

# **HEURISTICALLY GUIDED INVESTMENT PORTFOLIO SELECTION**

**By**

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## **ABSTRACT**

Investment portfolio selection is a problem of great interest to researchers across disciplines. An investor has a certain amount of wealth and wishes to invest in assets. He faces a problem to decide: (i) How to apportion his wealth- how should he invest in various assets: common equity, real estate, foreign equity, fixed income securities, etc. (ii) Also, suppose the investor decides to invest only in common equity or stocks: what should be the proportion of allocation of his wealth to different stocks? His main concern during all these issues is to maximize his expected return from the portfolio held by him subject to a certain risk.

Mean-risk models are the most popular models used to solve the problem of investment portfolio selection. It all started with the Markowitz (1952, 1959) mean-variance model: a very popular approach to maximize expected returns subject to a certain risk. Adding various real life constraints like cardinality constraints, quantity constraints, minimum transaction lots, etc. makes the problem a mixed integer non-linear programming formulation. This thesis looks at the portfolio problem from a holistic approach. Investors can have different attitudes to take risk which may also be influenced by the capacity to take risk. Knowing the investor's behavioral traits is very essential before allocating complex financial products to him. The risk appetite of an investor can result in different stocks being allocated to different investors. SEBI (2013) came out with the regulatory guidelines to govern these for the first time. They mandated a clear separation of the roles and responsibilities of the advisory division and the execution division in a firm.

We thus, consider the investment portfolio selection problem as a combination of two problems- (i) the investment advisory problem and (ii) the portfolio allocation problem. This work discusses the investment advisory problem and steps to deliver a regulatory compliant investment advice. The investment advisory problem is an important value addition to the entire portfolio selection problem.

Another important issue which investment advisers face is how to tap the information about prospective customers in order to generate more revenue channels. A knowledge based framework has been proposed in the thesis to capture knowledge about a prospective customer from the minds of the existing customer during the interactions which an adviser has with his existing client.

The thesis also tries to enhance a latest portfolio allocation technique from literature by looking at a portfolio as a tree of assets and not just an array. We have used the most widely used technique – Sharpe ratio as a performance measure. The motivation for this tree-based algorithm was obtained from the research done by (Aranha and Iba 2008, 2009; Aranha, Azevedo and Iba 2012). Aranha and Iba (2008) used a tree-structure to represent a portfolio. Aranha and Iba (2008) considered that a tree genome stored more information in its internal nodes rather than an array which is used for intelligent operations on the tree while arriving at an optimal portfolio. This tree-based algorithm is developed and compared with the index as according to Markowitz (1952), the index is the best representation of an ideal portfolio which has also been supported in the research by Aranha and Iba (2008). We then introduce the concept of cardinality both w.r.t sectors and w.r.t stocks and design a two-phase algorithm. Three strategies have been proposed for the two phase algorithm. The two-phase algorithm incorporates the concept of stock screening using a search algorithm proposed by Mahanti, Ghosh and Pal (1992) and allocates weights to the stocks using the proposed tree-based algorithm.

## References

- Aranha, C.C. and Iba, H. (2008). A tree-based ga representation for the portfolio optimization problem. In Proceedings of the 10th annual conference on Genetic and evolutionary computation (pp. 873-880). ACM.
- Aranha, C., & Iba, H. (2009). The memetic tree-based genetic algorithm and its application to portfolio optimization. *Memetic Computing*, 1(2), 139-151.
- Aranha, C., Azevedo, C. R., & Iba, H. (2012). Money in trees: How memes, trees, and isolation can optimize financial portfolios. *Information Sciences*, 182(1), 184-198.
- Markowitz, H. (1959). Portfolio selection: efficient diversification of investments. *New York*
- Markowitz, H. (1952). Portfolio selection\*. *The journal of finance*, 7(1), 77-91.
- Mahanti, A, Ghosh, S & Pal, A. (1992). A High Performance Limited-Memory Admissible and Real Time Search Algorithm for Networks. Maryland, College Park, University of Maryland at College Park, MD 20742: 1-15.
- SEBI, (2013). Securities and Exchange Board of India (Investment Advisers) Regulations 2013, Part-III, Section-4, The Gazette of India