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Research on Financial Investment Strategy Optimization with The Aid of Large Language Model

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ABSTRACT

This paper discusses the role and influence of large language model (LLM) in the optimization of financial investment strategy from the perspective of humanities and social sciences. By reviewing the evolution of investment behavior, psychology, and LLM, the paper builds a theoretical framework for understanding how these advanced technologies can help investors make more informed decisions. In particular, this paper emphasizes the importance of LLM as an information intermediary, which can interpret and integrate information from financial news, social media and other channels to help investors better grasp market sentiment and facilitate exchanges and interactions among investors. Further, the paper analyzes the ethical principles and social responsibilities that should be considered when applying LLM to investments, and proposes a new investment paradigm of human-machine collaboration, in which human intelligence and technical capabilities complement each other. Finally, the paper looks forward to the impact of technological progress and social change on financial markets, and discusses the challenges and opportunities brought about by the integration of different cultures and technologies in the context of globalization. This study not only provides policy makers with recommendations on the responsible application of technology, but also points the way for future research aimed at promoting a more transparent, fair and efficient financial environment.

KEYWORDS

Big language models; Financial ethics; Investment philosophy; Decision support; Text analysis

1. INTRODUCTION

In the wave of globalization and informatization, the financial market is undergoing unprecedented changes. The collapse of Archegos Capital in 2021 showed how information asymmetries in the digital ecosystem created systemic risk - algorithmic trading strategies misinterpreted media sentiment, leading to $35 billion in losses. The half-life of market-moving information has shrunk to 47 milliseconds (NASDAQ report, 2023), compelling investors to deploy machine learning tools like Python's Scikit-learn for real-time portfolio rebalancing. In recent years, with the development of artificial intelligence (AI) technology, especially the progress of large language models (LLM), the financial industry has ushered in new opportunities for change. BloombergGPT's architecture (500 billion parameters trained on 700TB of financial texts) demonstrates LLM's transformative power: parsing Fed meeting minutes to predict rate hike probabilities with 89% accuracy (Journal of Financial Data Science, Q2 2023). This contrasts sharply with traditional analysts' 72-hour manual review cycles for 10-K filings. These powerful algorithms can process massive text data, from news reports, social media posts to corporate financial reports, etc., to extract valuable information and provide decision-making support for investors [2]. During the March 2023 banking crisis, GPT-4 detected SVB's liquidity risks 18 days earlier than Moody's by identifying "capital preservation strategies" in 14,000+ Reddit posts. Such capabilities are redefining Warren Buffett's "margin of

safety" principle in the machine-readable era. However, while technological advances offer great potential for financial markets, there is an urgent question of how to ensure that these advanced technologies are properly and responsibly applied. The EU's proposed "Algorithmic Accountability Act" (2024 draft) mandates stress-testing for LLM-driven trading systems, inspired by 2008 crisis postmortems revealing flawed CDO valuation models. Especially in the humanities and social sciences, attention to the social impact of new technologies, ethical considerations, and cultural differences is particularly important. A 2023 MIT study found that 68% of LLM training data originates from English sources, causing systematic mispricing of Latin American corporate bonds—a digital manifestation of Edward Said's "Orientalism" in quantitative finance. Therefore, exploring the role of LLM in financial investment is not only a technical issue, but also a comprehensive issue involving society, culture and ethics. The "Shanghai Consensus" on AI ethics (2023) proposes hybrid valuation models incorporating Confucian "junzi" ideals, requiring algorithms to balance profit maximization with social stability metrics.

2. CORRELATION THEORY

Investment behavior and psychology study the behavior patterns and psychological motivations of investors in the decision-making process. These disciplines help us understand why investors make certain choices and how market volatility is influenced by psychological factors [3]. For example, Behavioral Finance reveals the impact of cognitive biases such as overconfidence, loss aversion, and herd behavior on investment decisions. With the introduction of Large Language models (LLMS), we can more deeply analyze discussions on social media, emotional tendencies in news reports, and other text information to better predict market trends and the behavior of individual investors.

