  Chair: Cong Qin
  - Zhaoli Jiang (Hong Kong Polytechnic University): Dynamic Mean-Variance Efficient Fractional Kelly Portfolios in a Stochastic Volatility Model
  - Yingda Song (Shanghai Jiao Tong University): Intra-Horizon Risk: The Role of Stochastic Volatility
  - Chen Yang (Chinese University of Hong Kong): Arbitraging on Decentralized Exchanges

    * Cong Qin (Shanghai University of Finance and Economics): Periodic Evaluation with Non-Concave Utility

11:00–11:30 Coffee Break

11:30–12:30 Keynote Lecture 1

- Speaker: Xin Guo (University of California, Berkeley)
- Title: An alpha-potential game framework for multi-agent system

12:30–13:30 Lunch Break

13:30–16:00 Session 2 (4 parallel tracks)

- Track A: Recent Advances in Machine Learning for Finance
  Chair: Lu Chung I
    * Yingda Song (Shanghai Jiao Tong University): Efficient Nested Estimation of CoVaR: A Decoupled Approach
    * Lu Chung I (NUS): Distributionally Robust Deep Q-learning
    * Ziteng Cheng (HKUST-GZ): Eliciting Risk Aversion with Inverse Reinforcement Learning via Interactive Questioning
    * Alessandro Boccassino (ETH Zurich & Vontobel): Machine Learning in Fixed Income Investing: Big Data Strategies for Alpha Generation
- Track B: Theory and algorithms in trading and market simulation
  Chair: Fenghui Yu
    * Fenghui Yu (TU Delft): Signal-adaptive Sequential Optimal Execution Quotes
    * Lingyi Yang (University of Oxford): Synthetic Data Generation and Detection via Rough Path Theory
    * Jasper Rennspies (Uni Freiburg): Covariance Modeling by Logarithmic Transformations and Dimensionality Reduction
    * Song Xuanye (NTU): Convergence analysis of Euler-Maruyama scheme for Mean-field McKean-Vlasov SDEs
    * Dongna Zhang (Northumbria University): Decoding macroeconomic forecasting
- Track C: Insurance-Finance markets
  Chair: Thorsten Schmidt
    * Christoph Knochenhauer (TU München): Optimal Trading with Unobservable Price Impact
    * Thorsten Schmidt (Uni Freiburg): Benchmark-Neutral Risk Minimization for insurance products and non-replicable claims
    * Helene Halconruy (Télécom SudParis): LDP drift parameter estimation for i.i.d. paths of diffusion processes
    * Gregor Kastner (Alpen-Adria-Universität Klagenfurt): Uncertainty Everywhere: Integrating Conceptual Uncertainty in the Stochastic Discount Factor
    * Yu-Jui Huang (University of Colorado, Boulder): Langevin Diffusions with Density-Dependent Temperature

- Track D: Advances in Optimal Decision Making in Financial Markets
  Chair: Shuajie Qian
  - Yang Liu (CUHKSZ): Convolution Bounds on Quantile Aggregation
  - Shuajie Qian (HKUST): Optimal Dynamic Contracts under Outside Options
  - Hu Sang (CUHK): Never stop or never start? Optimal stopping under a mixture of CPT and EUT preferences
  - Zeng Yuhao (CUHK): Deep Learning in Optimal Investment and Consumption under Capital Gains Taxes
  - Nabil Kazi-Tani (Université de Lorraine): Cyber risk prevention under risk averse spectral criteria.

16:00–16:30 Coffee Break

16:30–18:30 Session 3 (3 parallel tracks)

- Track A: Advanced Methods in High-Dimensional Financial Modeling
  Chair: Yuan Chen
  - Julian Pachschwöll (University of Vienna): Solving High-Dimensional Riccati Equations in Signature Volatility Models
  - Jasper Rennspies (University of Freiburg): Dynamic factor model for realized covariance matrices
  - Ilya Archakov (York University): A Realized Similarity Index
  - Yuan Chen (University of Vienna, VGSF): Cardinality-Constrained Optimization for Large-Scale Portfolio
- Track B: Machine Learning and Computational Methods in Finance
  Chair: Philipp Schmocker
  - Philipp Schmocker (NTU): Generative neural operators solve convex splitting problems
  - Gao Wenhan (NUS): Innovation Value Discrepancy and Its Role in Shaping Firms' Short-Term Gains and Sustainable Growth
  - Aniq Atiqi Rohmawati (Institut Teknologi Bandung): Sensitivity-Adjusted Risk Measure with Dynamic Dependence for Insurance Portfolios
  - Huansang Xu (NUS): Deep Learning CAT Bond Valuation
- Track C: Recent advances in portfolio optimization
  Chair: Jin Hyuk Choi
  - Jeonggyu Huh (Sungkyunkwan University): Breaking the Dimensional Barrier: A Pontryagin-Guided Direct Policy Optimization for Continuous-Time Multi-Asset Portfolio
  - Donghan Kim (KAIST): Generalizing the universal portfolio
  - Hyungbin Park (Seoul National University): A sensitivity analysis of the long-term expected utility of optimal portfolios
  - Yong Hyun Shin (Sookmyung Women's University): The Effects of Income and HARA Utility on Optimal Consumption, Investment, and Retirement Decisions

19:30– Conference Dinner (Venue: Peach Garden @ OCBC Center)

Day 2 – Friday, August 1, 2025

09:00–11:00 Session 4 (3 parallel tracks)

- Track A: New Developments in Optimal Control and Stopping
  Chair: Xiang Yu
  - Xiang Yu (Hong Kong Polytechnic University): An Extended Merton Problem with Relaxed Benchmark Tracking
  - Zhenhua Wang (Shandong University): Entropy-regularized stochastic controls and policy iteration for the associated HJB equations
  - Shihao Zhu (Ulm University): Asymmetric Information and Relative Performance in Dynamic Trading Games
- Track B: Market Design, Liquidity, and Strategic Behavior
  Chair: Xiaofei Shi
  - Xiaofei Shi (University of Toronto): A Dynamic Equilibrium Model of Liquidity Risk
  - Seongjin Kim (UNIST): Oligopolistic Market Equilibrium and the Effect of Observing Noise Trades
  - Junhuan Zhang (Beihang University): Profitability of collusive sandwich attack in automated market maker exchanges
  - Abdullah Mohammed AlGhazali (Dhofar University): Connectedness and hedging strategy between European sustainability and conventional stock markets
- Track C: Machine learning and AI in finance
  Chair: Liu Peng
  - Cheng Si (Syracuse University): When machines disagree: Evidence from large language models
  - Wayne Wei Li (Harbin Institute of Technology): Bayes Asymmetric Similarity Estimation in Binary Classification of Bankruptcy Prediction
  - Xiaofei Xu (Wuhan University): Multi-Period Portfolio Allocation: A One-Shot Stochastic Optimization Approach
  - Xie Haoyu (NUS): KAN we hedge?

11:00–11:30 Coffee Break

11:30–12:30 Keynote Lecture 2

- Speaker: Mathieu Rosenbaum (École Polytechnique)
- Title: Volatility and order flow: a tale of two fractional Brownian motions

12:30–13:30 Lunch Break

13:30–15:30 Session 5 (3 parallel tracks)

- Track A: Machine Learning Applications to Finance
  Chair: Wolfgang Härdle
  - Daniel Traian Pele (ASE Bucharest): Marketbusters: Hunting Anomalies with LLMs

    - Ruting Wang (City University of Hong Kong): Carbon risk measurement dynamics
    - Hannah Lai (National University of Singapore): Neural Tangent Kernel in Implied Volatility Forecasting: A Nonlinear Functional Autoregression Approach
    - Yezhou Sha (Capital University of Economics and Business, Beijing): Tree based learning for Financial Forensics
  - Track B: Portfolio Optimization and Risk Preferences
    Chair: Nicolas Nguyen
    - Nicolas Nguyen (University of Tübingen): Variational Bayes Portfolio Construction
    - Tao Pang (North Carolina State University): Optimal Portfolio Choice with Comfortable Consumption
    - Jin Hyuk Choi (UNIST): Unified asymptotics for investment under illiquidity: transaction costs and search frictions
  - Track C: Adapted Optimal Transport and Applications
    Chairs: Liu Chong / Bingyan Han
    - Daniel Bartl (NUS): Consensus models in mathematical finance via adapted optimal transport
    - Shuoqing Deng (The Hong Kong University of Science and Technology): Distribution-constrained optimal multiple stopping: A Root-type solution
    - Bingyan Han (The Hong Kong University of Science and Technology-Guangzhou): The McCormick martingale optimal transport
    - Fangrui Lim (University of Oxford): Causal Transports on Path Space

15:30–16:00 Coffee Break

16:00–17:00 Keynote Lecture 3

- Speaker: Min Dai (Hong Kong Polytechnic University)
- Title: Option Exercise Games and the q-Theory of Investment

Appendix: Talk Titles and Abstracts

Keynote Lecture 1

Xin Guo (University of California, Berkeley)

Title: An alpha-potential game framework for multi-agent system
Abstract: Designing and analyzing non-cooperative multi-agent systems interacting within a shared dynamic environment is a central challenge in many existing and emerging applications, including autonomous driving, smart grid management, and e-commerce. A primary objective in these systems is for agents to reach some Nash equilibrium, where no agent benefits from changing its strategy unilaterally. However, designing algorithms for approximating or computing Nash equilibrium is generally intractable unless a certain structure of underlying multi-agent interactions can be exploited.
In this talk we will present a new paradigm for dynamic N-player non-cooperative games called alpha-potential games, where the change of a player's value function upon unilateral deviation from her strategy is equal to the change of an alpha-potential function up to an error alpha. This game framework is shown to reduce the challenging task of finding alpha-Nash equilibria for a dynamic game to minimizing the associated alpha-potential function. The latter is then shown to be a conditional McKean–Vlasov control problem.
In such games, analysis of alpha reveals critical game characteristics, including choices of admissible strategies, the intensity of interactions, and the level of heterogeneity among players. We will discuss through simple examples some recent theoretical developments, along with a few open problems for this new game framework.

