

Development Trends in AI-Based Financial Risk Monitoring Technologies

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Abstract: In recent years, artificial intelligence (AI) technology has rapidly evolved and deeply integrated with the financial industry. It has been widely used in various scenarios such as intelligent customer service, credit scoring, robo-advisors, and risk management. Central banks and other financial regulatory authorities are also exploring the utilization of AI to strengthen economic monitoring, analysis, and forecasting. AI contributes to improving the efficiency of financial services, promoting inclusive finance, and enhancing regulatory effectiveness. However, it also introduces risks such as financial risk, data security, high-tech crime, and algorithmic discrimination. Major economies including China, the United States, and Europe have begun to enhance regulatory oversight of AI. This abstract summarizes the development trends in AI-based financial risk monitoring technologies.

Keywords: Artificial Intelligence, Financial Risk, Monitoring, Trends

DOI: <https://doi.org/10.5281/zenodo.10965494>

1 Introduction

In recent years, with the development of artificial intelligence algorithms such as deep learning, the continuous improvement of computing power, and the accumulation of data, artificial intelligence has gradually integrated with various industries, becoming a significant driving force for emerging economic development. In the finance industry, artificial intelligence has also been applied to a certain extent [1].

Firstly, it is applied in risk control and compliance management in the financial sector. Artificial intelligence technology plays a crucial role in risk management and compliance in the finance industry. Through machine learning and data mining techniques, artificial intelligence can identify abnormal transactions, fraudulent behavior, internal control compliance, and potential risk factors. It assesses the creditworthiness of financial institution customers and predicts risks [2,3]. Additionally, artificial intelligence technology can help financial institutions better comply with regulations and compliance requirements by automating compliance processes, monitoring risks, and providing compliance reports.

Secondly, it is applied in personalized customer services. Artificial intelligence technology helps financial institutions provide personalized services and optimize customer experiences. By analyzing customer data and behavior patterns, including personal information, credit

history, financial status, occupational background, and social network behaviors, artificial intelligence technology can tailor financial product recommendations, provide intelligent investment advice, and offer financial planning based on customers' credit risks.

2 Related work

2.1 Current state of AI financial services

The evolution of artificial intelligence (AI) technology is transitioning from "analytical" to "generative" approaches. Analytical [4-6] AI utilizes machine learning algorithms to compute conditional probability distributions within data, enabling analysis, judgment, and prediction based on existing datasets. It is primarily applied in areas such as advertising recommendation, decision support, and data analysis. However, analytical AI is limited in its ability to create entirely new content, as it relies on specific rules to process designated tasks. As a result, it is also referred to as "narrow AI" or "weak AI".

In contrast, generative AI can be trained on more diverse datasets, learning their underlying logic to generate new datasets and create novel content such as articles, images, music, and computer code. Compared to analytical AI, generative AI possesses stronger capabilities in understanding, reasoning, and content creation, thus offering a broader range of applications. Currently, the most representative form of generative AI is large language

models, with examples including [7] OpenAI's ChatGPT, Baidu's [8] Wenxin Yiyuan, and Alibaba's Tongyi Qianwen. Globally, there are already over 200 large models, with 90% of them developed by tech companies in China and the United States.

AI naturally aligns with the finance industry. Data is the most critical input for AI, and both analytical and generative AI models require extensive data for training. The finance industry, characterized by a high level of digitization, has accumulated vast amounts of user and transaction data in its daily operations, making it one of the most ideal environments for AI applications. [9] In fact, financial institutions are widely leveraging AI technology to upgrade or innovate their financial services. According to a survey by the US consulting platform Business Insider, 80% of banks in the United States believe that AI can improve financial services, and many have already integrated or plan to integrate AI into their financial operations. [10] By 2027, the global AI financial services market is expected to grow to \$130 billion.

2.2 AI-assisted financial services applications

Financial institutions are primarily using analytical AI to assist human employees. The application scenarios are as follows:

One is intelligent customer service. The work of customer service has obvious procedural characteristics, so it is one of the most widely used scenarios for AI [11]. At present, intelligent customer service mainly undertakes two tasks: First, answer customers' questions and doubts. For example, Erica, the intelligent customer service of Bank of America, uses voice recognition and natural language processing technology to analyze customers' problems, extract key information, and provide corresponding solutions; [12,13] Cimb's Eva specifically addresses the needs of smes and can work 7*24 hours a day, playing a greater role in helping smes during the epidemic. Ping An Bank of China's AI customer service has undertaken 80% of the workload. Second, personalized business recommendation. For example, Wells Fargo cooperated with Google to analyze user characteristics based on transaction data, social data, etc., and recommend financial services or investment products in a targeted manner.

