Importance sampling for option pricing with feedforward neural networks

Aleksandar Arandjelović

WU - Vienna University of Economics and Business
Welthandelsplatz 1, 1020 Vienna
Austria

Joint work with: Thorsten Rheinländer, Pavel V. Shevchenko

We study the problem of reducing the variance of Monte Carlo estimators through performing suitable changes of the sampling measure computed 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 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 generated by feedforward neural networks can approximate the optimal sampling measure arbitrarily well.
We conclude with a comprehensive numerical study pricing path-dependent European options for asset price models that incorporate factors such as changing business activity, knock-out barriers, dynamic correlations, and high-dimensional baskets.