Date: Apr. 10, 2023, 16:00-17:30 / 4 月 10 日（月）16:00〜17:30
Speaker: Aleksandar Arandjelovic (Macquarie University)

Title:
1. Deep hedging and portfolio optimization in financial markets with a large trader
2. Importance sampling for option pricing with feedforward neural networks

Abstract:
We study models of illiquid financial markets where a large trader can move market prices by means of her transactions. Having gained recent popularity, we focus on algorithmic strategies, a class of stochastic processes where artificial neural networks process market information to form trading decisions. We present a universal approximation theorem in the space of (nonlinear) stochastic integral processes in continuous time. A simple portfolio optimization problem highlights phenomena that arise due to the price impact of the large trader. In particular, numerical simulations show that optimal algorithmic strategies can lead to exploding or collapsing prices and completely destabilize the market. (This is joint work with Thorsten Rheinländer.)
We study the problem of reducing the variance of Monte Carlo estimators through performing suitable changes of the sampling measure which are induced by feedforward neural networks. To this end, building on the concept of vector stochastic integration, we characterize the Cameron-Martin spaces of a large class of Gaussian measures which are induced by vector-valued continuous local martingales with deterministic covariation. We prove that feedforward neural networks enjoy, up to an isometry, the universal approximation property in these topological spaces. We then prove that sampling measures which are generated by feedforward neural networks can approximate the optimal sampling measure arbitrarily well. We conclude with a numerical study pricing path-dependent European basket and barrier options in the case of Black--Scholes and several stochastic volatility models for the underlying multivariate asset. (This is joint work with Thorsten Rheinländer and Pavel V. Shevchenko.)