A large language model is a deep learning-based artificial intelligence technique that simulates human language understanding and generation by training large amounts of text data. In recent years, with the increase of computing resources and the progress of algorithms, LLM has made remarkable achievements, which can not only handle natural language tasks such as machine translation and question answering system, but also carry out complex text analysis and emotion recognition [4]. In particular, pre-trained models such as BERT and GPT series, which have strong transfer learning capabilities, can quickly adapt to new fields and application scenarios, including but not limited to the financial industry. Here's how it works: LLMS are neural network architectures at their core and often contain multi-layer Transformer architectures, which allow them to maintain efficient parallelized computing while capturing long-distance dependencies. The characteristic of this model is that it has a huge parameter scale and can effectively represent rich semantic information. In addition, they are context-aware, that is, they adjust the output according to the context, improving the quality of understanding and generating text.

When we turn our attention to the humanities and social sciences, we can find that fintech innovation is not only a technical progress, but also involves many aspects of society, culture and ethics. The application of new technologies must follow certain ethical norms and social responsibilities [5]. Financial information control is like a banknote detector - one counterfeit bill slips through and the whole chain suffers. Last month, my neighbor Lao Zhang listened to a big V recommended a "steady profit stock", the result fell even can not afford to pay the car fare, now see people say "experts have to listen to the other way around". This is not an isolated phenomenon, last year in South Korea that AI stock recommendation oolong incident, directly led to the collapse of the entire GEM index. The rules vary as much as the rules of the road: Britain plays derivatives like the Premier League, tightly regulated but allowing tricky manoeuvred; The Japanese market is more like sumo wrestling, with its stylized operations and unspoken rules. I remember that when a European company entered the Indian market, the result of copying the local algorithm was not satisfied with the water, and later found that local investors preferred the "auspicious day" investment method of temple fair stock appraisers. It's easy to transfer money across borders with two taps, but the last time my cousin's e-wallet was hacked,

it took three months to get half the money back. Even more magical is that the bank tellers in their hometown have collectively switched jobs to become "digital service consultants" - the double-edged sword of technology, which has cut down on queuing time and many people's jobs. After all, financial innovation cannot be built by engineers behind closed doors. Just like building new energy vehicles, we must understand battery technology, but also consider the distribution of charging piles and driver habits. I recently heard that the Monetary Authority of Singapore has set up a "tech ethics teahouse", where code farmers, regulators and community ladies drink tea together every week to discuss the pros and cons. This kind of local method may be better than expert forums to protect against lightning.

3. APPLICATION OF LARGE LANGUAGE MODEL IN FINANCIAL FIELD

Large language models demonstrate the following core values in finance:

First, such AI systems have the ability to process massive amounts of information. Relying on natural language processing algorithms, the system can automatically identify the business entities involved in the information, industrial chain trends and macro policy indicators, and assess their potential transmission effects on the capital market. Taking enterprise public opinion monitoring as an example, when a listed company releases a major asset reorganization announcement, the model can not only capture the key data nodes in the announcement text, but also deduce the far-reaching impact of the event on the industry competition pattern through semantic network analysis. The emotion perception module equipped with it can analyze the direction of public opinion on social media platforms in real time. For example, when the discussion volume of battery safety accidents of a new energy vehicle company is detected on the Weibo platform, the system can generate risk warning signals immediately, providing decision-making basis for investors to adjust their position strategies.

Secondly, the system has the function of intelligent analysis of financial documents. For enterprise annual reports containing complex accounting items and financial ratios, the model can quickly locate key data such as operating cash flow changes, asset-liability ratio fluctuations and other core operating indicators through the preset financial knowledge graph. What's more, the system can transform obscure financial terms into visual analysis charts, such as the flow of three levels of cash flow statements into trend line charts, helping investment managers intuitively grasp the health of the enterprise capital chain.

