

Application of Generative Artificial Intelligence in Financial Innovation and Risk Management

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Abstract

In the age of burgeoning technology, AI is playing an extremely indispensable role in finance. This paper focuses on the recent hot topic of two novel applications of generative AI, robo-advisors and emotionally-aware AI service, and the following risk prevention and control of them. And the thesis reviews the previous studies from 2022 to 2024 selected on AI core technology, machine learning, AIGC, robo-advisors and risk prevention. The review finds that during the growth of AI, though generative AI significantly improves the working efficiency, the methods to manipulate generative AI legally and avoid extra ethical and safety problems remain to be solved. Hence, the review proposes future research directions on AI explainable framework and regulatory prevention through human intervention to figure out the problems scientifically. Furthermore, this paper provides a holistic reference for both researchers and employees hoping to enhance and perfect generative AI, and address the security issues that are still not resolved at present.

Keywords

AIGC, robo-advisor, risk prevention

1. Introduction

Based on the big data, globally, almost 50% investors refer to generative AI when they are buying financial products, and more than 70% companies dispose financial business segment with the help of generative AI. Generative AI is a branch of AI that can output text, picture, audio and so on in a short time according to the user's need [1], which brings about production efficiency, new track creation and technological inclusion. The success and widespread of generative AI are credited to technological breakthroughs, algorithm support, updated data, an open source ecosystem and research and development sources. Generative AI has evolved into an extraordinarily sophisticated and mature field in recent years.

Artificial Intelligence Generated Content (AIGC) technology becomes the core technology of content production, and it is broadly applied in GPT-4, Stable Diffusion, Sora, Github Copilot and so on. In the field of finance, it can improve the university and enable people to enjoy personal service in investment and consultation. AIGC push generative AI from theory to practice, employing a human-machine collaboration operation mode and structured data output to enable generative AI to better address human needs. In finance, it can also automatically generate and review contracts, process efficiently and output display of data.

As generative AI continues to advance and innovate, it plays an increasingly significant role in finance. Generative AI has gradually become the business core in the financial industry, leading in services, operations, etc. The financial industry prioritizes efficiency and risk detection. In trading, there is an extreme requirement for speed. Even a difference of a few milliseconds can make a huge difference. Generative AI needs to leverage its decision-making by precisely reacting to users' needs in the shortest possible time. However, risk prevention is becoming increasingly significant. Detecting and preventing financial fraud [2], formulating current AI regulations and governance [3], mapping the ethical and legal risks of generative AI in the financial sector [4], and identifying the potential challenges and limitations [5] are the focuses of current research. Therefore, delving into the working principle of generative AI and preparing for potential risks proves necessary. Due to the excessively rapid advancement of AI, pressing methodology and practice time are urgently needed to guide AI.

This paper teases financial achievements with the contribution of generative AI in many aspects and supplements. Moreover, the paper mainly reviews the rising robo-advisors about their current situation and future expectations, and the following efficient operations and production innovations brought by generative AI, with the rising risk issues due to the rapid development of technology. Therefore, this paper also proposes risk prevention measures and regulatory measures for generative AI, aiming to summarize frontier defense methods for both regulators and investors in the era of developing the internet.

2. Overview of Generative AI in Finance

2.1 The Technical Core of Generative AI

The field of generative AI can be traced back to 2018 when the first AI model, ChatGPT-1, was created by OpenAI. It aroused heated discussion and concerns at that time. AI refers to a specific capability for machines of thinking, learning and make decisions like humans. Based on massive sample learning and data processing, the core operational logic of the GPT (Generative Pre-trained Transformer) series, GPT, has become a benchmark of generative AI. By 2026, the GPT series will have released the latest version GPT-5, symbolizing that the generative AI system has matured in technique. Compared to conventional AI, generative AI is a completely novel type of AI that can create entirely new content based on the Variational Auto-encoder (VAE) and Generative Adversarial Network (GAN) models [6]. Through the VAE algorithm, generative AI extracts information, decodes it, and then outputs something similar to the original data. Combined with GAN, another generative model that trains its generator and discriminator to compete and learn from each other, generative AI collects and identifies massive data based on the Large Language Model (LLM), thereby producing valuable and precise information. These emerging technologies enable generative AI to make breakthrough on comprehending knowledge and creating corresponding solutions to problems that never occurred before.

