NUS National University of Singapore | Centre for Quantitative Finance, Faculty of Science

NUS National University of Singapore | RMI Advancing Risk Management for Singapore and Beyond

Workshop Programme Agenda: Frontiers in FinTech and Quantum Computing 2022

*This agenda will be updated progressively. Please click **here** for the latest version.*

Date 21-22 February 2022
Time 14:00 – 18:00 (Singapore Time Zone, GMT +8)
Venue Online via Zoom

21 February 2022, Monday	
13:50-14:00	Openings
14:00-15:00	**Talk 1: Solving QUBOs on Digital and Quantum Computers** Speaker: **Thorsten Koch** (*Zuse Institute Berlin & Technische Universität Berlin, Germany*)
15:00-18:00	**3H Tutorial: Hands-on Introduction to Quantum Finance** Speaker: **Junye Huang** (*IBM, Singapore)* **Radha Pyari Sandhir** (*IBM, India)*
22 February 2022, Tuesday	
14:00-15:00	**Talk 2: 代 DAI - the Digital Art Index: Cryptos, Blockchains, NFTs** Speaker: **Wolfgang Karl Härdle** (*Humboldt Universität zu Berlin, Germany*)
15:00-16:00	**Talk 3: MachineFi: Unlocking Trillion-Dollar Machine Economy** Speaker: **Xinxin Fan** (*IoTeX, USA*)
16:00-17:00	**Talk 4: DBS' Perspective on Blockchain, Crypto, Digital Assets and Digital Currencies** Speaker: **Kelvin Tan** (*DBS, Singapore*)
17:00-18:00	**Talk 5: Fairness in Credit Scoring: Assessment, Implementation and Profit Implications** Speaker: **Stefan Lessmann** (*Humboldt Universität zu Berlin, Germany*)

Organizing Committee:

- Yi-Chun CHEN (National University of Singapore)
- Ying CHEN (National University of Singapore)
- Chao ZHOU (National University of Singapore)

21 Feb 2022@14:00-15:00

Talk 1: Solving QUBOs on digital and quantum computers

Speaker: Thorsten Koch (Zuse Institute Berlin & Technische Universität Berlin, Germany)

Abstract: Combinatorial optimization is to find optimal solutions to efficiently allocate limited resources, which has been widely used in almost all fields of e.g., finance, marketing, production, scheduling, inventory control. It is regularly claimed that quantum computers will bring breakthrough progress regarding the solution of challenging combinatorial optimization problems relevant in practice. In particular, Quadratic Unconstraint Binary Optimization (QUBO) problems are said to be the model of choice for the use in (adiabatic) quantum systems. We explain some of the meaning and implications, review the state of affairs, and give some computational results to underpin our conclusions.

Speaker bio: Prof. Dr. Thorsten Koch is Professor for Software and Algorithms for Discrete Optimization at TU-Berlin and head of the Applied Algorithmic Intelligence Methods and the Digital Data and Information for Society, Science, and Culture departments at the Zuse Institute Berlin (ZIB). He has worked in several areas, especially the planning of infrastructure networks, chip verification, mathematical education and integer optimization. From 2008-2014 he was the coordinator of the FORNE project, an industry collaboration project regarding gas transportation involving five universities and two research institutes. The project received the 2016 EURO Excellence in Practice Award of the European OR Society. From 2013-2019 he was head of the GasLab and the SynLab within the Research Campus MODAL (Mathematical Optimization and Data Analysis Laboratory). The project Optimized Execution of Dispatching conducted together with Germanys largest Gas Transmission System Operator became finalist of the 2020 INFORMS Innovative Applications in Analytics Award.

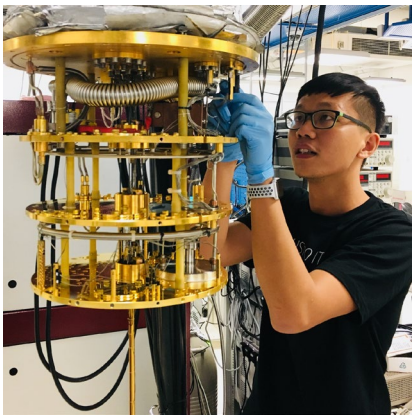
Currently, the work is focused on developing decomposition-based parallel methods for solving large-scale block-structured optimization problems. Such problems arise, for example, in data-driven, real-world analysis and planning of sustainable network infrastructures.

21 Feb 2022@15:00-18:00
Tutorial: Hands-on Introduction to Quantum Finance
Speaker: Junye Huang (IBM, Singapore) & Radha Pyari Sandhir (IBM, India)

Description: This is hands-on workshop introduces you to the world of quantum finance. You will learn how to use quantum computers to solve problems in the finance services sector such as portfolio optimization and option pricing as well as the basic concepts of quantum computing through programming with Qiskit (open source quantum SDK developed by IBM) and IBM Quantum Services.