Keynote Lecture 2

Mathieu Rosenbaum (École Polytechnique)

Title: Volatility and order flow: a tale of two fractional Brownian motions
Abstract: Price volatility and order flow dynamics are two commonly used measures of the intensity of market fluctuations that are evidently closely related. However, on the one hand, the rough nature of the volatility is an undeniable stylized fact. On the other hand, smooth fractional Brownian motions have been proposed to capture the autocorrelation of the order flow, in contrast to the paradigm of rough volatility. We discuss how to resolve this apparent contradiction, providing new microstructural foundations for the joint dynamics of prices, volatility and volumes. This is joint work with Johannes Muhle-Karbe, Youssef Ouazzabi Chahdi and Grégoire Szymanski.

Keynote Lecture 3

Min Dai (Hong Kong Polytechnic University)

Title: Option Exercise Games and the q-Theory of Investment
Abstract: Back and Paulsen (2009) advocate using closed-loop equilibria as the solution concept to characterize firm strategies for real option exercise games analyzed in Grenadier (2002). This approach allows a firm to respond to its competitor's strategy, resulting in a Markov subgame perfect equilibrium. Back and Paulsen (2009) identify a closed-loop equilibrium where firms use the simple net present value rule as doing so forms mutually best responses. The resulting outcome is equivalent to a perfectly competitive scenario in which firms ignore the option value of waiting and make zero profits.
We provide a rigorous definition of closed-loop equilibria and show that there exist two sets of (infinitely many) closed-loop equilibria associated with linear and nonlinear investment thresholds, respectively. In equilibrium, firms invest more quickly than in the open-loop equilibrium of

Grenadier (2002) yet more slowly than in the perfectly competitive outcome, and consequently earn positive profits, confirming Back and Paulsen (2009)'s conjecture. Furthermore, we find that the highest option value among the closed-loop equilibria associated with the linear investment thresholds corresponds to the lowest investment speed, below which preemption becomes a profitable deviation. This is a joint work with Zhaoli Jiang and Neng Wang.

Session 1, Track A: Data-driven and robust optimization (Chair: Daniel Bartl)

Samuel Drapeau (Shanghai Jiao Tong University)

Title: Carbon: Tax versus Cap-and-Trade
Abstract: To address global warming, a significant reduction in carbon emissions is required. Over the past fifteen years, 39 carbon tax schemes and 36 market-based cap-and-trade systems have been implemented worldwide. Whereas a carbon tax uniformly imposes a levy on emissions, a cap-and-trade system relies on a market mechanism to allocate emissions permits. The existing literature comparing these two regulatory approaches remains inconclusive regarding their relative superiority. Nevertheless, several studies highlight the greater allocative efficiency and potential welfare gains associated with cap-and-trade systems. These results, however, largely depend on idealized assumptions of perfect information, frictionless trading, and direct participation by industries. In practice, a limited number of large financial institutions, rather than emitting industries themselves, dominate carbon markets. In this study, we propose a simple model reflecting this market structure. Our findings suggest that, under these more realistic conditions, a carbon tax achieves higher overall welfare than a cap-and-trade system, even when the latter induces a shift towards greener industries. This is a joint work with S. Crepey and M. Tadese.

Karthik Natarajan (Singapore University of Technology and Design)

Title: Distributionally robust optimization through the lens of submodularity
Abstract: Distributionally robust optimization is used to tackle decision making problems under uncertainty where the distribution of the uncertain data is ambiguous. Towards this, we define a submodular ambiguity set and showcase its expressive power in modeling both discrete and continuous uncertainty. We provide numerical evidence of the modeling flexibility and expressive power of the submodular ambiguity set and demonstrate its applicability in two examples: project networks and multi-newsvendor problems. The paper highlights that the submodular ambiguity set is the natural discrete counterpart of the convex ambiguity set and supplements it for continuous uncertainty, both in modeling and computation.

Qikun Xiang (Nanyang Technological University)

Title: Provably convergent stochastic fixed-point algorithm for Wasserstein barycenter
Abstract: We propose a provably convergent algorithm for approximating the Wasserstein barycenter of continuous non-parametric probability measures. Our algorithm is inspired by the fixed-point iterative scheme of Álvarez-Esteban, Del Barrio, Cuesta-Albertos, and Matrán (2016) whose convergence to the Wasserstein barycenter relies on obtaining exact optimal transport (OT) maps. However, OT maps are typically only approximated in practice, and exact computation of OT maps between continuous probability measures is known to be tractable only for certain restrictive parametric families. To circumvent the need to compute exact OT maps between general non-parametric measures, we develop a tailored iterative scheme that utilizes consistent OT map estimators in place of the exact OT maps. This gives rise to a computationally tractable stochastic fixed-point algorithm which is provably convergent to the Wasserstein barycenter. Our algorithm remarkably does not restrict the support of the Wasserstein barycenter to be any fixed finite set and can be implemented in a distributed computing

environment. These features make our algorithm suitable for large-scale data aggregation and data-driven decision-making problems. In our numerical experiments, we compare our algorithm with state-of-the-art Wasserstein barycenter algorithms based on generative neural networks to showcase the superiority of our algorithm in accuracy, stability and efficiency. This talk is based on joint work with Zeyi Chen and Ariel Neufeld.

Kyunghyun Park (Nanyang Technological University)

Title: Scaling Limits of Multi-Period Distributionally Robust Optimization
Abstract: In this talk, we examine the scaling limit of multi-period distributionally robust optimization (DRO) via a semigroup approach. Each step involves a worst-case maximization over distributions in a Wasserstein ball around a reference process, and the multi-period problem arises through its sequential composition. When the Wasserstein ball's radius scales linearly with time, we show that the scaling limit of the multi-period DRO yields a strongly continuous monotone semigroup on C_b. Furthermore, we show that its infinitesimal generator is equal to the generator associated with the non-robust scaling limit plus an additional perturbation term induced by the Wasserstein uncertainty. As an application, we show that when the reference process follows an Itô process, the viscosity solution of the associated nonlinear PDE coincides with the value of a continuous-time stochastic differential game. This is based on joint work with Max Nendel (University of Waterloo), Ariel Neufeld (NTU Singapore), and Alessandro Sgarabottolo (LMU Munich).

Session 1, Track B: Signature Methods in Finance

Anna Kwossek (University of Vienna)

Title: Universal Approximation with Itô-Type Signatures
Abstract: Recently, many data-driven methods based on the signature of a path have been developed for applications in mathematical finance. These rely on universal approximation theorems, which state that continuous functionals on the path space can be approximated by linear functionals on the signature. While this is usually based on Stratonovich integration, Itô integration is more common in financial modeling. In this talk, we introduce a notion of path signature using a unifying framework for both Stratonovich-type and Itô-type integration. By extending the path with suitable quadratic variation terms, we deduce a pathwise universal approximation theorem that is applicable to the Itô signature of continuous semimartingales. This makes the approach particularly suitable for financial modeling. This talk is based on joint work with M. Ceylan and D. J. Prömel.

Binnan Wang (Peking University)

Title: Signature-Based Hedging: Theory and Simulation
Abstract: In this talk, I will introduce a new hedging framework based on Itô signature. We show that different orders of signature terms can be interpreted as tradable hedging strategies, providing new insights into the interpretability of path signatures. Theoretically, we establish universal nonlinearity for Itô signature of certain classes of stochastic processes. Based on this, we provide statistical bounds for out-of-sample hedging errors. Simulation results demonstrate that our hedging framework achieves comparable performance with neural network-based methods with superior computational efficiency. Preliminary empirical studies further confirm its effectiveness in real financial markets. This talk is based on joint work with Xin Guo (UC Berkeley) and Ruixun Zhang (Peking University).

Chong Liu (ShanghaiTech University)

Title: Higher Rank Signatures and Its Applications in Finance
Abstract: Usually people apply the weak topology to detect the difference between the laws of stochastic processes. However, the weak topology is not a suitable notion in many multi-stage optimisation problems as such a topology completely ignores the filtration, which describes the style of information evolution, attached to the underlying stochastic processes. To overcome this weakness, many mathematicians and economists introduced various stronger "adapted weak topologies" to ensure certain continuities. In this talk, I will briefly overview adapted weak topologies and their main properties, and then explain how to apply the so-called higher rank signatures from rough path theory to define a feasible metric for stochastic processes in adapted weak topologies. We may also discuss how to use this approach to establish a kernel regression scheme of the value functions in optimal stopping problems.