How generative AI masters these technologies is listed as follows. From two types of study, machine learning (ML) and deep learning (DL), generative AI is empowered by intelligence. Machine learning depends on human guidance, take images as an example, when feeding enough trading trend charts to AI, it can identify the trend of rise and fall, and recognize similar historical trends. Deep learning requires more computational load and data volume, and it relies more on AI itself. In deep learning, discriminative study, honored as a classification master, can distinguish and judge information, while a generative study can create diversified, reasonable suggestions in various fields. AIGC takes great effect in one of the most important segments of content creation, and takes the top priority in the output of generative AI. After sorting out the characteristics of certain items, AIGC generates totally new texts, images, videos, etc. by following the requirements and memory after learning. For computers, their memory is long-lasting, which helps them reserve and integrate multi-dimensional data across multiple timelines. And it can leverage AI maximized stored knowledge, this is friendly for humans to acquire knowledge.

AIGC has a huge power of content generation, code compilation, and complex reasoning. In terms of generating, there are many instruction types like text-to-text generation, text-to-image generation, text-to-video generation, and each one matches its own model. For instance, a typical type of text-to-text generative AI ChatGPT and DeepSeek rely on LLM, DouBao and Sora depend on a video generation model. The principle of large models is mainly divided into three parts: training, inputting, and generating, respectively

corresponding to summarizing language patterns, dividing the questions into tokens and predicting the answers word by word.

2.2 The Theoretical Logic of AIGC Empowering the Financial Industry

There is an even closer trend in the integration of generative AI and finance. So, many new financial applications have emerged in recent years, which brings vitality to the financial field. Generative AI is getting familiar with basic financial phenomena and the corresponding coping approaches through continuous machine learning, including advanced theories, background recognition, model implementation, transformers, core network framework structures, and so on. With the popularization of the Internet, more and more people prefer to refer to AI suggestions when they are trading or buying financial products. Undoubtedly, they can obtain comprehensive and complete information from AI and, to a large extent, get rid of emotional factors.

And it keeps AI closely related to current affairs and hot topics, which is beneficial for AI to obtain the latest information in case of information lag. It is undoubtedly friendly for institutions and individuals because of information equality and symmetry.

AIGC has an absolute advantage in information acquisition. AI can instantaneously scan and process a large amount of heterogeneous information, while identifying easily overlooked patterns and connections. Without human subjective thoughts, AIGC enhances objectivity and breaks down the information silos, boosting cross-disciplinary integration. Key functions include structuring unstructured data, integrating multilingual information seamlessly and understanding the implicit requirements. Vocabulary strategy prompts containing explicit frame tasks, export constraints and citation traceability awareness are effective and essential for leveraging AIGC. For the general public, it is universally beneficial because AI breaks the limitations of language and region.

Finance is the domain where AIGC excels. The financial industry is closely linked with mathematics, knowledge and decision-making, and a vast amount of structured data and unstructured data provide AIGC with an extremely awesome study environment. AIGC can break down statistic silos and integrate and understand data across different domains, which helps financial professionals generate financial, operational and customer profiling data. Afterwards, it can automatically organize into reports and provide investment and asset allocation recommendations based on the report. Then, it will check for corrections in a short time and identify the potential risk in the report. In addition, the inclusiveness of AIGC has brought increasing convenience to people and made it more practical.

3. The Cutting-edge Appliances of Generative AI in Finance

3.1 Intelligent Interaction and Marketing of Generative AI

Credited to large language models (LLMs) and databases, generative AI masters many practical financial applications. As proven by Buffett's 10-year experiment, passive investment always performs better than active investment. Passive investment vehicles track markets by holding portfolios that mirror representative indices, and the emerging investment pattern, the robo-advisor, is perfectly following this trend.