Agenda (Preliminary)

- Introduction to Quantum Computing (30 min)
- Introduction to Qiskit and IBM Quantum (30 min)
- Finance use cases demo
  - Portfolio optimization (30 min)
  - Option pricing (30 min)



Speaker bio: Junye Huang is a Quantum Developer Advocate at IBM. He is part of the IBM Quantum Community Team whose mission is building an open, diverse and inclusive quantum community. He is focusing on promoting quantum education in the Asia Pacific region. He organized the first Qiskit university hackathon in the world (before joining IBM) and is a guest lecturer for quantum computing courses at three Singapore universities (NUS, SMU and SUTD). Junye has given dozens of quantum technical talks and workshops on various topics including quantum finance. He was an invited speaker for SCxSC FinTech Conference 2021 organized Malaysia Securities Commission.

Junye led a team of 40+ to organize IBM Quantum Challenge 2021, an online quantum programming challenge, for celebration of 5th anniversary of IBM Quantum and 40 years of quantum computing. Over 1400 people from 76 countries participated in the event. This event pioneered the reservation of a dedicated quantum system for participants. He received Outstanding Accomplishment (highest level of recognition) from IBM Research for quantum education, together with the team behind Qiskit Global Summer School and Qiskit textbook.

His passion for quantum computers drives him to create educational games for quantum computers such as QPong, a quantum version of Pong which he created at the first Qiskit camp. QPong was subsequently ported to a physical Quantum arcade machine and toured around Europe, including the EU Quantum Flagship Event in Helsinki in October 2019.

Speaker bio: Radha Pyari Sandhir is a Qiskit Advocate and the India Quantum Community Manager at IBM Quantum. She's passionate about community growth and outreach, with a particular focus on engaging entry points for non-expert audiences.

Radha frequently combines her love for all things creative with educational endeavors. She has co-created a number of web apps and resources such as the Quantum Bubble Art Generator that generates a visual representation of quantum noise, and the D&D μStarter Kit for D&D players that harbors a quantum dice roller and generates characters. She conceptualized and authored The Photonic Trail: A Quantum Optics Treasure Hunt, a single-player fantasy game for QPlayLearn. She's organized numerous quantum events, including informal social gatherings centered on quantum, and was on the Scientific Board for the Internet Festival's Quantum Game Jam in November 2021.

22 Feb 2022@14:00-15:00

Talk 2: 代 DAI - the Digital Art Index: Cryptos, Blockchains, NFTs

Speaker: Wolfgang Karl Härdle (Humboldt Universität zu Berlin, Germany)

Abstract: Non fungible tokens (NFTs) are digital assets, mostly derived on an ETH Blockchain, have recently gained huge interest from investors, and the market sentiment went to a climax when some artwork sold at unforeseeable level. We create 代 DAI - a price index for the digital art market by collecting over 300,000 transactions from the top 10 collections of NFTs ranked by transaction volume. The BRC blockchain-research-center.de data is collected jointly with artnet.com and covers over 80% of the total volume of the market, and we apply hedonic regression in a panel setting and thereby we identify which factors drive the price of NFTs.

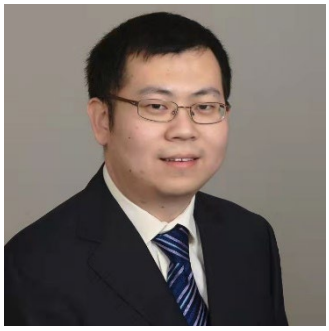
Speaker bio: Prof. Dr. Wolfgang Karl Härdle completed his Dr. rer. nat. in Mathematics at Heidelberg University and received his habilitation in Economics at Bonn University. He was the founder and Director of Collaborative Research Center CRC 373 “Quantification and Simulation of Economic Processes” (1994 - 2003), Director of CRC 649 “Economic Risk” (2005 - 2016) and also of C.A.S.E. (Center for Applied Statistics and Economics) (2001 - 2014). He is currently heading the Sino-German Graduate School (洪堡大学 + 厦门大学) IRTG1792 on “High dimensional non stationary time series analysis”. He is the Ladislaus von Bortkiewicz Professor at Humboldt-Universität zu Berlin and director of the BRC the joint Blockchain Research Centre with Zurich U.

His current research focuses on modern machine learning techniques, smart data analytics and the crypto currency eco system. He has published more than 40 books and more than 350 papers in top statistical, econometrics and finance journals. He is highly cited, and among the top scientist registered at REPEC and has similar top notch rankings in other scales, such as the Handelsblatt ranking.

He has professional experience in financial engineering, structured product design and credit risk analysis. His recent research extends nonparametric paradigms into machine learning, decision analytics and data science for the digital economy. He is the Editor in Chief of the Springer Journal „Digital Finance“. He supervised more than 60 PhD students and has long-term research relations to research partners in the USA, Singapore, Prague, Warsaw, Paris, Cambridge, Beijing, Xiamen, Taipei among others.