Hao Ni (University College London)

Title: High-Rank PCF-GAN: High-Fidelity Financial Time Series Generation
Abstract: Since the weak convergence for stochastic processes does not account for the growth of information over time represented by the underlying filtration, a slightly erroneous stochastic model in weak topology may cause huge losses in multi-period decision making. To address such discontinuities, Aldous introduced extended weak convergence, which can fully characterize essential properties, including the filtration. In this talk, we introduce a novel metric called High Rank PCF Distance (HRPCFD) for extended weak convergence based on high rank path development from rough path theory. We show that HRPCFD admits favorable analytic properties, enabling efficient training from data. We construct the HRPCF-GAN by using HRPCFD as a discriminator for conditional time series generation. Our numerical experiments on hypothesis testing and generative modeling validate the superior performance of our approach compared to several state-of-the-art methods, highlighting its potential in synthetic time series generation and classical financial problems like optimal stopping or utility maximisation.

Session 1, Track C: Advances in Quantitative Finance and Econometrics

Dominic Rainsborough (University of St. Gallen – SGI)

Title: The Effects of Trade Policies on Country-Level Investment Decisions of Private Equity Funds
Abstract: We investigate the impact of greater resort by states to trade distortions on the investment behavior of private equity funds, taking explicit account of their country and industry mandates. We use a sample of 9,142 transactions across 60 countries and 52 industries completed by 1,623 PE funds during 2010–2020. We observe a negative and significant relationship between trade policies likely to crimp imports into the target country and the probability of a PE fund investment. This effect is driven by subsidies paid to import-competing firms. In contrast, we find a positive and statistically significant effect of tariffs on the probability of a PE fund investment in a given country. Using subsample analyses, we find distinctive regional differences in funds' investment decision-making with regards to commercial policies.

Lei Zhou (National University of Singapore)

Title: Debt Structure and Recovery Rates
Abstract: This paper investigates the impact of debt structure complexity on corporate bond recovery rates through both theoretical modeling and empirical analysis. We first develop a structural model incorporating different layers of debt priority. The model indicates that the recovery rate of senior bonds follows a stepwise upward pattern as leverage increases, while

junior bonds exhibit a fluctuating but generally increasing trend. Empirically, we test these predictions using a comprehensive dataset of corporate bonds. We find that the interaction between senior and junior debt creates nonlinear recovery dynamics, where the introduction of additional subordinated debt can either dilute or reinforce senior bond recoveries depending on the firm's leverage level. Additionally, we show that a higher proportion of loans within the debt structure is negatively associated with bond recovery rates, highlighting competitive effects between debt instruments. Furthermore, our analysis of bond covenants reveals that restrictions on subordinated debt issuance significantly enhance the recovery rates of senior secured bonds, reinforcing the role of contractual protections in mitigating default risk.

Florian Rossmannek (Nanyang Technological University)

Title: Efficient Sobolev Approximation of Linear Parabolic PDEs in High Dimensions
Abstract: We study the error in first order Sobolev norm in the approximation of solutions to linear parabolic PDEs. We use a Monte Carlo Euler scheme obtained from combining the Feynman–Kac representation with an Euler discretization of the underlying stochastic process. We derive approximation rates depending on the time-discretization, the number of Monte Carlo simulations, and the dimension. In particular, we show that the Monte Carlo Euler scheme breaks the curse of dimensionality with respect to the first order Sobolev norm. Our argument is based on new estimates on the weak error of the Euler approximation of a diffusion process together with its derivative with respect to the initial condition. As a consequence, we obtain that neural networks are able to approximate solutions of linear parabolic PDEs in first order Sobolev norm without the curse of dimensionality if the coefficients of the PDEs admit an efficient approximation with neural networks.

Matthias Fengler (University of St. Gallen)

Title: Proxy-identification of a Structural MGARCH Model for Asset Returns
Abstract: We extend the multivariate GARCH (MGARCH) specification for volatility modeling by developing a structural MGARCH model that targets the identification of shocks and volatility spillovers in a speculative return system. Similarly to the proxy-SVAR framework, we leverage auxiliary proxy variables to identify the underlying shock system. The estimation of structural parameters, including an orthogonal matrix, is achieved through techniques derived from Riemannian optimization. Our analysis of daily S&P 500 returns, 10-year Treasury yields, and the U.S. Dollar Index, employing news-driven instrument variables, identifies an equity and a bond market shock.

Session 1, Track D: Advanced Topics in Financial Risk and Portfolio Dynamics

Zhaoli Jiang (Hong Kong Polytechnic University)

Title: Dynamic Mean-Variance Efficient Fractional Kelly Portfolios in a Stochastic Volatility Model
Abstract: In this paper, we improve the mean-variance efficiency of the fractional Kelly strategy, a popular investment strategy in the market, by minimizing the variance of the return of a portfolio with as high expected return as the fractional Kelly strategy. In view of time inconsistency arising from the mean-variance criterion, we consider so-called equilibrium portfolio strategies that can be consistently implemented by the investor. We derive the equilibrium portfolio strategy in closed form and show that it always leads to a smaller variance of return than the fractional Kelly strategy. By calibrating the model parameters to market data, we show that the reduction of variance achieved by the equilibrium portfolio can be economically significant. We also show in an out-of-sample test that the equilibrium portfolio strategy outperforms the fractional Kelly strategy under various performance measures.

Yingda Song (Shanghai Jiao Tong University)

Title: Intra-Horizon Risk: The Role of Stochastic Volatility
Abstract: We propose a unified framework for computing intra-horizon risk measures in models incorporating both stochastic volatility and jumps. Analytical formulae are derived for approximating both intra-horizon value at risk (iVaR) and intra-horizon expected shortfall (iES), along with establishing the convergence rate for the approximation errors. Additionally, we design an enhanced algorithm to further improve the efficiency of our method. Empirical findings underscore the significance of incorporating stochastic volatility for accurate intra-horizon risk assessment, revealing: (i) models with stochastic volatility yield more timely and accurate assessments of the intra-horizon risk in market, particularly during the recent recessions; and (ii) the contribution of jump risk to intra-horizon risk measures under stochastic volatility models (averaging between 50% and 54%) consistently lower than their counterparts with constant volatility (averaging between 75% and 90%). This research contributes to refining risk assessment methodologies in dynamic financial environments and offers practical insights for risk management strategies.

Chen Yang (Chinese University of Hong Kong)

Title: Arbitraging on Decentralized Exchanges
Abstract: Decentralized exchanges (DEXs) are alternative venues to centralized exchanges to trade cryptocurrencies (CEXs) and have become increasingly popular. An arbitrage opportunity arises when the exchange rate of two cryptocurrencies in a DEX differs from that in a CEX. Arbitrageurs can then trade on the DEX and CEX to make a profit. Trading on the DEX incurs a gas fee, which determines the priority of the trade being executed. We study a gas-fee competition game between two arbitrageurs who maximize their expected profit from trading. We derive the unique symmetric mixed Nash equilibrium and find that (i) the arbitrageurs may choose not to trade when the arbitrage opportunity is small; (ii) the probability of the arbitrageurs choosing a higher gas fee is lower; (iii) the arbitrageurs pay a higher gas fee and trade more when the arbitrage opportunity becomes larger and when liquidity becomes higher. The above findings are consistent with our empirical study.

Cong Qin (Shanghai University of Finance and Economics)

Title: Periodic Evaluation with Non-Concave Utility
Abstract: A fund manager's performance is often evaluated annually and compared with a benchmark, such as a market index. In addition, the manager may be subject to trading constraints, such as limited use of leverage, no short-selling, and a forced liquidation clause. We formulate this as a periodic evaluation problem with a non-concave utility, a stochastic reference point, and trading constraints. The value function is characterized as the unique solution to a Hamilton-Jacobi-Bellman equation with periodic terminal and boundary conditions, which must be imposed carefully due to possible discontinuities at the terminal time and/or on the liquidation boundary. We find that, at the evaluation time, future investment opportunities induce a discontinuity in the value function on the liquidation boundary, leading to a substantial change in local risk-aversion. More importantly, this local concavity/convexity weakens and shifts inward from the liquidation boundary to the interior region as the evaluation horizon increases. As a result, the joint effect of periodic evaluation and forced liquidation can generate highly nonlinear investment strategies, which is helpful in understanding the complexity of trading strategies in the loss region.

Session 2, Track A: Recent Advances in Machine Learning for Finance

Yingda Song (Shanghai Jiao Tong University)

Title: Efficient Nested Estimation of CoVaR: A Decoupled Approach
Abstract: This paper addresses the estimation of the systemic risk measure known as CoVaR, which quantifies the risk of a financial portfolio conditional on another portfolio being at risk. We identify two principal challenges: conditioning on a zero-probability event and the repricing of portfolios. To tackle these issues, we propose a decoupled approach utilizing smoothing techniques and develop a model-independent theoretical framework grounded in a functional perspective. We demonstrate the decoupled estimator can achieve approximately the optimal square root convergence rate. Additionally, we establish the smoothness of the portfolio loss functions, highlighting its crucial role in enhancing sample efficiency. Our numerical results confirm the effectiveness of the decoupled estimators and provide practical insights for the selection of appropriate smoothing techniques.

