# Applications and Challenges of AI Technology in Financial Portfolio Management

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**Abstract.** With the rapid development of artificial intelligence technology, financial portfolio management has entered a new era characterized by data-driven and intelligent decision-making. Based on the customer-centered service philosophy, managers propose intelligent investment strategies that better meet market demand. Based on the dynamic development of AI technology, we build a theoretical analysis framework for intelligent portfolio management according to the internal logic of the financial market, which can explain the intelligent development mechanism consisting of the investment decision mechanism and risk control cycle mechanism of machine learning and quantitative analysis. Furthermore, we explore opportunities to move towards high-quality development goals from the perspective of practical changes and technological applications in financial portfolio management. The role of AI technology in financial portfolio management is to provide investors with investment portfolios that meet their personalized needs. Researchers are committed to continuously improving the quality of investment strategies and enhancing satisfaction. Therefore, it is necessary to strengthen portfolio control based on internal quality data flow, establish an interaction and risk assessment mechanism between investors' preferences and market performance quality perception, and establish a performance and market environment evaluation system to achieve qualitative evaluation and market performance evaluation, to realize the high-quality development of financial portfolio management, promote the stability and prosperity of the financial market, and truly meet the diversifying needs of investors.

## 1 Introduction

Financial portfolio management is one of the responsibilities of asset managers and an integral part of financial markets. It includes active management and passive management, with an emphasis on fund managers and index tracking. To optimize the investment portfolio, asset managers entrust financial engineers to develop quantitative strategies. Since the 20th century, quantitative analysis has become the key to financial portfolio management. Evaluation indicators are conducive to risk control. Unlike the traditional investment strategy, intelligent portfolio management emphasizes data-driven algorithm optimization and risk assessment. Therefore, we put forward the issue of AI technology in financial portfolio management, and machine learning algorithm is a new tool for investment decision-making [1].

Intelligent portfolio management comes from quantitative analysis with data as the core, and model construction involves statistical principles, which is also an essential content of financial engineering [2]. From the perspective of portfolio, intelligent portfolio management pursues the balance between risk and return. People combine machine learning with quantitative analysis to realize the modernization of investment decisions. However, these are theoretical aspects. Today, technicians have implemented a unique way based on intelligent investment decisions. Its comprehensive promotion has changed the traditional investment strategy and reflected the power of science and technology. Moreover, it will improve risk management and have a far-reaching impact on financial markets. Therefore, in discussing the application of AI technology in financial portfolio management, we must have a forward-looking vision and pattern. In the financial field, the proposition of intelligent investment strategy is put forward. In a word, AI technology is the condition and guarantee to realize the modernization of financial portfolio management. In practice, intelligent portfolio management has made some progress, but there are also shortcomings. At present, technicians have not found the best intelligent investment strategy and are working hard. Therefore, concerning technological progress and the requirements of financial market development, intelligent portfolio management needs improvement.

Based on the above analysis, this paper puts forward an intelligent portfolio management method based on AI in optimizing investment decisions. Through machine learning theory and quantitative analysis, this study solves the risk management problems in traditional portfolio management. The main research content is the generation of personalized investment strategies. It can effectively cope with the risks brought by market

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fluctuation, improve investment efficiency, and reduce investment costs.

## 2 Overview of the Basic Theory and Current Research of Financial Portfolio Management Platform

### 2.1 Business Model Building and Academic Background of Financial Portfolio Management

As an essential part of financial research, financial portfolio management is significant in promoting the migration and application of quantitative analysis concepts in financial investment. It is an important means to achieve risk control and profit maximization. This paper analyzes asset allocation and related investment strategies in financial investment. After analyzing machine learning, we proposed a quantitative analysis method for financial investment research. In addition, taking the construction of financial portfolio management as an example, this paper gives a possible integration approach between machine learning technology and the financial investment field, which provides new ideas and research paradigms for investment decision-making and risk management.

### 2.2 A Review of Research on Service Platforms for Financial Portfolio Management

Financial portfolio management generally refers to a discipline that takes asset allocation, risk control, and income maximization that is related to knowledge of financial markets as the research object. Financial portfolio management belongs to finance and investment, which has distinct characteristics of risk management and asset allocation. Compared with macroeconomics, it presents more complex attributes. In the research process, people can't realize deep exploration by quantifying and applying traditional economic models, which limits the types of research methods to some extent. With the advent of the era of big data and AI technology, academic circles pay much more attention to research methods for financial portfolio management. In recent years, scholars have begun to focus on combining innovation and interdisciplinary, and the construction and application of machine learning in financial investment is a typical representative. In addition, based on the complexity of the research objects and issues involved, it has become an urgent problem for academic circles to realize the effective integration of AI technology and financial investment. This study attempts to test the above theories with practical applications to provide a theoretical basis and practical reference for promoting the interface and innovation of internal and external elements in this field.

