

Learning High Dimensional Functions for Finance: Mathematical Foundations and Applications

Supervisor: [Kathrin Glau](#)

Research Group: [Probability & Applications](#)

Project description:

Financial risk management, trading and hedging requires banks and other financial institutions to perform highly complex simulations of their future portfolio under realistic market conditions. In this research project we will contribute to the efficient computation arising in risk assessment, which allows for fat tail distribution and more realistic dependence structures. Based on the expertise in both financial modelling and numerical analysis, we will guarantee that the model complexity is aligned with the computational complexity without resorting to ad hoc simplifications, and with guaranteed error bounds.

Core of the project is the development, analysis and application of methods to pricing, hedging and risk management problems in finance. The methods we will advance range from polynomial interpolation and their combination with deep learning to specific model order reduction techniques for partial differential equations. We will specifically work on efficiency for parametric problems.

In the project we specifically build on the following publications:

- Burkovska, O.; Glau, K.; Mahlstedt, M.; Wohlmuth, B.: Complexity reduction for calibration to American options *Journal of Computational Finance*, 2019, 23(1), 25-60, preprint: arXiv:1611.06452
- Gaß, M.; Glau, K.; Mair, M.: Magic Points in Finance: Empirical Interpolation for Parametric Option Pricing. (Open Access) *SIAM Journal for Financial Mathematics*, 2017, 8(1), 766-803
- Gaß, M.; Glau, K.; Mahlstedt, M.; Mair, M.: Chebyshev Interpolation for Parametric Option Pricing. (Open Access) *Finance and Stochastics*, 2018, 22(3), 701-731

We are looking for a PhD student with strong mathematical background in theory and coding (with a level having very successfully passed a master in mathematics or equivalent).

Some clearly stated initial projects allow the PhD student to immediately contribute to advancing the research in the field while learning the methodologies and applications we consider. The project is also wide enough so that the PhD student will be able to develop an own focus, contributing to the theoretical analysis, the implementation, the application or to an industrial collaboration.

Further information:

[How to apply](#)

[Entry requirements](#)

[Fees and funding](#)