Contrary to the stereotype, the robo-advisor breaks through the limitations of the traditional model, injecting vitality into self-driven wealth management, which brings commendable personalized service and adaptability. The robo-advisor also supports multiple investment methods, including stocks, bonds, funds, exchange-traded funds (ETFs), real-world assets (RWAs), private equity, commodities, and indices, meeting different users' needs. For example, in terms of those under 20, between 25-40, and above 60, the robo-advisors recommends different configurations for diverse risk appetites and investment proportions. Generally, the older the investor is, the less risk they should assume. The robo-advisor captures users' risk appetites, follows investment theories, and, according to mathematical algorithms, precisely formulates a scheme for users [7]. The robo-advisor helps investors in various ways, such as determining the investment proportion, automatically and ideally allocating investors' assets, and calculating the limit of capital fluctuations, which is extremely friendly for novices and the confused. For example, when investors want to buy stocks of mature companies, pursuing stable returns, they can enter specific instructions in the agent and

wait for the result. The agent will automatically open the stock website and screen out the stocks that meet users' needs layer by layer, and then make a comprehensive and all-round decision after the investors have confirmed it's the one they are interested in. A wide range of investment options, flexible asset allocation, and professional and objective data provide the clients of a robo-advisor with more personalized choices, bringing more satisfaction.

Another apparent advantage of the robo-advisor is that it is open to the public and operates in real-time. The robo-advisor breaks with tradition by continuously collecting instant data, which helps to reduce the information gap. Traditional AI only refers to past events and trends, makes comparisons, and responds similarly. For events that have never occurred before, traditional AI has no way to respond.

However, the robo-advisor follows current news reports and constantly analyzes the globally changing situation. As it tracks open information, it can generate quick coping strategies to meet the challenges of emergencies. When the market changes significantly, the robo-advisor creates human-readable warnings and cautions with contextually appropriate explanatory content, which reminds investors in time so that they can prepare for the change ahead of schedule. According to Charles Schwab, a remarkable financial institution, the robo-advisor achieved a 28% retention rate and a 42% portfolio adjustment reduction, indicating that investors are willing to heed the advice and make correct decisions in the current situation. The result shows that through immediate adjustment, investors obtain significantly higher returns. First-hand information constantly protects investors from the mutated market. It also set aside enough time to deal with the sudden great changes.

Moreover, a robo-advisor has constant adaptability to studying. As the algorithm undergoes updates and iterations, the old algorithms will gradually be replaced.

Robo-advisor keeps pace with the times and optimizes computing power and models. So, facing personal finance management and robot consultation problems, robo-advisor transforms big data into personal value with the back of extraction of structured and unstructured data present to investors after integration [8].

Another cutting-edge application is the emotion-aware AI customer service that can be directly put into use. Based on users' questions and responses, generative AI can spontaneously detect users' emotions, then adjust the way of communication and solve the problem properly. It is applicable in a wide range of scenarios, like after-sales services, business handling, human relay work, and so on. The most valuable aspect lies in improving users satisfaction and convenience, due to the repeated confirmation of satisfaction level.

As emotion-aware AI customer service detects users' emotional fluctuations and explains and soothes emotions, while robo-advisors formulate rational investments for the clients, they address the emotional bias of financial decisions together. Additionally, the combination ensures a rational and logical decision, avoiding the extreme consequence caused by emotional overreaction. This can efficiently help customers to calm down in a short time, avoiding making extreme decisions by the higher-ups.

3.2 Efficient Operation and Product Development

The value of generative AI works in efficient operation embodied in cost reduction, efficiency lifting, and human endowment. As generative AI is highly skilled in operational content, analysis and decision making, it is highly suitable for improving efficiency throughout the entire process. It can play a significant role in intelligent customer service and AI&RPA (Robotic Process Automation) process automation, enhancing human-machine collaboration while strengthening the ability of scientific decision-making. At the same time, generative AI empowers the development thoroughly. After generating users profile, it automatically uses generative design and assists with algorithms and codes, creating multiplex mode products. Moreover, a trial-and-error type of experiment is put into practice to select the excellent ones from the large-scale test samples. It can break down the barriers of traditional industries and give rise to innovative products.

One typical skill of generative AI is drafting and reviewing contracts. Through database, industry templates, target requirement, etc., generative AI automatically and quickly generates a contract that meets the user's needs. Contrary to traditional human labor, generative AI comes with a strict review mechanism and is able to examine every flaw comprehensively. In addition, compared to making a contract manually, generative AI has achieved speed and accuracy, helping enterprises and individuals save significant time and cost. For companies and their staff, it effectively reduces the loopholes that are overlooked during manual review. Also, a standard contract can reduce potential loss and prevent problems related to non-compliance with regulations.