Lu Chung I (NUS)

Title: Distributionally Robust Deep Q-learning
Abstract: We propose a novel distributionally robust Q-learning algorithm for the non-tabular case accounting for continuous state spaces where the state transition of the underlying Markov decision process is subject to model uncertainty. The uncertainty is taken into account by considering the worst-case transition from a ball around a reference probability measure. To determine the optimal policy under the worst-case state transition, we solve the associated non-linear Bellman equation by dualising and regularising the Bellman operator with the Sinkhorn distance, which is then parameterised with deep neural networks. This approach allows us to modify the Deep Q-Network algorithm to optimise for the worst case state transition. We illustrate the tractability and effectiveness of our approach through several applications, including a portfolio optimisation task based on S&P 500 data. This talk is based on joint work with Julian Sester (NUS) and Aijia Zhang (NUS).

Ziteng Cheng (HKUST-GZ)

Title: Eliciting Risk Aversion with Inverse Reinforcement Learning via Interactive Questioning
Abstract: We investigate a framework for identifying an agent's risk aversion through interactive questioning. First, we study a one-period setting where the agent's risk aversion is characterized by a state-dependent cost function and a distortion risk measure. We establish the quantitative identifiability of this framework, proving that a finite number of interactions suffices to estimate the true risk aversion within a specified accuracy. Next, we analyze question design efficiency to accelerate estimation and derive a theoretical upper bound on convergence. We propose a novel design method based on distinguishing power and evaluate its performance via simulations. Additionally, we extend our analysis to an infinite-horizon setting, incorporating a discount factor to model dynamic risk aversion. Our approach to inferring risk preferences enables personalized robo-advising tailored to individual clients' needs.
This is based on a joint work with Anthony Coache (Imperial) and Sebastian Jaimungal (UToronto).

Alessandro Boccassino (ETH Zurich & Vontobel Asset Management)

Title: Machine Learning in Fixed Income Investing: Big Data Strategies for Alpha Generation
Abstract: In the context of systematic quantitative strategies applied to the fixed income asset class, we investigate whether expanding data inputs and model complexity can enhance excess

returns and yield predictability. For the former, we expand from yield-curve-only dataset up to macroeconomic, technical, and sentiment datasets. For the latter, we expand from traditional linear regressions up to sophisticated LSTM neural networks with attention.
After reviewing existing predictability approaches available in the literature (spanning hypothesis, macro-enhanced models, and ML with traditional and alternative data), we forecast one-month-ahead government-bond directional move in excess returns and yields, as an up/down classification task. Results begin by building and testing fundamental benchmarks—carry, value, and momentum factors constructed both in a cross-sectional and directional fashion and subsequently further enhanced with trend timing (with moderate gains) and sentiment timing (with unsatisfactory results). We then show that static ML algorithms (logistic, penalized regressions, trees and MLPs) yield incremental improvements as data breadth increases, and that LSTM with attention further captures temporal patterns, with broader datasets offering preliminary gains over yield-curve–only inputs. These findings underscore the potential for sophisticated ML algorithms and non-traditional data to add meaningful value to bond-forecasting frameworks.

Session 2, Track B: Theory and Algorithms in Trading and Market Simulation

Fenghui Yu (TU Delft)

Title: Signal-Adaptive Sequential Optimal Execution Quotes
Abstract: This talk presents optimal execution strategies for sequentially placing limit orders at specific quote prices in a limit order book. Unlike classical approaches focused on trading speed, we study how limit orders should be placed over time with signal-driven quotes, incorporating both execution risk and price impact. We consider four settings: risk-neutral execution, execution with running inventory risk, exponential utility, and a combination of both. With general functions for price impact and inventory risk, we derive the corresponding HJB equations and show that all these problems reduce to a common structure and admit fully explicit solutions for optimal execution across all cases. We also illustrate the effectiveness of the optimal strategies using signals learned from limit order book data.

Lingyi Yang (University of Oxford)

Title: Synthetic Data Generation and Detection via Rough Path Theory
Abstract: In the last few years, we have witnessed the rapid evolution of generative AI. With new technologies come new challenges. These tools can be maliciously used for misinformation and therefore detection tools need to keep up with this evolution. We frame the problem of detecting synthetic data as an anomaly detection problem on data streams and present a novel pipeline for scoring new streams for conformance. We show that our approach preserves desirable invariances, namely to affine transformations of the data and appending metadata. Our pipeline is versatile and can be used with a wide array of multi-modal tick data with complex missingness patterns. In the other direction, we also see how ideas from rough path theory can be utilised in making generative models more efficient by reducing the number of sampling steps required.

Jasper Rennspies (University of Freiburg)

Title: Covariance Modeling by Logarithmic Transformations and Dimensionality Reduction
Abstract: We propose an approach to model realized covariance matrices by transforming them and using the Dynamic Factor Model. We capture the persistence and the common dynamics in the volatilities and the correlations by extracting persistent factors of which the estimation is less affected by Microstructure Noise because we apply the gamma-transformation of Archakov and Hansen (2021). The proposed models ensure the positive-definiteness of the covariance matrix

and model parsimoniously such that we can deal with a large cross-section of stocks. In-sample, we observe an increasing trend in the largest factor that drives the realized correlations which loads heavily on the series associated with within-sector correlations. Moreover, we compare the models in a forecasting setting.

Song Xuanye (Nanyang Technological University)

Title: Convergence analysis of Euler-Maruyama scheme for Mean-field McKean-Vlasov SDEs.
Abstract: Building on the well-posedness of the backward Kolmogorov partial differential equation in the Wasserstein space, we analyze the strong and weak convergence rates for approximating the unique solution of a class of McKean–Vlasov stochastic differential equations via the Euler–Maruyama time discretization scheme applied to the associated system of interacting particles. We consider two distinct settings. In the first, the coefficients and test function are irregular, but the diffusion coefficient remains non-degenerate. Leveraging the smoothing properties of the underlying heat kernel, we establish the strong and weak convergence rates of the scheme in terms of the number of particles N and the mesh size h. In the second setting, where both the coefficients and the test function are smooth, we demonstrate that the weak error rate at the level of the semigroup is optimal, achieving an error of order $N^{-1} + h$.

Dongna Zhang (Northumbria University)

Title: Decoding macroeconomic forecasting
Abstract: Macroeconomic forecasting plays a key role in shaping monetary policy and investment decisions. However, a persistent challenge is the inherent uncertainty that surrounds macroeconomic forecasts. We conduct an extensive analysis of the determinants of forecast quality, drawing on a database of over 2.5 million macroeconomic forecasts. By systematically varying design choices across a wide range of plausible specifications and data samples, we generate a rich dataset capturing the full extent of decision-induced variability (NSEs) and sampling errors (SEs). By reframing SEs and NSEs in the context of a meta regression, we provide a framework to understand systematic links between forecast quality and its determinants. This allows us to explore relative contributions of different decision-critical factors to forecast quality in terms of their magnitude and directional impact. Using boosted decision trees and state-of-the-art explainability algorithms, we decompose the NSE and SE contributions to forecast errors into a systematic and a non-systematic component, revealing the extent to which NSEs are predictable based on observable forecasting decisions. By highlighting the dominant role of the forecast environment, the importance of parsimony and informed variable selection, we offer practical guidance for improving forecasting practices. The proposed meta-regression-based decomposition framework enriches the methodological literature on machine learning–informed forecasting.

Session 2, Track C: Insurance-Finance markets

Christoph Knochenhauer (TU München)

Title: Optimal Trading with Unobservable Price Impact
Abstract: We consider an optimal trading problem in a price impact model in which the price impact parameters are unobservable. The problem is formulated as a Bayesian adaptive optimal stochastic control problem in which trading and estimation of the unobservable parameters occur simultaneously. One of the central challenges is that the choice of trading rate actively influences the state and information acquisition. The problem, initially non-Markovian, is embedded into a higher-dimensional Markovian, full information control problem with control-dependent filtration and noise. To that problem, we apply the stochastic Perron method to characterize the value function as the unique viscosity solution of the HJB equation and construct arbitrarily

good piecewise constant controls. The theoretical analysis of the problem is complemented by an in depth numerical study.

Thorsten Schmidt (Uni Freiburg)

Title: Benchmark-Neutral Risk Minimization for insurance products and non-replicable claims
Abstract: In this talk we will study the pricing and hedging of nonreplicable contingent claims, such as long-term insurance contracts like variable annuities. This problem is approached in the benchmark-neutral setting of Platen (2024). In contrast to the classical benchmark approach the stock growth-optimal portfolio is emplyed as numéraire which in typical settings leads to an equivalent martingale measure, the benchmark-neutral measure. The resulting prices can be significantly lower than the respective risk-neutral ones, which is particularly attractive for long-term investments. We derive associated risk-minimizing hedging strategies under the assumption that the contingent claim possesses a martingale decomposition. For a set of nonreplicable contingent claims, these strategies allow monitoring the working capital needed to generate their payoffs and assess the emerging diversification effect. Finally, we propose an algorithmic refinancing strategy that allows the modeling of the working capital.
Joint work with Michael Schmutz and Eckhard Platen.

