ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

Prof. R. Wattenhofer

Generative models for Volatility Surfaces for Initial Margin and Backtesting

Initial Margin (IM) methodologies are a fundamental mechanism to preclude systemic market risks, acting as a safeguard against potential losses from defaulting counterparties. However, these methodologies often struggle to keep pace with the dynamic nature of financial systems and the increasing complexity and diversity of financial data.

One substantial challenge is the design of IM methodologies for option portfolios. This process involves estimating volatility surfaces dynamics to forecast future potential exposure of portfolios, a key step in calculating risk in margin models. The traditional Filtered Historical Simulation approach, which is the state of art on cash equity markets, is not easy to lift to the option markets due to the static and dynamic relation between the prices of option contracts with different characteristics.

This project aims to explore the potential of machine learning methods in improving the robustness and realism of traditional modelling methods. We are particularly interested in the use of generative models, such as Generative Adversarial Networks (GANs), as a means to incorporate more diverse data and add flexibility to traditional financial modeling approaches. The generation of scenarios of volatility surfaces can also be used to provide new paths along which backtesting can be performed, which is a key practical matter.

At the heart of this research is also to break down the "black-box" perception often associated with machine learning applications in finance. Our aim is to demonstrate how these tools can reinforce the robustness of existing financial methodologies, while providing a solid benchmark in line with industry practices for margin calculation and risk modeling.

Requirements:

Knowledge of finance and financial terms is necessary. Prior experience and a strong interest in machine learning is recommended. Creativity and programming skills are advantageous.