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Optimization of investment decisions using investor's utility and a probability distribution of stocks price obtained by machine learning

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Decision making is very interesting topic. Since our life greatly depends on the quality of our choice, decision making is always a top concern. Earnest research on decision making has been conducted so far. In this paper we will try to get some new findings about decision making by using latest technologies from Artificial Intelligence, economics and finance.

Financial market is one of the situations where the decision making will be seriously important. Various studies on how to analyze a financial market and how to make a best decision have been done. For example, William Forsyth Sharpe established CAPM (Capital Asset Pricing Model) in 1960s. Stephen Ross proposed the Multi-Factor Model and APT (Arbitrage Pricing Theory) in 1976. Expected utility by John von Neumann and Oskar Morgenstern in 1944 and Prospect theory by Daniel Kahneman and Amos Tversky in 1979 are the theories for decision making.

In engineering field, with the development of computer science, we can afford a large number of calculations in very short period of time.

Several kinds of algorithms to analyze a large amount of data have been developed. For instance, Clustering, Association Rule, k-Nearest Neighbor, Decision Tree, Neural Network, Support Vector Machine (SVM) and Reinforcement Learning.

This paper will target the financial market and propose a high performance trading agent that has the special ability to analyze data and to optimize the investor's utility (the feeling of satisfaction). Firstly, I will introduce k-Nearest Neighbor which is used as an analysis tool. It can predict a probability distribution of future stock prices, based on the past data. Secondly, three different kinds of method such as average, voting and Prospect utility are applied to optimize a decision making. We describe several techniques to adjust several best parameters (k in k-NN, α - β - λ in value function) needed in the decision making algorithms. Finally, in order to verify the performance of these proposals, we use actual market data like TOPIX. As a result, this research shows that these methods can lead to a good result (profit).