Hélène Halconruy (Télécom SudParis)

Title: LDP drift parameter estimation for i.i.d. paths of diffusion processes
Abstract: With the rise of large-scale sensitive data, understanding the tradeoffs between privacy and utility is crucial. Traditionally, exploring statistical inference under "local differential privacy" (LDP) has focused on N random variables without historical context, posing challenges like hypothesis testing and (non)parametric estimation. In the paper on which this talk is based, we address drift parameter estimation from N i.i.d. diffusion paths under LDP by proposing a contrast function using a pseudo-likelihood approach and adding suitably scaled Laplace noise to ensure privacy. Our findings provide explicit conditions for privacy, under which we establish the consistency and asymptotic normality of the estimator. This is a joint work with Chiara Amorino and Arnaud Gloter.

Gregor Kastner (Alpen-Adria-Universität Klagenfurt)

Title: Uncertainty Everywhere: Integrating Conceptual Uncertainty in the Stochastic Discount Factor
Abstract: Estimating the stochastic discount factor involves model and parameter uncertainty. We show that a third source—conceptual uncertainty in how risk factors are constructed—is similarly consequential. Minor data preprocessing choices, such as portfolio breakpoints or sorting rules, can materially impact asset pricing outcomes. We develop a Bayesian model averaging framework that systematically integrates over trillions of such arbitrary yet defensible specifications. Accounting for conceptual uncertainty improves out-of-sample pricing accuracy and yields consistently high Sharpe ratios. Our findings highlight that data preprocessing decisions are not innocuous and that modeling them explicitly enhances inference in empirical asset pricing.

Yu-Jui Huang (University of Colorado, Boulder)

Title: Mean-field Langevin diffusions with density-dependent temperature
Abstract: In non-convex optimization, Langevin diffusions are commonly used in search of an (approximate) global minimizer. The fundamental rationale is to perturb gradient descent by a Brownian motion, whose influence is controlled by a "temperature" process, thereby allowing

the diffusion to escape from local minimizers. In the literature, the temperature process is usually exogenously given as a constant or a time-dependent function, which is in itself independent of the diffusion. In this talk, we introduce a new temperature process that endogenously depends on the probability density function of the diffusion. As the Langevin dynamics is now self-regulated by its own probability density at each time, it forms a distribution-dependent stochastic differential equation (SDE) of the Nemytskii type, distinct from the standard McKean-Vlasov equations. For the existence of a solution to the SDE, we first show that the corresponding Fokker-Planck equation has a solution, relying on the optimal transport theory; next, by Trevisan's superposition principle, a weak solution to the SDE is constructed from the solution to the Fokker-Planck equation. Furthermore, based on suitable SDE estimates, we prove that as time goes to infinity, the probability density functions induced by the SDE has a well-defined limit, which admits an explicit formula in terms of the Lambert W function. We demonstrate in several numerical examples that the density-regulated Langevin dynamics approaches the global minimum faster than the classical Langevin dynamics. Joint work with Zach Malik.

Session 2, Track D: Advances in Optimal Decision Making in Financial Markets

Yang Liu (CUHK Shenzhen)

Title: Convolution Bounds on Quantile Aggregation
Abstract: We propose a novel quantile aggregation method based on convolution bounds. The proposed bounds are useful in various applications in statistics and operations research. Theoretical results provide both upper and lower bounds on the quantiles of aggregated distributions, leveraging tools from stochastic orders and measure concentration. Applications include robust risk estimation and performance guarantees for ensemble learning.

Shuaijie Qian (HKUST)

Title: Optimal Dynamic Contracts under Outside Options
Abstract: We study a dynamic contract design problem in the presence of outside option risks. In our model, a principal hires an agent whose effort can increase customer purchases. The agent is compensated through a contract linked to the arrival of customer purchases. Outside options arrive randomly, and upon receiving such an offer, the agent may choose to terminate the current contract and switch to the new opportunity.
We analyze the principal's optimal response to these random outside option shocks. Depending on the value of the outside option and the agent's performance, the principal may choose to either match the offer to retain the agent or terminate the contract early.

Hu Sang (CUHK)

Title: Never stop or never start? Optimal stopping under a mixture of CPT and EUT preferences

Zeng Yuhao (CUHK)

Title: Deep Learning in Optimal Investment and Consumption under Capital Gains Taxes
Abstract: We study a continuous-time optimal investment and consumption problem under capital gains taxes. We derive the Hamilton-Jacobi-Bellman (HJB) equation associated with the problem and demonstrate that its solution can be approximated effectively by a deep learning-based approach. We implement the method and show that it delivers stable and accurate results across a range of economic scenarios, providing insights into optimal investor behavior under tax

frictions. Our results highlight the usefulness of deep learning tools in solving high-dimensional stochastic control problems that arise in finance.

Nabil Kazi-Tani (Université de Lorraine)

Title: Cyber risk prevention under risk averse spectral criteria.
Abstract: In this talk, we will introduce a model for the mitigation of cyber risks in networked systems using a risk-averse approach based on spectral criteria. An initial graph is subject to external cyber attacks, modeled by a Susceptible-Infected-Susceptible (SIS) Markov process with controlled infection and recovery rates. We consider the problem of minimizing the risk associated with the evolving structure of the network by employing self-protection and self-insurance efforts, as well as purchasing insurance coverage. We introduce spectral criteria—dependent on the eigenvalues of the graph Laplacian at final time T - for which we establish monotonicity in the sense of first-order stochastic dominance and continuity with respect to the Wasserstein distance. This framework enables us to prove the existence of minimizers for two general optimization problems under consideration: the cases of global and local self-protection. We will illustrate our theoretical findings by numerical simulations. This is a joint work with Nicolás Hernández-Santibáñez (UTFSM, Santiago, Chile) and Mariano Vazquez-Gaete (CMM, Santiago, Chile).

Session 3, Track A: Advanced Methods in High-Dimensional Financial Modeling

Julian Pachschwöll (University of Vienna)

Title: Solving High-Dimensional Riccati Equations in Signature Volatility Models
Abstract: We study signature-based volatility models where the volatility is given as a linear com- bination of signature terms of an underlying primary process, specified as a multivariate time-extended Ornstein–Uhlenbeck process. Using the affine framework introduced by Cuchiero et al., we view the log price enhanced with the signature of the primary process, as an infinite-dimensional affine process. Under certain non-trivial assumptions, this allows us to express the characteristic function of the log price as the solution to an infinite-dimensional Riccati ODE. Truncating this system provides a practical method for approximating the characteristic function, enabling option pricing via Fourier methods. This talk focuses on the numerical solution of the truncated Riccati system, including a non-linear balanced truncation approach by Benner et al. to reduce the dimensionality of the ODE system.

Jasper Rennspies (University of Freiburg)

Title: Efficient Sampling for Realized Variance Estimation in Time-Changed Diffusion Models
Abstract: This paper analyzes the benefits of sampling intraday returns in intrinsic time for the realized variance (RV) estimator. We theoretically show in finite samples that depending on the permitted sampling information, the RV estimator is most efficient under either hitting time sampling that samples whenever the price changes by a pre-determined threshold, or under the new concept of realized business time that samples according to a combination of observed trades and estimated tick variance. The analysis builds on the assumption that asset prices follow a diffusion that is time-changed with a jump process that separately models the transaction times. This provides a flexible model that allows for leverage specifications and Hawkes-type jump processes and separately captures the empirically varying trading intensity and tick variance processes, which are particularly relevant for disentangling the driving forces of the sampling schemes. Extensive simulations confirm our theoretical results and show that for low levels of noise, hitting time sampling remains superior while for increasing noise levels, realized business time becomes the empirically most efficient sampling scheme. An application to

stock data provides empirical evidence for the benefits of using these intrinsic sampling schemes to construct more efficient RV estimators as well as for an improved forecast performance.

Ilya Archakov (York University)

Title: A Realized Similarity Index
Abstract: We construct a measure of association between two random variables that is based on their similarity in both direction and magnitude. Under special conditions the proposed measure becomes an unbiased and consistent estimator of the linear correlation coefficient for which the sampling distribution is available. The latter is intrinsically insensitive to heavy tails and outliers which facilitates robust inference for correlations. The measure can be extended to a higher dimensional setting where it can be interpreted as an index of joint similarity between multiple random variables. We inspect empirical performance of the proposed measure with financial returns at high and low frequencies.

Yuan Chen (University of Vienna, VGSF)

Title: Cardinality-Constrained Optimization for Large-Scale Portfolio
Abstract: We propose a portfolio optimization model that reconciles Keynes's advocacy for concentrated investments with Markowitz's emphasis on diversification. By in- corporating cardinality constraints into the Markowitz mean-variance framework, we enable investors to focus on a small set of assets, fostering specialized expertise. Cardinality constraints allow investors to still use the sample covariance matrix in high-dimensional settings with limited data, balancing diversification needs while mitigating estimation errors inherent in such environments.

Session 3, Track B: Machine Learning and Computational Methods in Finance

Philipp Schmocker (Nanyang Technological University)

Title: Generative neural operators solve convex splitting problems
Abstract: Motivated by forward-backward proximal splitting algorithms in the PDE literature, we introduce generative neural operators as a novel framework to solve convex splitting problems. To each layer of a generative neural operator, we apply a structurally dependent activation function incorporating the non-differentiable part of the underlying optimization problem. On the other hand, the differentiable part is included as weight (gating mechanism) to the generative neural operator. In addition, we add a gated residual connection, which then closely mirrors the structure of forward-backward proximal splitting algorithms. Besides quantitative approximation theorems for generative neural operators, we show that a random weight initialization guarantees the convergence to a minimizer of the convex splitting problem. In numerical examples, we apply our generative neural operator to solve various problems in mathematical finance.
This talk is based on joint work with Anastasis Kratsios and Ariel Neufeld.

