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Implementation of Artificial Intelligence in Investment Decision-making in the Chinese A-share Market

QIAN, Kun [1*] FAN, Chao [2] LI, Zihan [3] ZHOU, Huiming [3] DING, Weike [4]

[1] EFREI, France
[2] Trine University, USA
[3] Northeastern University, USA
[4] University of Illinois at Urbana-Champaign, USA

**** QIAN, Kun is the corresponding author, E-mail: kunqian6@gmail.com***

Abstract: Financial services are crucial in people's lives, and the development of Artificial Intelligence (AI) technology has brought about new forms of financial services with great potential and prospects. Particularly in risk control and investment decision-making, AI technology not only improves efficiency and saves costs but also mitigates risks and uncertainties caused by subjective factors. This article first introduces several typical securities investment theories in the market, comparing them from aspects such as analysis methods and trading strategies, and analyzes the securities market. Then, the article introduces the popular machine learning technologies in AI and their applications, especially in the investment field. Utilizing mature machine learning methods, the article conducts securities investment analysis based on the trading data and key financial information of listed companies, establishes models for experimentation, and discusses the results. The results indicate that applying AI technology to predict and analyze stock markets is scientifically feasible. Finally, the article summarizes the entire content, proposes suggestions adapted to local investment based on the current situation of the A-share market, and looks forward to the future.

Keywords: Artificial Intelligence (AI), Investment Decision-making, Financial Services, A-share Market

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1 INTRODUCTION

In recent years, the surge in artificial intelligence (AI) technology has permeated various sectors, promising transformative solutions across diverse applications. [1-2] This widespread adoption has fostered the perception of AI as an omnipotent tool capable of tackling any challenge. However, amidst this optimism, caution is warranted. Despite rapid advancements, the notion of AI entirely supplanting human roles in decision-making, particularly in investments, remains contentious.

To delve into this discourse, we turn our attention to the AI Powered Equity ETF (AIEQ), pioneered by Equbot LLC in 2017. [3-4] AIEQ leverages cutting-edge technologies like natural language processing and machine learning to guide stock selection and trading decisions. Unlike human-driven assessments, AIEQ's strategies rely solely on AI-driven analyses and predictions, operating without human intervention.

Despite its technological sophistication and an extensive history spanning over five years, [5-8] AIEQ's performance in the market has been less than stellar. While it diversifies across sectors such as semiconductors and retail, it struggles to outperform conventional benchmarks.

Investment outcomes are multifaceted, shaped by macroeconomic trends, interest rates, corporate performance, and investor behavior, among other factors. AI, despite its computational prowess, faces challenges in simulating human psychological nuances critical for sustained success in trading. Hence, while AI holds promise in enhancing investment strategies, its current limitations underscore the need for further refinement and evaluation.

2 RELATED WORK

In 1956, during a symposium at Dartmouth College, John McCarthy first proposed the concept of AI, suggesting that machines could simulate human learning activities and other features of human intelligence. In 1966, Joseph Weissenbaum, a German-American computer scientist at [9] MIT, developed the first chatbot in human history. In 1997, IBM's artificial intelligence chess computer "Deep Blue" beat the then world chess champion Garry Kasparov, AI development began to move into a fast lane. Since 2010, massive data and new computing power have promoted the diversified development and application of AI, and pushed AI to human life -> brought AI into everyday life. At present, AI core technologies such as big data, computer vision, speech recognition, natural language processing, and machine learning have been widely used. Big data refers to

the acquisition of valuable information from a huge amount of structured, semi-structured and unstructured data, which is the basic condition for the development of AI. Computer vision refers to the ability of a computer to observe and recognize images like a human. Speech recognition refers to the ability for computers to recognize and understand speech signals; Natural language processing (NLP) [10]is the ability of computers to communicate with humans in the form of natural language. Machine learning refers to the ability of computers to continuously learn similar to humans, and is the most core technology of AI.

With the increasingly mature theory and technology of artificial intelligence and the continuous expansion of application scenarios, the application of artificial intelligence has become the focus of competition for the development of artificial intelligence in countries around the world. Although China's entry into the field of Al was later than that of Western developed countries and has developed rich application scenarios in finance, medical care, manufacturing, education, transportation, logistics, retail and other industries. In the financial sector, artificial intelligence has been deeply applied in risk control, investment and financing decision-making, and service upgrading, reshaping the value chain of the financial industry, and playing an important role in regulating the compliance operation of the financial market and improving the effectiveness of the market. For example, AI can help investors to process huge amounts of information at [11-13]A faster speed, thus weakening the information asymmetry of the A-share market, reducing the irrational behavior of investors, and to a certain extent, promoting the efficient market hypothesis in the A-share market.