22 Feb 2022@15:00-16:00
Talk 3: MachineFi: Unlocking Trillion-Dollar Machine Economy
Speaker: Xinxin Fan (IoTeX, USA)

Abstract: In this talk, Dr. Xinxin Fan will introduce MachineFi, an IoTeX's initiative for unlocking the emerging trillion-dollar machine economy and enabling people to truly own their devices and data. After explaining the basic concept of MachineFi, Dr. Fan will present the MachineFi technology stack that faciliates developers to bring a wide range of smart devices onboard for building innovative decentralized applications. Finally, Dr. Fan will discuss some typical use cases of MachineFi.



Speaker bio: Xinxin Fan, Ph.D. is the Head of Cryptography at IoTeX, a Silicon Valley-based technology platform that is applying blockchain to secure and evolve the Internet of Things (IoT). He is responsible for directing the company's strategy and product roadmaps as well as developing the core technologies and IP portfolio. Before joining IoTeX, he was a senior research engineer of the Security and Privacy Group at Bosch Research Technology Center North America. Dr. Xinxin Fan received his Ph.D. in Electrical and Computer Engineering from the University of Waterloo in 2010. He has published 50+ referred research papers in top-tired journals, conferences, and workshops in the areas of cryptography and information security and is an inventor of 15 patent filings for innovative information security and privacy-enhancing technologies. He is also a Certified Information Systems Security Professional (CISSP) from (ISC)² and a (co-)chair of IEEE P2418.1 and IEEE P2958 standards working groups.

22 Feb 2022@16:00-17:00

Talk 4: DBS' perspective on Blockchain, Crypto, Digital Assets and Digital Currencies

Speaker: Kelvin Tan (DBS, Singapore)

Abstract: Blockchain / Distributed Ledger Technology introduced by bitcoin has created innovations in many areas, including a crypto market that is now worth US$2T to US$3T. How is DBS approaching this new technology as well as the opportunities and threats brought about by it? In this talk, I will present the recent advances and industrial implementations on Blockchain, Crypto, Digital Assets and Digital Currencies from DBS' perspective.

Speaker bio: Kelvin is currently the Head of Innovation for Treasury & Markets at DBS since 2018 where he is responsible for advancing a culture of innovation and driving projects involving emerging technologies such as AI, Blockchain, Quantum Computing, etc.. He was deeply involved in the DBS Digital Exchange & Custody project as well as the initial conceptualization of Partior, the digital currency project in partnership with JP Morgan and Temasek, that were launched in Dec 2020. He also spearheaded the Digital Tokenized Bond project that was launched in May 2021.

Prior to joining DBS, Kelvin was the Head of Fintech & Data at SGX where he had re-architected the data infrastructure to enable low-latency, high-frequency, data capture into a realtime data warehouse enabling realtime data analytics, visualization and AI. He was also leading SGX's efforts in blockchain and represented SGX on MAS 'Project Ubin on central bank digital currencies, especially on phase 3 focussing on Delivery-vs-Payment.

Kelvin graduated with two bachelor degrees, one in computer systems engineering and one in computer science, followed by a masters in wealth management. He initially started his career as a virtual reality engineer before switching to the financial services industry.

22 Feb 2022@17:00-18:00

Talk 5: Fairness in Credit Scoring: Assessment, Implementation and Profit Implications

Speaker: Stefan Lessmann (Humboldt Universität zu Berlin, Germany)

Abstract: The rise of algorithmic decision-making has spawned much research on fair machine learning (ML). Financial institutions use ML for building risk scorecards that support a range of credit-related decisions. Yet, the literature on fair ML in credit scoring is scarce. The paper makes three contributions. First, we revisit statistical fairness criteria and examine their adequacy for credit scoring. Second, we catalog algorithmic options for incorporating fairness goals in the ML model development pipeline. Last, we empirically compare different fairness processors in a profit-oriented credit scoring context using real-world data. The empirical results substantiate the evaluation of fairness measures, identify suitable options to implement fair credit scoring, and clarify the profit-fairness trade-off in lending decisions. We find that multiple fairness criteria can be approximately satisfied at once and recommend separation as a proper criterion for measuring the fairness of a scorecard. We also find fair in-processors to deliver a good balance between profit and fairness and show that algorithmic discrimination can be reduced to a reasonable level at a relatively low cost.

Speaker bio: Stefan completed his PhD and habilitation at the University of Hamburg in 2007 and 2012, respectively. He then joined the Humboldt-University of Berlin in 2014, where he heads the Chair of Information Systems. He serves as an associate editor for several international journals and department editor of Business and Information System Engineering (BISE). Stefan has secured substantial amounts of research funding and published several papers in leading international journals and conferences (Google Scholar, ResearchGate). His research concerns machine learning and artificial intelligence (MLAI) methodologies and their use cases in managerial decision support. Stefan specializes on MLAI applications in the broad scope of marketing and risk analytics. Stefan actively participates in knowledge transfer and consulting projects with industry partners; from start-up companies to global players and not-for-profit organizations.