Gao Wenhan (National University of Singapore)

Title: Innovation Value Discrepancy and Its Role in Shaping Firms' Short-Term Gains and Sustainable Growth
Abstract: This research explores the relationships between technological innovations and firm growth trajectories, examining both immediate and long-term development. By analyzing the divergence between scientific and economic innovation value, we demonstrate how the timing and nature of market recognition play a pivotal role in shaping a company's development and long-lasting success. Our analysis spans 7,506 firms with 2,522,601 granted patents from 1976 to 2022. It reveals that firms with substantial scientific contributions alone often realize considerable

long-term growth due to gradual market appreciation of their innovations. However, firms that display strong economic appeal but lack substantial scientific depth typically experience fleeting short-term gains. Those that excel in both scientific and economic dimensions display steady but moderate growth, potentially limited by increased competition. In contrast, firms deficient in both metrics consistently perform poorly. We further construct trading strategies via both predicted and ex-post data to test the portfolio return within the scientific and economic value discrepancy. These findings offer strategic implications, emphasizing the importance of balancing innovation's scientific and economic aspects to foster sustained growth and long-term competitive advantage, offering insights for executives in intangible asset management.

Aniq Atiqi Rohmawati (Institut Teknologi Bandung)

Title: Sensitivity-Adjusted Risk Measure with Dynamic Dependence for Insurance Portfolios
Abstract: This work examines an integrated approach for insurance portfolio risk assessment by introducing a sensitivity-adjusted risk measure. This measure refines tail risk estimation through a nonlinear transformation, addressing limitations in standard coherent risk measures while maintaining consistency with Value-at-Risk (VaR) and Expected Shortfall (ES). To capture the dependence between risk components, a dynamic t-Copula is employed, allowing for time-varying joint risk structures beyond static correlation assumptions. Furthermore, a Random Forest classifier is applied to segment policyholder risk profiles, offering improved classification accuracy over traditional decision trees. The methodology is evaluated on an insurance portfolio dataset, where results indicate that the proposed risk measure provides a more adaptive characterization of extreme loss exposure. The dynamic Copula model enhances joint risk modeling, while the machine learning-based segmentation refines portfolio-wide risk assessment. Comparative analysis with standard VaR and ES frameworks demonstrates that this approach better accounts for nonlinear dependencies, improving capital allocation and solvency assessment in insurance risk management.

Huansang Xu (NUS)

Title: Deep Learning CAT Bond Valuation
Abstract: In this paper, we propose an alternative valuation approach for CAT bonds where a pricing formula is learned by deep neural networks. Once trained, these networks can be used to price CAT bonds as a function of inputs that reflect both the current market conditions and the specific features of the contract. his approach offers two main advantages. First, due to the expressive power of neural networks, the trained model enables fast and accurate evaluation of CAT bond prices. Second because of its fast execution the trained neural network can be easily analyzed to study its sensitivities w.r.t. changes of the underlying market conditions offering valuable insights for risk management. This talk is based on joint work with Julian Sester (NUS).

Session 3, Track C: Recent advances in portfolio optimization

Jeonggyu Huh (Sungkyunkwan University)

Title: Breaking the Dimensional Barrier: A Pontryagin-Guided Direct Policy Optimization for Continuous-Time Multi-Asset Portfolio
Abstract: Solving large-scale, continuous-time portfolio optimization problems involving numerous assets and state-dependent dynamics has long been challenged by the curse of dimensionality. Traditional dynamic programming and PDE-based methods, while rigorous, typically become computationally intractable beyond a few state variables (3-6 limit in prior studies). To overcome this critical barrier, we introduce the Pontryagin-Guided Direct Policy Optimization (PG-DPO) framework. Our framework accurately captures both myopic demand and complex

intertemporal hedging demands, a feat often elusive for other methods in high-dimensional settings. P-PGDPO delivers near-optimal policies, offering a practical and powerful alternative for a broad class of high-dimensional continuous-time control problems. PG-DPO leverages Pontryagin's Maximum Principle (PMP) and backpropagation-through-time (BPTT) to directly inform neural network-based policy learning. A key contribution is our highly efficient Projected PG-DPO (P-PGDPO) variant. This approach uniquely utilizes BPTT to obtain rapidly stabilizing estimates of the Pontryagin costates and their crucial derivatives with respect to the state variables. These estimates are then analytically projected onto the manifold of optimal controls dictated by PMP's first-order conditions, significantly reducing training overhead and enhancing accuracy. This enables a breakthrough in scalability: numerical experiments demonstrate that P-PGDPO successfully tackles problems with dimensions previously considered far out of reach (up to 50 assets and 10 state variables).

Donghan Kim (KAIST)

Title: Roughness in finance via Schauder Representation
Abstract: This presentation will explain two distinct concepts for measuring the roughness of financial data. We first introduce the idea of the p-th variation of a real-valued continuous function along a general class of refining partition sequences. We demonstrate that the finiteness of the p-th variation of a given path is closely linked to the finiteness of the ℓ^p-norm of the coefficients along a Schauder basis, analogous to how the H"older exponent relates to the ℓ^∞-norm of the Schauder coefficients. This result establishes an isomorphism between the space of H"older continuous functions with finite (generalized) p-th variation along a given partition sequence and a subclass of infinite-dimensional matrices, equipped with an appropriate norm, in the spirit of Ciesielski.

Hyungbin Park (Seoul National University)

Title: A sensitivity analysis of the long-term expected utility of optimal portfolios
Abstract: This work investigates dynamic and static fund separations and their stability for long-term optimal investments under three model classes. An investor maximizes the expected utility with constant relative risk aversion under an incomplete market consisting of a safe asset, several risky assets, and a single state variable. The state variables in two of the model classes follow a 3/2 process and an inverse Bessel process, respectively. The other market model has the partially observed state variable modeled as an Ornstein-Uhlenbeck state process. We show that the dynamic optimal portfolio of this utility maximization consists of $m + 3$ portfolios: the safe asset, the myopic portfolio, the m time-independent portfolios, and the intertemporal portfolio. Over time, the intertemporal portfolio eventually vanishes, leading the dynamic portfolio to converge to $m + 2$ portfolios, referred to as the static portfolio. We also prove that the convergence is stable under model parameter perturbations. In addition, sensitivities of the intertemporal portfolio with respect to small parameters perturbations also vanish in the long run. The convergence rate for the intertemporal portfolio and its sensitivities are computed explicitly for the presented models. This is joint work with Heejun Yeo.

Yong Hyun Shin (Sookmyung Women's University)

Title: The Effects of Income and HARA Utility on Optimal Consumption, Investment, and Retirement Decisions
Abstract: This study examines an infinite-horizon optimal consumption, investment, and retirement decision problem, in which an agent maximizes the expected utility of consumption based on a Hyperbolic Absolute Risk Aversion (HARA) utility function. The model distinguishes between pre-retirement and post-retirement phases, characterized by differing income

levels Y_i $(i = 1, 2)$ and baseline lump sums L_i $(i = 1, 2)$ in the HARA utility function, respectively. Specifically, we assume that the agent receives a higher income but has a lower baseline lump sum before retirement, whereas after retirement, the agent receives a lower income but has a higher baseline lump sum, that is, $Y_1 > Y_2 \geq 0$ and $L_2 > L_1 \geq 0$. The decision to retire is modeled as a one-time, irreversible choice. To analyze this problem, we employ the martingale approach combined with a dual method. The key contributions of this study are: (1) deriving an explicit condition for the optimal retirement timing in terms of income and utility parameters, and (2) demonstrating the monotonic relationships between optimal consumption, portfolio allocation, and retirement timing with respect to income and the baseline lump sum in the HARA utility function. This is a joint work with Dr. Tae Ung Gang (KAIST).

Session 4, Track A: New Developments in Optimal Control and Stopping

Xiang Yu (Hong Kong Polytechnic University)

Title: An extended Merton problem with relaxed benchmark tracking
Abstract: This paper studies a Merton's optimal portfolio and consumption problem in an extended formulation by incorporating the benchmark tracking on the wealth process. We consider a tracking formulation such that the wealth process compensated by a fictitious capital injection outperforms the benchmark at all times. The fund manager aims to maximize the expected utility of consumption deducted by the cost of the capital injection, where the latter term can also be interpreted as the expected largest shortfall of the wealth with reference to the benchmark. By considering an auxiliary state process, we formulate an equivalent stochastic control problem with state reflections at zero. For general utility functions and Itô diffusion benchmark process, we develop a convex duality theorem, new to the literature, to the auxiliary stochastic control problem with state reflections in which the dual process also exhibits reflections from above. For CRRA utility and geometric Brownian motion benchmark process, we further derive the optimal portfolio and consumption in feedback form using the new duality theorem, allowing us to discuss some interesting financial implications induced by the additional risk-taking from the capital injection and the goal of tracking.

