
Stochastic Portfolio Theory: A Machine Learning Approach

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Abstract

In this paper we propose a novel application of Gaussian processes (GPs) to financial asset allocation. Our approach is deeply rooted in Stochastic Portfolio Theory (SPT), a stochastic analysis framework introduced by Robert Fernholz that aims at flexibly analysing the performance of certain investment strategies in stock markets relative to benchmark indices. In particular, SPT has exhibited some investment strategies based on company sizes that, under realistic assumptions, outperform benchmark indices with probability 1 over certain time horizons. Galvanised by this result, we consider the inverse problem that consists of learning (from historical data) an optimal investment strategy based on any given set of trading characteristics, and using a user-specified optimality criterion that may go beyond outperforming a benchmark index. Although this inverse problem is of the utmost interest to investment management practitioners, it can hardly be tackled using the SPT framework. We show that our machine learning approach learns investment strategies that considerably outperform existing SPT strategies in the US stockmarket.

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