# Chapter 66
# Financial Asset Management Using Artificial Neural Networks

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## ABSTRACT

*Investors typically build portfolios for retirement. Investment portfolios are typically based on four asset classes that are commonly managed by large investment firms. The research presented in this article involves the development of an artificial neural network-based methodology that investors can use to support decisions related to determining how assets are allocated within an investment portfolio. The machine learning-based methodology was applied during a time period that included the stock market crash of 2008. Even though this time period was highly volatile, the methodology produced desirable results. Methodologies such as the one presented in this article should be considered by investors because they have produced promising results, especially within unstable markets.*

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## INTRODUCTION

A typical investment portfolio contains four main asset classes. The four main asset classes are U.S. stocks, bonds, international stocks, and hedge positions. Each of these asset classes has multiple stock indices. A successful investment portfolio is determined by the total return on investment over the course of the portfolio. The strategy of creating investment portfolios will vary depending on several factors. Likewise, the evaluation of the success of a portfolio can also vary by client. For example, a conservative client might be satisfied with a 5% return on investment, while an aggressive investor might not be satisfied with a 7% return on investment. The portfolio is an investment in the owner's future; therefore, the return over a long time period is a better determination of the portfolio's success. The time period that is often used to evaluate the performance of a portfolio is five years.

The diversification of a portfolio is an important part of deciding whether a portfolio is performing well. Although many strategies exist, in general, portfolios that are more diverse are considered more resilient to changes in the market and therefore, they are more desired. Another determination of the success of a portfolio is its variance. As was explained earlier, this will change depending on the owner of the portfolio. Investors range from being risk-averse to those who seek risk when it comes to their preferred investment strategy. If the variance in a portfolio is high, the risk is high, which means that there is an increased probability that the return on investment will be minimal or produces a loss. The amount of risk often depends on the age of the portfolio's owner. Given the risk associated with this type of portfolio, it is often difficult to satisfy the owner of an investment. For example, if the owner has a low-risk tolerance, the client might not be satisfied with the construction of a highly volatile portfolio even it is producing a positive return. Some investors are simply not satisfied with the drastic changes in the portfolio's performance over short periods of time even if the intent is to build a long-term positive gain. For these types of clients, a portfolio that shows a lower positive rate of return with a lower variance might be a better fit for the client's risk tolerance and age. Although most financial advisors would disagree with a risk-averse strategy and recommend a more risk-seeking strategy, ultimately, the final decision resides with the owner of the portfolio.

The traditional approach allocates assets for a diversified investment portfolio consists of a risk-tolerance questionnaire, a life stage assessment, a portfolio-objective-guidance-matrix, and finally, allocation judgments made by a financial advisor with the clients' approval. These questions help the client and advisor decide the best path for the client while keeping the risk at an acceptable level. It will help the advisor determine if the client is willing to accept a higher or lower risk/volatility of returns of their investment. The biggest limitation of the traditional approach is that stock indices are difficult to predict, due to volatile behavior and very complex interaction of multiple variables. The stock market is a complex system and has non-linear behavior making it exceedingly difficult to predict.

This research presented in this article has multiple objectives: first, to show that artificial neural networks (ANNs) are capable of predicting real-world occurrences, and secondly, to provide a decision support aid that financial advisors can consult when determining how assets are allowed when constructing a client's investment portfolio. Many financial firms currently do not use machine learning-based systems because they consider the market to be unpredictable due to its high volatility. The research presented in this article will demonstrate that investors should consider decision support systems built upon machine learning techniques because they are capable of producing high rates of returns even during times when the market is highly volatile.