### 2.3 Systematic Analysis of Financial Portfolio Management

The data involved in the research of financial portfolio management include historical data and real-time data [3]. The former refers to the data collected and processed by researchers, such as historical market data and economic indicators; the latter refers to real-time data from exchanges and financial data service providers. Data sources reflect the great value of financial portfolio management data and add practical difficulties to the unification and large-scale use of subsequent data.

## 3 Design and Implementation of an Intelligent System Construction Platform for Financial Portfolio Management

### 3.1 Platform Architecture Design of Intelligent Investment Portfolio Management System

In AI technology construction, data preprocessing is the first step and the most critical step to building an intelligent portfolio management platform. It is often called "data cleaning". Data cleaning is the process of describing the structure and organization of data preprocessing [4]. It defines the types of data sources and transformations in data preprocessing and the relationships between them, which are usually represented in a data flow diagram. In this process, it is necessary to express the schema layer data of the upper knowledge system of data entities in a unified form, which requires the builder to have a specific abstract ability and control ability of the whole domain knowledge to restore the known semantic relationship between existing knowledge to the maximum extent. Take the famous financial market data as an example, and stock prices are the story's core. The story contains many information, such as opening price, closing price, trading volume, price-earnings ratio, etc., which is abstract. We convert this into a simple data-cleaning structure, as shown in Figure 1. According to this, the data structure of the financial market can be completely presented.

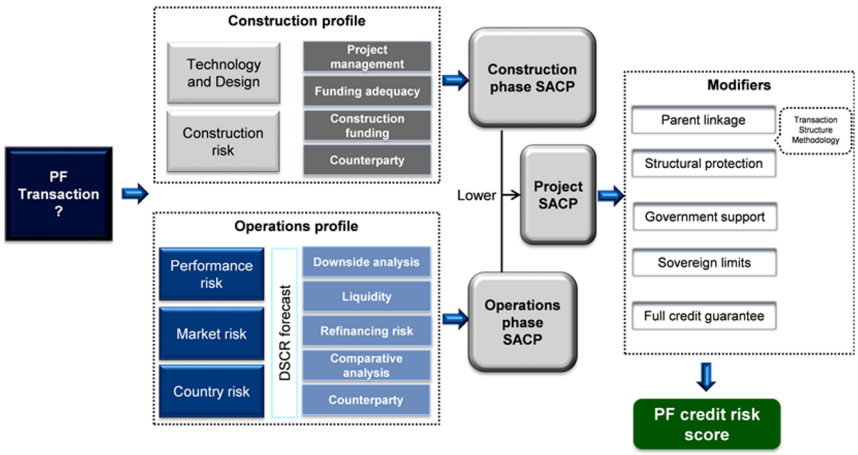


**Fig. 1.** The generation and optimization framework of financial portfolio management entities

### 3.2 Intelligent Strategies for Financial Portfolio Management

Common application scenarios of machine learning include data mining and pattern recognition. They are an interdisciplinary theory that combines the theories of statistics, computer science, and financial investment. The primary application logic presents financial market data and investor behavior in structured knowledge through algorithms to realize the systematization and structuring of financial market knowledge. From the perspective of application scale, we can divide machine learning into supervised learning and unsupervised learning. Supervised learning is a structured knowledge base containing a wide range of domain information, covering comprehensive knowledge of multiple disciplines and topics. The defect is that the model accuracy is low. Unsupervised learning focuses on a structured knowledge base in a specific field or topic. In comparison, unsupervised learning is generally developed by scientists who focus on extracting key information, thus resulting in more accurate models that can efficiently support in-depth investigations and decision-making [5].