2.1 Artificial intelligence and financial markets

The ability of AI to empower the financial industry will enhance its risk management capabilities, promote efficiency in the financial industry, and create a range of new products and services to reshape the value chain of the financial industry. In investment management, AI will provide intelligent analysis and decision support capabilities for core and supporting businesses in investment management, improve the automation level of business, and create a new model of investment management. We listed some application scenarios of AI in investment management to illustrate the current situation and future development trend of AI in investment management.

(1) Stock market prediction: [14] In stock price prediction, AI can expand the range of data that can be analyzed to improve the accuracy of prediction, achieve a high degree of automation of prediction models, and reduce the cost of stock research. In terms of sentiment analysis, AI can improve the win rate of stock price prediction by monitoring investor sentiment from public opinion data, which can be combined with methods such as technical analysis. In market trend forecasting, text analysis can be used to analyze a certain type of specific text, such as policy documents, etc., to achieve the prediction of the policy or development trend of a certain market sector, so as to achieve the purpose of predicting the market trend.

(2) Financial risk identification: At the early stage of the financial risk of listed companies, we can explain the authenticity of the financial data disclosed by the company to a certain extent by monitoring the business behavior of the company. In the process of identifying corporate financial risks or corporate financial fraud, AI will conduct a comprehensive and objective analysis of the business data, financial data and other data of the enterprise, and identify potential financial data fraud problems by evaluating the quality of corporate financial data.

(3) Process automation: Generative AI in investment management will greatly improve the automation level of basic work and improve the work efficiency of practitioners. [13-15] To be specific, document arrangement can help realize the automatic arrangement and summary of meeting minutes, enterprise reports and research reports; Applications such as code generation reduce the barrier to access to specific knowledge and skills, widening the circle of competence of researchers; Knowledge management will transform the way practitioners learn and work, making it simple and efficient to master the cross-professional and cross-domain knowledge system.

(4) ESG investment: AI can enrich the data sources of ESG rating, automate the data collection process and risk monitoring, and realize the transformation of rating models from static to dynamic.

The widespread use of AI will have a number of effects on the stock market [16]:

The traditional stock market is undergoing profound transformation due to the widespread application of AI. Combined with Gartner's AI technology maturity curve, we believe there will be a series of AI applications in equity-related industries over the next five years. The benefits brought by AI applications will first be reflected in the realization of traditional business cost reduction and efficiency improvement. However, the in-depth application of AI in the core investment link still needs the development of technology and the improvement of relevant laws and regulations.

The wide application of AI in the stock market will stimulate the investment willingness of market participants by weakening the asymmetry of information and reducing market volatility, increase liquidity, and thus improve the effectiveness of the market. However, the application of AI is a double-edged sword. While AI brings huge development opportunities to the stock market, it may produce a series of risk problems such as technical risks and legal compliance risks.

2.2 The application of artificial intelligence in the stock market

Intelligent investment decision: Artificial intelligence can provide more accurate and faster investment decision support through big data analysis, machine learning and other technologies. By analyzing large amounts of historical data and market trends, AI can predict the movement of stock prices and help investors develop more informed investment strategies. At the same time, AI can also provide personalized investment advice based on investors' risk tolerance and investment goals to achieve better investment returns.

Intelligent trading: [17-19] The application of artificial intelligence in stock market trading is also increasingly widespread. Smart trading is an automated trading strategy based on machine learning that automatically makes trading decisions and executes trades based on market data and trends. Intelligent trading can reduce human errors and emotional interference, improve the efficiency and accuracy of trading. However, smart trading also carries certain risks, as errors in machine learning models and abrupt changes in the market can lead to unexpected losses.

Intelligent Risk Management: Risk management is a crucial part of stock market investing. AI can provide more accurate and faster risk assessment and management through technologies such as big data analytics and machine learning. By analyzing historical data and market trends, AI can predict the risk level of stock prices, providing investors with more timely risk warnings and countermeasures. At the same time, AI can also provide personalized risk management schemes according to investors' risk tolerance and investment goals to achieve better risk control.

2.3 The advantage of AI in the stock market

Compared with traditional stock price prediction methods, AI has some advantages in stock price prediction.