Zhenhua Wang (Shandong University

Title: Entropy-regularized stochastic controls and policy iteration for the associated HJB equations
Abstract: We study an entropy-regularized continuous time stochastic control problem. We first provide the "policy improvement" property of the associated policy iteration algorithm (PIA), then we focus on the convergence of the PIA. In the setting of bounded coefficients and no control over the diffusion term, with a sequel of estimates we show the compactness of the value sequence generated by the Policy Iteration Algorithm (PIA), and derive the convergence of the sequence to the optimal value. Then the discussion is extended to two scenarios with a large discounting rate: 1. Bounded coefficients with "small" controls over the diffusion term; 2. Unbounded coefficients with no controls over the diffusion term. The existence of the solution to the HJB equation and regularity of the optimal value are also achieved. This talk is based on joint works with Yu-Jui Huang, Zhou Zhou, Hung Tran and Paul Zhang.

Shihao Zhu (Ulm University)

Title: Asymmetric Information and Relative Performance in Dynamic Trading Games
Abstract: This paper examines a financial market with two investors engaged in mean-variance portfolio selection under a relative performance criterion within an asymmetric information framework. Specifically, one investor has direct access to the random drift of the risky asset, while the other can only observe the asset's price. Each investor aims to optimize both her

terminal wealth and relative performance compared to the other. We seek a Nash equilibrium, defined as a set of trading strategies in which both investors simultaneously achieve their intrapersonal equilibrium. We derive this Nash equilibrium in a semi-explicit form and further explore the impact of asymmetric information and relative performance concerns on trading strategies and value function through a detailed numerical example. This work is joint with Yu-Jui Huang at CU Boulder.

Session 4, Track B: Market Design, Liquidity, and Strategic Behavior

Xiaofei Shi (University of Toronto)

Title: A Dynamic Equilibrium Model of Liquidity Risk
Abstract: We present a framework for analyzing the equilibrium implications of liquidity risk dynamics on asset prices. Our model features two risk-averse agents who continuously trade a security to hedge nontraded risks, while facing stochastic transaction costs correlated with their trading needs. We derive explicit solutions for equilibrium prices and traded quantities under small transaction costs, showing that the illiquidity discount increases with the correlation between trading costs and trading needs. Calibrating the model using NYSE and AMEX data, we find that liquid portfolios recover faster from liquidity shocks and exhibit smaller fluctuations, whereas illiquid portfolios are highly sensitive to trading-cost dynamics. For the most illiquid portfolio, the illiquidity discount increases by 12% with full correlation compared to the uncorrelated case. Joint work with Agostino Capponi and Johannes Muhle-Karbe.

Seongjin Kim (Ulsan National Institute of Science and Technology)

Title: Oligopolistic Market Equilibrium and the Effect of Observing Noise Trades
Abstract: We study a continuous-time equilibrium model of financial markets with asymmetric information, in the spirit of Kyle (1985), where multiple market makers imperfectly compete through demand schedules as in Kyle (1989). A key contribution of our work is to characterize a continuous-time equilibrium in which the insider's optimal trading strategy includes a non-zero martingale component derived from the noise path. This challenges the conventional restriction to absolutely continuous strategies and highlights the relevance of richer admissible classes. To clarify this structure, we analyze a sequence of models: (i) a discrete-time model with strategic market makers competing through demand schedules, (ii) a modified discrete-time model where the insider observes noise trades, (iii) a continuous-time model where insider strategies lie in the semimartingale class, and (iv) a constrained continuous-time model with finite variation strategies. We show that the continuous-time equilibria in (iii) and (iv) emerge as limits of models (ii) and (i), respectively, establishing a precise link between informational access in discrete time and optimal strategy classes in continuous time. We also establish the convergence rate of key equilibrium parameters as the time step approaches zero, providing a precise quantitative description of how discrete-time models converge to their continuous-time limits and clarifying the asymptotic structure of strategic trading equilibria.

Junhuan Zhang (Beihang University)

Title: Profitability of collusive sandwich attack in automated market maker exchanges
Abstract: In decentralized exchanges, sandwich attackers may collude with validators through private memory pools. We investigate the collusive behaviors between sandwich attackers and colluding validators in terms of a new game-theoretic market microstructure model of automated market maker based decentralized exchange. We also explore the impacts of this collusion on the other agents including arbitrageurs employing the two-point (TA) arbitrage strategy, liquidity providers using the balancing swap fees and impermanent loss strategy, swap traders using the moving average (MA) and zero intelligence (ZI) strategies, and ordinary validators with honest

strategy. The deep reinforcement learning is used to optimize the collusive trading strategy of sandwich attackers. We validate our model using daily closing prices of USDT/BTC from January 1, 2023 to December 31, 2023. The results show that: 1) the collusive sandwich attack strategy is effective and profitable; 2) colluding validators receive larger rewards than those from only verifying transactions; 3) the collusion does not affect the rewards of the ordinary validators, but reduces the rewards of the liquidity providers; 4) rewards for the TA arbitrageurs are diminished as a result of collusion; 5) MA and ZI swap traders consistently suffer losses.

Abdullah Mohammed AlGhazali (Dhofar University)

Title: Connectedness and hedging strategy between European sustainability and conventional stock markets
Abstract: The aim of this paper is to analyze the connectedness between sustainability and conventional stock price returns of the main European countries (Europe, Belgium, France, Italy, the Netherlands, Spain, Finland, and Germany) using the time-varying parameter vector autoregression (TVP-VAR) model. In addition, we use the GARCH-DCC model to assess the optimal portfolio weights and hedging strategies. The results show strong dynamics and positive spillovers among the sustainability and conventional stock markets. The spillover size shows a significant jump during the pandemic outbreak, the 2016 Chinese stock market crash, Brexit, and the Ukraine-Russia tensions. During the pandemic, all conventional stock markets except Italy and Spain are net shock contributors, while all sustainability stock markets are net receivers except for France, Germany, and Europe. The results of the optimal hedge ratio reveals that the sustainability stock asset is an expensive hedge before and during the pandemic. The optimal weight values indicate that investors should hold more conventional stocks than sustainability stocks irrespective of the pandemic crisis. The Italian-sustainability stocks portfolio provides the highest hedging effectiveness before and during the COVID-19 period.

Session 4, Track C: Machine learning and AI in finance

Cheng Si (Syracuse University)

Title: When machines disagree: Evidence from large language models
Abstract: We use six large language models to predict stock returns from news headlines and document substantial variation across providers and investment horizons. Stocks with higher cross-provider and cross-horizon dispersions earn lower future returns, especially among small firms with positive news and limited analyst coverage. For large firms, such dispersions delay the incorporation of information on earnings announcement days; for small firms, cross-horizon dispersion contributes to post-earnings announcement drift. These effects persist after controlling for analyst forecast dispersion, highlighting the growing role of AI technologies in shaping information processing and diffusion in financial markets.

Wayne Wei Li (Harbin Institute of Technology)

Title: Bayes Asymmetric Similarity Estimation in Binary Classification of Bankruptcy Prediction
Abstract: There has been intensive research regarding machine learning models for predicting bankruptcy in recent years. However, the lack of interpretability limits their growth and practical implementation. An alternative method involves the development of machine learning models that are easily understandable to humans, but such approaches often suffer from reduced predictive accuracy. In this study, we propose a Bayes Asymmetric Similarity Measure that effectively addresses this trade-off. We demonstrate that, as the size of the training data increases, our method asymptotically approaches the Bayes optimal classifier. A case study

confirms that our approach performs competitively with state-of-the-art machine learning models in bankruptcy prediction. Additionally, we examine the model's explainability in supporting transparent decision-making.

Xiaofei Xu (Wuhan University)

Title: Multi-Period Portfolio Allocation: A One-Shot Stochastic Optimization Approach
Abstract: This paper presents a multi-period factor investing framework utilizing a one-shot stochastic optimization approach, which efficiently addresses the complexities of multi-period decision-making under uncertainty. Traditional portfolio optimization models, based on single-period analyses and static beta estimations, often fail to capture the evolving dynamics of financial markets. By extending the classical mean-variance optimization to a multi-period setting and employing a one-shot stochastic optimization methodology, we optimize portfolio weights across multiple periods simultaneously. This approach leverages Gaussian Processes and the long-term utility function to model the dynamic and stochastic nature of asset returns, ensuring theoretical consistency and favorable sample complexity properties. Our empirical analysis, which includes a comparison of dynamic versus static beta estimations, demonstrates that the proposed one-shot optimization delivers superior performance metrics such as Compound Annual Growth Rate and Sharpe Ratio. Additionally, portfolios optimized using machine learning-driven forecasts exhibit superior risk-return trade-offs and resilience across diverse market conditions compared to conventional benchmark strategies like Buy and Hold and Minimum Variance portfolios. These findings provide valuable insights for portfolio managers aiming to optimize risk-adjusted returns over multiple investment horizons, thereby contributing an efficient and theoretically grounded methodology to the finance literature and advancing the practice of long-term factor-based investing.

Xie Haoyu (NUS)

Title: KAN we hedge?
Abstract: We propose a hedging framework that replaces the standard neural network architecture from the deep hedging approach introduced in Bühler et al. (2019) with Kolmogorov–Arnold Networks (KANs), and we study its effectiveness in several market situations. Our approach retains the model-free deep hedging structure introduced in Bühler et al. (2019), while leveraging the compositional inductive bias of KAN to improve approximation quality of hedging strategies. In particular, we provide a theoretical convergence analysis of KAN-based strategies, and empirically demonstrate their superior performance compared to deep neural networks in markets with multiple tradable instruments. In specific benchmark scenarios such as in the case of a restricted sample size (due to limited historical data), hedging errors obtained via KAN-based hedges are consistently smaller than those obtained in the deep hedging approach. These results suggest that in these practice-relevant situations KAN-base deep learning hedges can serve as a more expressive and efficient function approximator in the context of learning optimal trading strategies. This talk is based on joint work with Julian Sester (NUS), Wang Mingjie (NUS) and Marko Weber (NUS).

