Computational Math Seminar

Relative Arbitrage Opportunities in Stochastic Games and its Numerical Scheme

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Abstract: The Relative arbitrage portfolio outperforms a market portfolio over a given time horizon with probability one. When an investor competes with both market and peers, does relative arbitrage opportunity exist? What is the best performance one can achieve? What is the impact on the market when a large group of investors competes in a similar way? We construct a framework of multi-agent optimization for relative arbitrage problems to answer these questions. Under a dynamical system with interacting investors, the objective is characterized by the smallest non-negative continuous solution of the Cauchy problem for the associated partial differential equation. We solve the optimal strategies by deriving the Nash equilibrium in finite player and mean field games. However, solving this numerically presents many challenges due to the non-uniqueness and the curse of dimensionality. We provide a deep learning approach to tackle minimal solutions in the high-dimensional PDEs based on the associated obstacle problem and Deep Galerkin Method. We show that the minimal deep learning based solution is a good approximation in the volatility-stabilized models when compared to the grid-based numerical solution. We lay out a few future research topics related to deep learning, mean field type problems, and inverse problems.

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Virtual (RSVP by email to lruthotto@emory.edu)

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