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Issue Abstracts

Deep Execution - Value And Policy Based Reinforcement Learning For Trading And Beating Market Benchmarks

Kevin Dabérius, Elvin Granat and Patrik Karlsson

In this paper, the authors introduce the term 'Deep Execution' and where to utilize deep reinforcement learning (DRL) for optimal execution. The authors demonstrate two different approaches to solve optimal execution: (1) the deep double Q-network (DDQN), a value based approach and (2) the proximal policy optimization (PPO) a policy based approach, used for trading and beating market benchmarks, such as the time-weighted average price (TWAP) benchmark. We show that, firstly, the DRL can reach the theoretically derived optimum by acting on the environment directly. Secondly, the DRL agents can learn to capitalize on price trends (alpha signals) without directly observing the price. Finally, that the DRL can abuse available information to create dynamic strategies as an informed trader and thus outperform static strategies such as TWAP.

Deep Option Pricing - Term Structure Models

Jorg Kienitz, Sarp Kaya Acar, Qian Liang and Nikolai Nowaczyk

This paper proposes a data-driven approach, by means of an Artificial Neural Network (ANN), to value financial options within the setting of interest rate term structure models. This aims to accelerate existing numerical methods which is important for applications like historical VaR or exposure calculation being used in financial institutions. With ANNs being a universal function approximation method, this method trains an ANN on synthetically generated data including term structures of yield and volatility. Then, within an VaR or exposure calculation instead of applying costly numerical methods for the financial model, the engine runs the trained ANN. This is faster and more efficient and allows (a) considering term structures of yields, (b) term structures of volatilities and (c) trade interpolation. We outline the generation of the training data, the neural net selection and propose further methods for optimization. In particular we consider a control variate method and the application of no arbitrage conditions and regularization to the cost function used for learning and calibration. Finally, we test our approach on the Hull-White model with time-dependent term structure for volatility and the Trolle-Schwartz model. The latter adds an un-spanned stochastic volatility to the rates dynamic. The numerical results show that the ANN solution, especially the one with the control variate, is accurate and reduces the computing time significantly.

Modern Perspectives On Reinforcement Learning In Finance
Petter N. Kolm and Gordon Ritter

The authors give an overview and outlook of the field of reinforcement learning as it applies to solving financial applications of intertemporal choice. In finance, common problems of this kind include pricing and hedging of contingent claims, investment and portfolio allocation, buying and selling a portfolio of securities subject to transaction costs, market making, asset liability management and optimization of tax consequences, to name a few. Reinforcement learning allows us to solve these dynamic optimization problems in an almost model-free way, relaxing the assumptions often needed for classical approaches. A main contribution of this article is the elucidation of the link between these dynamic optimization problem and reinforcement learning, concretely addressing how to formulate expected intertemporal utility maximization problems using modern machine learning techniques.

Socially Responsible Investing: Combining ESG Ratings With News Sentiment Generates Alpha
Peter Hafez, Ricard Matas, Francisco Gomez, Marko Kangrga, Jiangang Dou, Boris Skorodumov, Alan Liu

In this paper, the authors show how abstract ESG ratings as a stock screener for downside protection can be significantly improved when combined with sentiment indicators derived from news and social media. Following a statistical approach, consisting in evaluating thousands of long-only monthly-rebalanced random portfolios, this presentation will provide evidence that ESG ratings used for portfolio screening provide downside risk mitigation and a positive, albeit modest, increase in performance with respect to fully random portfolios. The performance and downside protection of ESG-screened portfolios can be enhanced by adding a sentiment overlay. Furthermore, the price reaction of ESG-related negative events leads to fast momentum signals followed by slow reversal signals. Therefore, a double overlay of broad sentiment and ESG reversal signals improves alpha generation by up to 300 basis points and reduces the maximum drawdown by a factor of two compared to the random market portfolio.

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The Four Horsemen Of Machine Learning In Finance

Matthew Dixon and Igor Halperin

Machine Learning has been used in the financial services industry for over 40 years, yet it is only in recent years that it has become more pervasive across investment management and trading. Machine learning provides a more general framework for financial modeling than its linear parametric predecessor, generalizing archetypal modeling approaches, such as factor modeling (Feng et al., 2018; Gu et al., 2018; Chen et al., 2019), derivative pricing, portfolio construction, optimal hedging with model-free, data-driven approaches (Halperin, 2017) which are more robust to model risk and capture outliers. Yet despite their demonstrated potential, barriers to adoption have emerged — most of them artifacts of the sociology of this interdisciplinary field. Based on discussions with several industry experts and the authors' multidecadal experience using machine learning and traditional quantitative finance at investment banks, asset management and securities trading firms, this position article identifies the major red flags and sets out guidelines and solutions to avoid them. Examples using supervised learning and reinforcement in investment management & trading are provided to illustrate best practices.