## 4 Analysis of the Core Technologies of the Business Intelligence Auxiliary System Construction Platform

### 4.1 Entity Generation and Optimization Framework

For natural language processing (NLP), the first step is to determine the source of text data in the financial field. The survey found that text data resources in the economic field most exist in the financial news, research reports, and policy documents. Therefore, we study how to get the relevant information from these texts. In addition, based on the NLP framework, we construct an information extraction model. Obtaining the frame diagram includes the following modules: the first is the text preprocessing module, whose function is to clean and segment the text. The second is the entity recognition module, which mainly processes all texts and extracts the entities that need recognition. The third is the relationship extraction module, whose function is to extract the relationship between entities. The fourth is the event extraction module, which mainly extracts the financial events in the text. The workflow is as follows: the engine obtains text data and passes it to the preprocessing module, which accepts the data and passes it to the entity recognition module. Next, the entity identification module identifies entities from the text and passes it to the relationship extraction module, which identifies the relationships between entities from the text and finally passes it to the event extraction module, which extracts financial events in the text and provides the processed information.

### 4.2 Financial Portfolio Management – Resource Analysis and Custom Tools Development Technology

In the process of financial portfolio management, the first step is to determine the source of data [6]. The study found that the majority of financial data resources are held by large exchanges and financial data service providers. Therefore, the study obtains the corresponding data from these sources. Researchers have constructed an automatic data acquisition model based on the data mining framework. The frame diagram includes the following modules: The first is a demand planning module whose primary function is to accept the collected data. The second is the data acquisition module, whose primary function is to process all the responses and extract the required data; the third is the data download module, whose function is to download the captured data; and the fourth is the data processing module, whose primary function is to process the data and process the corresponding requests. The main workflow is as follows: The Engine receives requests sent by the Collection Module and forwards them to the Scheduler, which accepts requests and forwards them to the Downloader. The Download Module downloads and retrieves data from the Internet.

The data is filtered and returned to the engine. Finally, they are forwarded to the Collection Module, where the necessary data is extracted and transferred to the data processing module. After processing, the data is made available.

### 4.3 Business Functions of Simple Financial Portfolio Management

When conducting financial portfolio management, we usually start with two relationships: one is asset correlation, and the other is market trend [7]. Asset correlation can be directly extracted from the original data, while the market trend requests complex calculations of the existing data, which can reveal the deeper relationship between assets. The construction process includes building a single-layer map at the asset level, the market level, the investor level, and a multi-level map for the financial investment. In addition, we judge the correctness and evaluate the quality of the domain entities added to the graph to ensure that the constructed graph has high accuracy. Unlike single-level graphs, multi-level graphs are more complex, can store more entities, and have more complex entity relationships. Therefore, the graph neural network model is used for verification. This model is a graph neural network model with shared variables. The parameter scale is small and has more application advantages than other models. In the application, the model can combine entities and relationships in the diagram to complete the representation of entities and relationships. In addition, the model can evaluate entities under the influence of functions and select the diagram with the highest evaluation. Multi-link prediction can improve the accuracy and verify whether the graph you create is accurate.

## 5 Application Examples of Financial Portfolio Management Platform

For financial investment, investors need to analyze market dynamics, asset characteristics, and investment strategies to prepare for investment in advance. Asset allocation is an essential part of methods for investors to form investment decisions, and it is also the basis for investors to learn financial market knowledge and form investment concepts.

This study uses regression analysis, value at risk (VaR) calculation, and stress testing. Based on asset allocation, we comparatively analysis of asset classes, market environments, investment strategies, etc. We found that various asset classes have similarities and correlations; market environments are related, and the performance of some assets will be significantly different under different market environments. Analysis of market data and investment strategy development was conducted through regression analysis. We selected the portfolios of many markets as the control group, conducted stress tests and analysis on them, and obtained the risk assessment results. In addition, the existing problems were analyzed. Regarding the development of portfolio management for investors, this paper proposes the following strategies: Focus on the study of asset allocation theory; Focus on the development of risk management skills; Cultivate intuitive sense in combination with financial data platforms; Pay attention to market trends. Based on the relevant financial market information and the knowledge learned by investors, the stocks, bonds, and derivatives are selected for investment strategy design in application.

Finally, we make a conclusion and outlook on the financial market for investors, asset managers, risk control, and strengthening portfolio management.

## 6 Conclusion and Prospect

We can systematically analyze the research hotspots and development trends of investment strategies in financial markets with AI technology. It not only makes the research more comprehensive but also provides guiding suggestions for the research, helping researchers examine the follow-up research direction and the possibility of innovation. Therefore, it is necessary to consider how AI can be effectively integrated into financial portfolio management research to demonstrate the potential value of this technology in new fields and promote its widespread application and development.

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