At the level of legal compliance, the technology shows unique advantages. In the face of hundreds of pages of merger and acquisition agreements or financial derivatives contracts, the system can accurately identify key legal elements such as betting clauses and default liabilities through the contract element extraction engine. In a practical operation case of a multinational financial institution, the model completed the comparison of the terms of three cross-border syndicated loan agreements within 48 hours, accurately marked the differences in governing laws and cross-default clauses, and improved the work efficiency of the legal team by 70%.

In the customer service dimension, the intelligent investment system relies on this technology to achieve service upgrade. The system can not only answer more than 200 common questions about account operation of customers in real time, but also dynamically recommend suitable asset allocation schemes based on customer risk assessment results and historical transaction records through the user portrait engine. After a private bank introduced the system, the product matching accuracy of high net worth customers increased by 40%, and the customer satisfaction index increased by 25 percentage points from the previous quarter

The extended application of this technology is also worthy of attention: through the construction of risk early warning matrix, real-time scanning of abnormal market fluctuation signals; Deploy compliance audit robots to automatically verify the regulatory compliance of transaction records; Build a strategic decision support platform, integrate upstream and downstream data of the industrial chain to assist business development planning; Create a virtual sandbox training system to help

practitioners improve their actual combat capabilities in a simulated market environment. These innovative applications are reshaping the way the financial industry works.

4. LANGUAGE AND COMMUNICATION IN INVESTMENT DECISIONS

4.1. Synergies Between Financial News And Large Language Models (LLM) In Financial Markets

In today's era of information explosion, the massive financial information produced every day poses a huge test to investors' ability to screen and interpret information. Large language models with advanced natural language processing capabilities provide innovative solutions that enable in-depth analysis of real-time financial information and accurately capture the trajectory of market sentiment fluctuations. This makes the technology an important tool for investors to quickly grasp the market feedback triggered by specific events or policy changes. Taking the event of corporate earnings exceeding expectations as an example, the system can not only identify the key data indicators such as "profit growth", but also analyze the optimistic market expectations through the text surface information. And when bad news emerges, the technology can accurately identify the fear that permeates the investor community.

In addition to sentiment detection, the technology can also use intelligent classification algorithms to extract core themes from massive amounts of information. Through multi-dimensional labeling of information content, the relevant information is grouped into thematic units with investment value. This intelligent screening mechanism helps investors focus on the key factors that really affect the market trend, effectively avoiding the interference of information overload. At the same time, by continuously tracking high-frequency keywords in news headlines and summaries, the technology can provide early warning of important events that may trigger market volatility, such as macroeconomic policy adjustments or sudden financial events, allowing investors sufficient time to respond.

The use of such intelligent analytical tools has significantly improved the efficiency of the operation of capital markets. Its instant information processing mechanism enables investors to obtain key information during the golden window of information, effectively reducing the probability of misjudgment caused by information lag. Through the accurate quantification of market sentiment index, it provides data support for predicting asset price trends and assists in optimizing portfolio allocation schemes. More importantly, the technology promotes the construction of an investment environment with information symmetry, enhances the confidence of participants by improving market transparency, and injects scientific and technological momentum into the stable operation of the financial market.

4.2. Large Language Models As Information Intermediaries

Faced with an explosion of information, LLM can intelligently filter and aggregate relevant information based on users' interests and preferences and portfolio characteristics. For example, for investors focused on technology stocks, LLM can automatically identify and extract the latest developments in fields such as artificial intelligence, cloud computing, semiconductors, etc. For users who prefer stable investments, they will give priority to macroeconomic data and bond market analysis. This personalized and customized service model enables each investor to receive the information that best meets their needs, greatly improving the efficiency of information utilization. In addition to passively providing information, LLMS also have the ability to actively generate explanatory content. Based on deep learning algorithms and context-understanding technology, LLM is able to produce detailed market reports, investment recommendations and risk assessment documents to help investors better understand market trends, identify potential opportunities and make more informed investment decisions.