First, AI analyzes a wider range of data and can correlate data from different [20] types and sources. For example, fundamental analysis attempts to predict changes in stock prices by studying factors such as market trends, industry sentiment, and company operating and financial metrics. Technical analysis does not focus on the internal driving factors of stock price, but focuses on historical data such as stock price and trading volume, and tries to find the change law of stock price. However, AI algorithms such as machine learning can not only incorporate the types of data studied by the above two analysis methods, but also study more complex unstructured data, such as news, social media comments, etc. Because AI algorithms such as machine learning can analyze massive amounts of data, AI can often mine data trends that humans ignore, so as to achieve more accurate predictions.

Second, AI can achieve a high degree of automation of prediction models, greatly improving the speed of prediction. Traditional forecasting methods require researchers to actively acquire, process and screen data, and then select a suitable forecasting model, resulting in a long research period and low model applicability. However, with the development of AI, AI can not only provide researchers with more predictive model choices, but also achieve a high degree of automation of full-stack investment processes such as data acquisition and processing, data analysis, model selection, and algorithm trading, so as to analyze market trends and stock price changes in real time, make better and more timely investment decisions, and improve the win rate [21-22].

Third, AI can lower the threshold of stock research and save research costs. AI has dramatically reduced the cost of stock research by automating much of the research traditionally done by human analysts. Moreover, with the improvement of the human-computer interaction ability of AI, investors can easily communicate with AI in natural language, build investment strategies that meet personal investment goals and risk preferences, and AI can show the model prediction process to investors in real time and dynamically.

Although the advantages of AI in stock price prediction are prominent, its disadvantages cannot be ignored. First, although AI provides an effective analytical method for predicting stock prices, it does not ensure that all factors are taken into account in a complex stock market, especially unexpected events that will greatly affect stock prices. Second, there is a risk of over-reliance on [23-25] AI predictions. In the process of using AI models, investors do less work with human participation, which is easy to produce excessive dependence on AI models. Third, AI predictive models still require continuous human monitoring and intervention. Most AI is a black box model with a low degree of interpretation of the predictive principles. Therefore, people must continuously monitor the AI prediction process and intervene in the AI model when necessary to ensure that errors or defects in the model are quickly found and repaired to improve the reliability of the model.

3 METHODOLOGY

In the rise and fall prediction test, this paper chooses Gree Electric Appliances (stock code 000651) as the test object. [26] Gree Electric Appliances as a blue-chip stock, its quarterly report issued comprehensive content and high credibility. Therefore, this experiment starts from the perspective of fundamental indicators, based on the main financial data reported by Gree Electric Appliances. In order to fully consider the market development and other factors, we selected all the quarterly reports of Gree Electric Appliances in the past 11 years as the research object, and divided them into two parts: training data and test data. We use logistic regression method to learn and analyze these data. The training data is used to train the model, while the test data is used to evaluate the performance of the model.

The main financial data comes from NetEase Finance.

3.1 Data preparation and processing

After obtaining the original data, it is usually necessary to carry out data cleaning, data standardization and other steps before the obtained data can be used. So the next step is data processing.

(1) Data cleaning

Data cleaning is the process of re-examining and verifying the data, the purpose is to deal with the missing value, abnormal value and so on. [27-29] In addition to the 2 items excluded in the above section due to multiple omissions in the report, it is also necessary to fill in the data of the missing items in the report of individual quarters, such as the weighted net asset income and net profit (after deducting non-operating profit and loss).

The standardization of data is to solve the problem of excessive difference in value and volume. For example, the total assets of an enterprise can reach hundreds of millions, while the weighted return on equity is measured as a percentage, with a wide difference, so it is necessary to scale the data proportionally to make it fall into a small specific range. Commonly used methods are min-max standardization, z-score standardization and so on. min-max standardization, also known as deviation standardization, is a linear transformation of the original data, so that the result falls into the interval [0,1], and the conversion function is:

$$x = \frac{x - x_{\min}}{x_{\max} - x_{\min}} \quad (1)$$

Standardization, also known as standard deviation calibration, is a common method of data standardization. This method is based on z-score (standard deviation) for data standardization. [30]The mean (mean) and standard deviation of the original data, that is, the mean is 0 and the standard deviation is 1, and the processed data after feature scaling conforms to the standard normal distribution. The method adopted by x-μ in this paper is that the standard deviation of the standard data eliminates the influence of dimension. The conversion function is:

$$x = \frac{x - \mu}{\sigma} \quad (2)$$

3.2 Algorithm and strategy

Predicting the rise and fall of stocks can be regarded as a binary problem. If it goes up, then y is 1; If it goes down, then y is 0. In classification problems, logistic regression is a very classic algorithm, and in the most populardeep learning problems, logistic regression or Softmax class algorithms are often used in the final fully connected layer. Similarly, logistic regression can also be regarded as a shallow network structure of deep learning, which has a certain scalability, so it is decided to adopt this algorithm.

$$h_\theta(x) = \frac{1}{1 + e^{-\theta^T x}} \quad (3)$$

Suppose that the function represents probability, i.e.:

$$h_\theta(x) = P(y = 1 | x, \theta) \quad (4)$$

The assumption function represents the probability of a stock rising, and the threshold of the probability of a stock rising is set to 50% by default. That is, if the probability of a stock rising is greater than or equal to 50%, the stock will rise; if it is less than 50%, the stock will fall.