Session 5, Track A: Machine Learning Applications to Finance

Daniel Traian Pele (ASE, Bucharest)

Title: Marketbusters: Hunting Anomalies with LLMs
Abstract: We introduce Marketbusters, a novel pipeline that combines large language models (LLMs) with advanced technical indicator analysis to detect financial anomalies and forecast market crashes. Our framework integrates rolling-window technical feature extraction and LLM-based chart interpretation, producing robust anomaly signals aligned with future log-returns

and optimized through cost-sensitive thresholding. Applied to S&P 500 data, our approach consistently outperforms traditional models in early crash detection and risk mitigation, especially during periods of elevated volatility. These results underscore the potential of integrating AI-driven pattern recognition with technical analysis for next-generation financial anomaly detection and market surveillance.

Ruting Wang (City University of Hong Kong)

Title: Carbon Risk Measurement Dynamics
Abstract: Reducing carbon exposure has become a common goal across countries. High-carbon-intensive firms face increasing risks, including stranded assets, rising operational costs, and greater financing burdens. Traditional asset pricing theory suggests that investors require higher compensation to compensate for these risks, leading to a "high-carbon premium". In contrast, investor preference theory argues that growing aversion to high-carbon assets and a preference for green investments may drive up low-carbon stock prices, resulting in a "low-carbon premium". This tension between theories gives rise to the "carbon premium puzzle". A key limitation of existing discussions is their neglect of left-tail extreme downside risks that are of primary concern to investors. To address this gap, this research constructs a dynamic carbon risk indicator (DCRI) using Quantile LASSO analysis, which captures tail event risks within the financial network. This carbon risk indicator not only forecasts the future low-carbon premium but also captures uncertainties faced by investors in returns and the risk-reward trade-off in high-carbon firms. In summary, our index suggests that investors will shift toward low-carbon firms when the tail risks associated with high-carbon firms increase.

Hannah Lai (National University of Singapore)

Title: Neural Tangent Kernel in Implied Volatility Forecasting: A Nonlinear Functional Autoregression Approach
Abstract: Forecasting implied volatility across different levels of moneyness and maturity is crucial yet challenging due to the high dimensionality of the Implied Volatility Surface (IVS) and the nonlinearity that characterizes its temporal dependence. We adopt a Nonlinear Functional Autoregressive (NFAR) framework to a sequence of IVS and employ neural networks that admit a Neural Tangent Kernel (NTK) parametrization to capture nonlinear interactions between surfaces. We illustrate the theoretical and numerical advantages of the proposed functional NTK (fNTK) estimator and establish a link to functional kernel regression. Our empirical analysis includes over 6 million European call and put options from the S&P 500 Index, covering January 2009 to December 2021. The results confirm the superior forecasting accuracy of the fNTK across different time horizons. When applied to short delta-neutral straddle trading, the fNTK achieves a Sharpe ratio ranging from 1.30 to 1.83 on a weekly to monthly basis, translating to 90% to 675% relative improvement in mean returns compared to forecasts based on functional Random Walk model.

Yezhou Sha (Capital University of Economics and Business, Beijing)

Title: Tree Based Learning for Financial Forensics
Abstract: Insider trading is more than an intellectual game—it constitutes fraud and signals market failure. Drawing on a uniquely constructed dataset of legal case documents and applying generalised random forest learners, we address a significant gap in the empirical literature. For each insider trading case, we collect detailed information on transaction timing, settlement prices, and realised profits or losses. Combined with individual-level characteristics, firm fundamentals, trading metrics, and macroeconomic indicators, our high-dimensional panel spans over 1,000 variables per stock-day observation. Machine learning enables a rigorous analysis of

the determinants and behavioural patterns of insider trading in emerging markets and provides a robust foundation for the application of advanced machine learning techniques.

Session 5, Track B: Portfolio Optimization and Risk Preferences

Nicolas Nguyen (University of Tübingen)

Title: Variational Bayes Portfolio Construction
Abstract: Portfolio construction is the science of balancing reward and risk; it is at the core of modern finance. In this paper, we tackle the question of optimal decision-making within a Bayesian paradigm, starting from a decision-theoretic formulation. Despite the inherent intractability of the optimal decision in any interesting scenarios, we manage to rewrite it as a saddle-point problem. Leveraging the literature on variational Bayes (VB), we propose a relaxation of the original problem. This novel methodology results in an efficient algorithm that not only performs well but is also provably convergent. Furthermore, we provide theoretical results on the statistical consistency of the resulting decision with the optimal Bayesian decision. Using real data, our proposal significantly enhances the speed and scalability of portfolio selection problems. We benchmark our results against state-of-the-art algorithms, as well as a Monte Carlo algorithm targeting the optimal decision.

Tao Pang (North Carolina State University)

Title: Optimal Portfolio Choice with Comfortable Consumption
Abstract: In this paper we investigate a Merton-type portfolio optimization problem with a minimum comfortable consumption constraint, utilizing a stochastic control approach. By translating the Hamilton-Jacobi-Bellman (HJB) equations into second-order ordinary differential equations (ODEs) through a novel method, we precisely characterize the set of candidate value functions. We then identify the optimal consumption rate, investment strategy and the value function explicitly by virtue of the stochastic perturbation method. This approach can be applied to derive explicit solutions for other portfolio choice problems under constraints, with detailed studies of the corresponding HJB equations. In addition, we have extended the model when inflation is considered. We also discuss some applications, such as retirement funds, pension funds, endowment portfolios and the AK model for economic growth.

Jin Hyuk Choi (Ulsan National Institute of Science and Technology)

Title: Unified asymptotics for investment under illiquidity: transaction costs and search frictions
Abstract: We investigate the optimal investment problem in a market with two types of illiquidity: transaction costs and search frictions. We analyze a power-utility maximization problem where an investor encounters proportional transaction costs and trades only when a Poisson process triggers trading opportunities. We show that the optimal trading strategy is described by a no-trade region. We introduce a novel asymptotic framework applicable when both transaction costs and search frictions are small. Using this framework, we derive explicit asymptotics for the no-trade region and the value function along a specific parametric curve. This approach unifies existing asymptotic results for models dealing exclusively with either transaction costs or search frictions. This is joint work with Tae Ung Gang.

Session 5, Track C: Adapted Optimal Transport and Applications

Daniel Bartl (NUS)

Title: Consensus models in mathematical finance via adapted optimal transport
Abstract: Optimal transport theory provides a powerful analytical framework for studying

probability measures. However, it falls short when applied to the laws of stochastic processes, as it ignores their intrinsic temporal structure — namely, the filtration. Recently, an adapted optimal transport framework has emerged as a natural extension of classical optimal transport to the setting of stochastic processes. In this talk, I will focus on barycenters in this context and highlight their relevance to consensus models in mathematical finance.

Shuoqing Deng (HKUST)

Title: Distribution-constrained optimal multiple stopping: A Root-type solution
Abstract: We consider the problem of optimal multiple stopping where the stopping times should satisfy some distribution constraints. For a large class of cost functions, we reformulate the problem into a sequence of optimal stopping problem of a time-reversed process, explicitly construct the solution and verify the optimality using a martingale inequality. The methodology has links with the Root's solution to Skorokhod embedding problem and the inverse boundary hitting problem.

Bingyan Han (HKUST-GZ)

Title: The McCormick martingale optimal transport
Abstract: Martingale optimal transport (MOT) often yields broad price bounds for options, constraining their practical applicability. In this study, we extend MOT by incorporating causality constraints among assets, inspired by the nonanticipativity condition of stochastic processes. This, however, introduces a computationally challenging bilinear program. To tackle this issue, we propose McCormick relaxations to ease the bicausal formulation and refer to it as McCormick MOT. The primal attainment and strong duality of McCormick MOT are established under standard assumptions. Empirically, we apply McCormick MOT to basket and digital options. With natural bounds on probability masses, the average price reduction for basket options is approximately 1.08% to 3.90%. When tighter probability bounds are available, the reduction increases to 12.26%, compared to the classic MOT, which also incorporates tighter bounds. For most dates considered, there are basket options with suitable payoffs, where the price reduction exceeds 10.00%. For digital options, McCormick MOT results in an average price reduction of over 20.00%, with the best case exceeding 99.00%. This is a joint work with Erhan Bayraktar and Dominykas Norgilas.

Fang Rui Lim (Oxford)

Title: Causal Transports on Path Space
Abstract: Causal optimal transport and its induced Wasserstein-type distance on the space of probability measures on path space has been the focus of much research recently, owing to its efficacy in handling dynamic optimization problems arising from mathematical finance. We investigate these (bi-)causal transports between the laws of various stochastic equations and provide a full characterization of these (bi-)causal Monge maps and couplings. As an application, we compute explicitly the adapted Wasserstein distance between Gaussian processes and scalar stochastic equations.