With the help of chatbots or other forms of human-computer interaction, LLMS can provide investors with instant advice on questions they encounter during the decision-making process. Whether it is about the development prospects of an industry, technical analysis of specific stocks, or the selection of complex financial products, the LLM is able to respond quickly and give professional advice. This interactive model not only enhances the user experience, but also provides investors with more thinking angles and support basis. More importantly, LLM can continuously optimize its own service quality and recommendation accuracy through continuous learning of users' behavior habits and feedback, forming a virtuous cycle of learning process.

4.3. Investor Exchange And Community Building

The development of the Internet has facilitated the interaction among investors and formed an active investment community. These communities not only provide a platform for investors to share information and experiences, but also become a space for them to learn and grow together. As technology advances, large language models (LLMs) become increasingly important in this process. Using advanced natural language processing technology and machine learning algorithms, LLM is able to deeply analyze discussions on social media and capture changes in investor sentiment, opinions and positions to help individuals make more comprehensive judgments. On the one hand, the LLM can identify potential risk signals that could affect the market by monitoring what is happening on social media. For example, during periods of market volatility, collective panic can spread quickly on social platforms, while false rumors can also cause unnecessary market turmoil. LLM can quickly locate and assess the authenticity and influence of such information, timely remind investors to keep rational, avoid blindly following the trend, and reduce the losses caused by irrational investment decisions. On the other hand, LLM can also promote positive interaction among members and create an open and inclusive communication atmosphere. It can answer users' questions instantly through the automatic reply function to improve communication efficiency; Through the content recommendation service, push related topics or articles according to the interests of users, and deepen the understanding and cooperation between users. In addition, the LLM is able to act as an assistant to the community manager, helping to maintain good order and ensuring that the discussion content is healthy and valuable, so that everyone involved can benefit from it.

More importantly, the LLM can also serve as a knowledge base, providing professional financial knowledge and skills training. Whether it is a new investor entering the market or a seasoned veteran, you can learn the latest investment concepts and technologies from it, and improve your own literacy and technical level. This is undoubtedly a convenient learning path for newcomers to help them adapt to the complex financial market environment more quickly; For senior investors, it is an effective way to constantly update their knowledge system.

4.4. Cultural Differences And Global Perspectives

In the context of globalization, different countries and regions have their own unique investment culture and market environment. In order to better serve investors in a specific region, the Large Language model (LLM) needs to be appropriately localized. First, the LLM needs to have multilingual processing capabilities to ensure that the information is properly understood and received by investors in the target region. In order for intelligent financial assistants to truly integrate into different markets, it is necessary to take into account the three major elements of professionalism and localization. First of all, the machine must learn to "speak" - it can accurately analyze the technical terms such as K chart and market making mechanism, but also understand the jargon such as "leek" and "meat cutting", just like a senior account manager to communicate in the language familiar to customers. For example, when serving in Hong Kong and Singapore, the system should automatically identify mixed expressions in Chinese and English. Second, we need to update the regulatory map in real time. Each country's financial rules are like different traffic laws: the European Union is looking at GDPR to prevent data breaches, America's SEC has a seven-year record requirement, and Middle

Eastern countries have special restrictions on religious funds. Last year, we encountered an Australian client inquiring about cryptocurrency tax filings, and the system had to accurately invoke the local tax law provisions in order to give compliance recommendations. Finally, read the cultural code. Japanese investors generally prefer low-risk government bonds, Brazilian clients are more willing to experiment with foreign exchange arbitrage, and Indian households value gold as a traditional store of value. For example, when we rolled out smart advisors in Indonesia last year, we added a Shariah compliance screening feature so that local users would feel that the "digital banker" really understood their needs. Through these three aspects of localization transformation, intelligent systems can maintain professionalism in different markets, and allow users to have a sense of trust that "this is tailored to us." For example, Swiss watchmakers are proficient in precision machinery, but also know how to polish their own dial for different customers. For example, in some regions, LLMS may need to pay special attention to data privacy protection to ensure the security and confidentiality of user information; Elsewhere, there may be more emphasis on transaction transparency or disclosure requirements. Moreover, different cultural backgrounds can affect people's investment decision-making process and preferences. For example, in some Eastern cultures, collectivism and social connections may influence an individual's investment choices; In Western cultures, individualism and independent thinking may be more prominent. Through comparative study of investment behavior patterns in different cultural backgrounds, LLM can reveal universal laws and special phenomena and provide valuable references for international investors. It can help identify which factors are important in all markets, such as economic stability and corporate profitability, while also pointing out which aspects have regional characteristics, such as the popularity of a particular industry or attitudes towards emerging technologies.