3.3 Experimental design

The empirical process was implemented using 0ctave tool. The general idea is to first randomly allocate the processed data, proportionally allocate 70% of the data as training data to the training set, and 30% of the data as test data to the test set. Then, the training is conducted through the data of the training set, the results are evaluated and recorded, and the obtained model parameters are sent back to the test group for testing, and the test results are evaluated and recorded. This process is repeated ten times, each time re-randomly allocating the data, and finally the group with the best performance in the test results is selected as the optimal model and recorded.

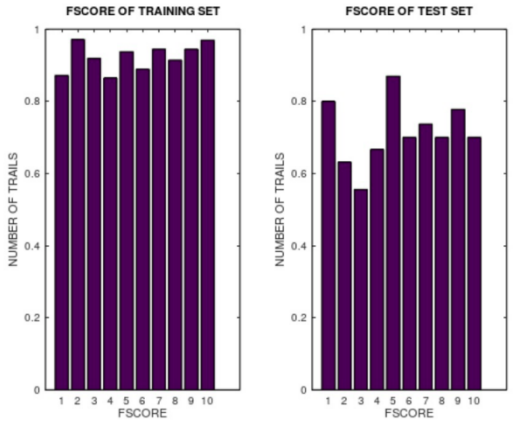

Figure 1. Comparison of F-score performance between training set and test set

3.4 Result

Firstly, the performance of the training set was observed. From the evaluation results of 10 tests, it can be found that the performance of the training set was very good, and the recall rate, accuracy and F-score value were all above 0.8, and even the accuracy reached 1 twice in test 2 and test 10.

Then observe the performance of the test set, the average recall rate is about 0.62, the average accuracy is about 0.85, both have good performance. The mean value of F score is about 0.71, except for 0.55 in experiment 3, the rest are above 0.6. The best performance in the test set is Trial 5, which has an F score of about 0.86 and can be

selected as the optimal model. The model obtained in this experiment not only has excellent performance, but also shows good generalization ability, which can be used as an auxiliary decision-making tool when considering investment in Gree electric appliances.

5 CONCLUSION

In conclusion, the integration of Artificial Intelligence (AI) technology into the financial sector holds immense promise, particularly in areas like risk management and investment decision-making. This study explored various securities investment theories and evaluated the application of AI in the investment field. By leveraging machine learning techniques, we conducted comprehensive analyses of stock market data, focusing on the performance of Gree Electric Appliances (stock code 000651) as a case study. Our findings suggest that while AI shows potential in predicting stock market trends and optimizing investment strategies, there are challenges that need to be addressed for its widespread adoption. Despite the encouraging results achieved in training models, the performance of AI algorithms in real-world scenarios, as evidenced by the AIEQ example, underscores the importance of human oversight and intervention in investment decisions. Further research and development efforts are necessary to refine AI models and enhance their applicability in investment management.

In summary, while AI technology offers valuable insights and automation capabilities for investment decision-making, its effectiveness is contingent upon careful consideration of market dynamics and human intervention. Moving forward, a balanced approach that combines the strengths of AI with human expertise will likely yield the most optimal investment outcomes. Moreover, ongoing advancements in AI, coupled with regulatory frameworks that ensure transparency and accountability, will pave the way for a more efficient and resilient financial ecosystem. As we navigate the evolving landscape of AI-driven finance, continuous evaluation and refinement of AI models will be essential to harness its full potential while mitigating associated risks.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author Contributions

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About the Authors

QIAN, Kun

Business Intelligence, EFREI,Villejuif, France,FRA

FAN, Chao

Information Science,Trine University,Phoenix, AZ, USA

LI, Zihan

Computer Science,Northeastern University,San Jose, CA, USA

ZHOU, Huiming

Computer Science, Northeastern University, CA, USA

DING, Weike

Electrical and Computer Engineering,University of Illinois at Urbana-Champaign,Champaign, Illinois,USA

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