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Abstract:

In this work, we study in depth the problem of Portfolio Optimization, and the application of Genetic Algorithms to solve it. We discuss the limitation of current approaches, that do not take into consideration multiple scenarios, nor transaction costs, and propose a modification of the Genetic Algorithm System for Portfolio Optimization to address these issues.

A Financial Portfolio is a strategy of making investiments in a number of different applications, instead of focusing in a single security. The idea behind the creation of a Financial Portfolio is that by investing in many different assets, the investor can reduce the specific risk from each asset, while maintaining a target return rate. Markowitz, in 1958, proposed a formal model for this strategy, which is called the Modern Portfolio Theory (MPT).

Nowadays, there is a number of optimization techniques that propose to solve the MPT's equations in order to find out the risk/return optimal portfolio for any given market. However, while Markowitz model has a very elegant mathematical construction, when we remove the restrictions that do not hold in the real world, it becomes a very hard optimization problem.

A number of numerical techniques have been developed to solve this problem. Among then, we highlight the Genetic Algorithms (GA), which are random search heuristics which have showed themselves very appropriate for such large problems. Current GA-based approaches, however, still tackle a limited version of the problem, without complications like transaction costs.

In this work we extend the current GA-algorithms for Portfolio Optimization, aiming at a system that is able to overcome some of the incomplete points in its predecessors. More specifically, we wish to address the modeling of a transaction cost measure, and the influence of market changes over time.

In this work we develop two new techniques: Objective Sharing and Seeding, to address the above questions. We perform experiments of these new techniques using historical data from the NIKKEI and the NASDAQ market indexes.

From the results of our experiments we can see that it is possible to get consistently high returns while reducing the distance of the optimal portfolios between scenarios. It becomes apparent that our approach is a fruitful one, and can be used to build models that are closer to the real world than other current techniques.