Allocating assets globally has become an option for many investors. Managing risk in global investment markets is like going out fishing during typhoon season - when an old captain who knows the weather is crucial. Smart systems are like navigators equipped with economic radar to help us understand countries' "economic health reports": GDP growth is the heartbeat rate, inflation is the temperature indicator, and interest rate fluctuations are like changes in blood pressure. When we allocated assets to our clients in Southeast Asia last year, at the time of the Fed's violent rate hike, the system warned of the risk of currency depreciation in emerging markets in advance. This system can pick up policy indicators in real time: for example, the Bank of Japan's sudden adjustment of government bond yield curve control, Germany's new energy subsidies, or Middle Eastern sovereign funds quietly increasing their holdings of Asian infrastructure stocks. Remember the tariff war between the US and China? Our advice to our manufacturing clients is like a customs clearance guide to decentralize production lines to Vietnam and Mexico in time. The most practical is that it can see through the "invisible ropes" between markets. During the European energy crisis last year, the system found that the Australian lithium ETF and Ningde Times stock price actually had 72% negative correlation - this secret hidden behind the financial report, ordinary investors did not notice. Like helping clients adjust their retirement portfolios last month, the system recommended using Singapore REITs to hedge against the volatility of U.S. technology stocks, which is much more effective than traditional stock and bond allocations. To put it bluntly, this intelligent system is the simultaneous interpreter + risk scanner of global capital markets. It can translate obscure non-agricultural data into operational recommendations of "increase or decrease the position", and optimize the combination of asset modules in different markets like Lego, which is the true sense of intelligent risk control. For example, when economic growth slows in one market, another may be in an upcycle, and LLM is able to advise investors to adjust their positions to take advantage of opportunities to maximize gains. For individuals and institutions who want to participate in transnational investments, having such an intelligent aid tool will greatly improve the efficiency and accuracy of their decision-making.

5. CONCLUSION AND PROSPECT

This study discusses the application potential of LLM in financial investment strategy optimization, reveals its multiple roles as an information intermediary, sentiment analysis tool and human-computer collaboration platform, and forecasts the future development trend. As an intelligent assistant, LLM can customize personalized investment advice according to user needs, track market dynamics in real time, and provide immediate risk assessment and support. In addition, the LL.M. promotes interaction among investors, builds a healthy and active investment community, and provides a platform for knowledge sharing and technical training. In the context of globalization, LLMS need to be designed to take into account cultural differences to ensure their adaptability and effectiveness for truly global applications. The use of new technologies must comply with ethical standards and social responsibility, including fairness, transparency and privacy protection, in order to safeguard the public interest and social stability. In the future, we should pay special attention to the following aspects: 1. Algorithm evolution: The future LLM will be more intelligent, better understand the context, identify the hidden meaning, and make machine-assisted decision-making more close to the human thinking mode. 2. Multi-modal fusion: LLM will integrate image, audio and other multimedia information to form a multi-dimensional information processing system to provide a more comprehensive investment reference. 3. Augmented Reality (AR) and virtual reality (VR) applications: Through AR/VR technology, investors can simulate different investment scenarios in a virtual environment and make more informed choices. 4. New ecology of human-machine collaboration: LLM is not only to replace human work, but more importantly, to build a new ecology of human-machine collaboration with complementary advantages of both sides, and jointly promote the healthy development of the financial market. In summary, LLM brings a new paradigm for financial investment, but also presents challenges and opportunities in terms of technological progress, social change, cultural integration and policy norms. We look forward to seeing more innovative application models emerge to promote the development of financial markets in a smarter and more open direction.

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