Project Proposal: Finding the Efficient Frontier for an Investment Portfolio using

Multi-Objective Optimization through Evolutionary Algorithms

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Modern portfolio theory states that an increase of expected return of a portfolio will also result in the increase of the riskiness as measured by the variance of the portfolio. Investors will always prefer a higher expected return to a lower expected given the same variance and will always prefer lower variance given the same expected return. Thus, trying to maximize the expected return while simultaneously decreasing the variance leads to a multi-objective optimization problem. I will attempt to find the efficient frontier using a class of numerical optimization algorithms known as evolutionary algorithms.

Evolutionary algorithms use the principles of evolutionary biology such as crossing over and mutation to find optimal solutions and are examples of Monte Carlo simulations for optimization. Different evolutionary algorithms such as the Non-Sorting Genetic Algorithm II (NSGA-II) or the Strength-Pareto Evolutionary Algorithm 2 (SPEA-2) and different probabilities for the crossover and mutation may return different results and run for various times depending on the type of problem encountered. Different examples from *Multi-Objective Optimization using Evolutionary Algorithms* will be used to demonstrate these methods.

Reference:

[1] K. Deb, *Multi-Objective Optimization using Evolutionary Algorithms* (John Wiley & Sons, 2001).