4. The Challenges and Methodology of Risk Prevention and Control in Finance

In the past, the detection of fraudulent activities mainly depended on manual work, comparing and screening out the abnormal data, which was particularly inefficient and prone to error. By contrast, generative AI leverages neural networks and anomaly detection models and studies the normal trading patterns to capture outliers in a large amount of data quickly and precisely. In recent years, there are fraudulent activities such as identity theft, payment fraud, account takeover by phishing, malware attacks, and social engineering. In the intricate transactions in the financial field, fraudulent activities have always been an awful thing for both investors and the market. Hence, how to prevent financial fraud is of utmost importance.

Baseline model and natural language processing (NLP) are two fundamental machine learning modes. NLP filters the data by the identity of named entities and keyword research and specializes in machine translation, question answering systems, language modelling, and text summarization [9]. The baseline model covers the definition standard, simplified implementation, and the boundaries definition. Generative AI makes a comparison between the actual transaction data and the baseline model and concludes whether this financial transaction has problems in a short time, which prominently saves people's energy and time.

Since robo-advisors receive most of their data from the public domain, which contains a great deal of complicated and redundant information, it's hard to ensure that every piece of information is correct. If the generative AI database is filled with false information, the content it generates will become horrible.

Nevertheless, due to the openness of the database, this approach still poses risks. Individuals with malicious intent may upload fake news and spurious transaction data online. Consequently, the generative system may be misled, and the baseline may deviate. Subsequently, the data they detect will no longer be accurate. Therefore, it is extremely important to promptly identify false information.

As mentioned in the data sources for robo-advisors, robo-advisor has delved into unstructured data such as social media, news reports, and voice communication. Generative AI generates simulated data through GAN and LLM, breaking through the predicament of traditional AI algorithms. So, it can identify and analyze underlying data in a highly efficient and accurate manner. For instance, generative AI can track current trends and respond to them appropriately, timely adjusting the investment proportions of individual financial products. It can also simulate extreme market scenarios and make corresponding adjustments to ensure that the risks for investors are minimized. Investors' risk appetites and pressure tests offer AI different scenarios to adapt to. By training on various scenarios and utilizing mathematics and algorithms, AI can evaluate the impact of extreme events and provide more appropriate advice to investors.

Despite having great potential, generative AI still faces some challenges that need to be addressed in the financial sector. The urgent problem that needs an immediate solution is how to provide AI with training data that does not violate privacy [10].

At the same time, regulatory institutions cannot precisely and comprehensively understand the AI operating model. Thus, whether there are any under-the-table dealings remains unknown. Therefore, the transparency of information and the effectiveness of supervision are the main factors influencing market confidence. More publicity should be made available to all.

To sum up, AI is promising to change the financial regulatory system by increasing the ability to identify risk, the capacity to enhance regulatory strategy and boost model and algorithm. However, to maximize its potential, regulators should address the problem of data privacy and accuracy and the ethical AI problems.

5. Conclusion

Generative AI has been evolving rapidly for many years. In the era of advancing science and technology, generative AI offers convenience and sound advice to people in the financial field based on databases, special algorithms, and models. AIGC and machine learning have laid the foundation for AI in the financial field, while robo-advisors and emotionally-aware AI have been integrated and are being widely used. Yet, the excessive growth of generative AI brings inevitable risks. Financial fraud always exists in the market, so how to address unexpected and sudden incidents becomes crucial. As the existing regulations cannot cover all aspects, explainable computer language models and necessary human intervention supervision prove effective.

In the future, generative AI will become more mature, cover a wider range of fields, and have closer interdisciplinary intersections with finance. In the long term, generative AI will continuously empower inclusive finance and promote the development of finance. Due to the rapid development of the Internet, the financial risks still need to be seriously, as algorithm black box and data forgery advent frequently, up-to-date supervision and constantly updated algorithms seem valuable. Governments and supervision institutions should play a leading role in the punishment and prevention of illegal use of generative AI, and build a periodic risk management system to ensure the security of online finance.

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Conflicts of Interest

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