The second is credit score. Traditional credit scoring models primarily use structured data, which makes it impossible to score a customer if they do not have a bank account and the associated transaction transfers. AI can widely use structured [14] (such as transaction history) and unstructured data (such as employment history, spending habits, etc.) for credit scoring, which can greatly improve efficiency, accuracy, and reach. For example, the United Bank of the Philippines has built a credit scoring model based on artificial intelligence technology to give credit ratings to unbanked groups, thereby improving loan availability.

Third, intelligent investment advisers. An intelligent advisory system built with AI technology can generate a portfolio suitable for investors' needs by analyzing investors' risk appetite, financial goals and market conditions, and adjust investment strategies in a timely manner according to market operation. This helps to lower the investment threshold and provide more precise investment choices for investors with different levels of wealth and risk tolerance. A number of Chinese and foreign financial institutions, such as jpmorgan Chase in the US and Flush in China, have launched intelligent advisory services [15].

Fourth, risk management. Risk management models based on AI technology can analyze, identify and predict risk factors in finance, investment, credit and other fields through big data analysis, and take measures to reduce risks and protect the interests of financial institutions and consumers. [16,17] For example, Singapore's DBS bank has used AI to improve its anti-money laundering/anti-terrorist financing alarm prioritization, significantly reducing the number of false positives. A number of commercial banks in China have established AI anti-money laundering models, using machine learning, knowledge graph and other technologies for real-time monitoring and intelligent analysis of anti-money laundering.

2.3 AI financial services opportunities

For the financial system, artificial intelligence is a "double-edged sword", bringing outstanding opportunities and risks. Opportunities include:

First, improve business efficiency. The speed and accuracy of AI technology in processing financial transactions are not only higher than human, but also higher than existing electronic means. [18] Ping An Bank, for example, said that smart customer service has improved the efficiency of its customer service business by two to three times. A model built by AI firm Snorkel AI for a US bank to assess lending policies and risk exposure processed 250,000 documents in a single day with an accuracy of 99.1%, far exceeding both human and existing technology [19]. Bridgewater predicts that generative AI will bring even greater efficiency gains, the impact of which will only be fully felt in the next 10 to 20 years.

Second, promote financial inclusion. Under the traditional model, the cost of providing services to some "long-tail customers" is greater than the benefit, resulting in some people being excluded from the financial system [20]. AI technology has greatly improved the availability of data and the ability to process data, and the marginal cost of providing services is very low, so it can bring "long tail customers" into the scope of business, such as AI credit scoring can provide loans to people without bank accounts, and intelligent investment advisers can allow small investors with low disposable income to invest and improve their property income.

Third, we will improve the effectiveness of financial

regulation. In theory, large models can help financial authorities obtain diversified data from multiple channels and monitor the operation of the financial system. Its strong analytical and forecasting capabilities can assist financial management departments to conduct policy simulations and select the best policies from a variety of policy combinations. Large models can also identify and predict risks in advance, helping financial authorities to better maintain financial stability through prior supervision.

3 AI in Financial Risk Monitoring

The characteristics of big data technology can well solve the problem of insider trading supervision. The 4V characteristics of big data technology are different from traditional manual models [21]: large volume of processed data, diverse data categories, high-speed data processing and analysis, high-value accurate analysis. These characteristics are very much in line with the difficulties faced by insider trading supervision in practice. Since big data technology is the correlation analysis of all data, rather than the analysis of similar data, it can simultaneously analyze the transaction data and the social relationship of the transaction subject, so as to detect and identify suspicious transactions and related transaction subjects more quickly and accurately.

Artificial intelligence technology can be another regulatory assistant. Relying on a large number of relevant case data in the past as learning materials, machine learning is used to enable it to have the ability to identify insider trading, and reinforcement learning is carried out through future data, that is, the machine learning model of "semi-supervision + reinforcement" is adopted, so as to make supervision more rapid and effective [22].

3.1 Big data collects information

Big data technology can quickly integrate the activities of individuals in the securities market and their social networks. Traditional supervision mode often uses manual mode to collect data information, especially the social relationship network of the trading subject in insider trading. Given that insider traders often take steps to cover up their wrongdoing, the network of relationships they build is complex [23]. Each case study requires regulators to reconstruct a new social network map, which further increases the difficulty and timeliness of regulation. Big data technology can easily solve this problem, which can quickly and accurately build the relevant network diagram, and integrate the related activities of each subject in the network, so that regulators can no longer focus on multiple types of data collection and data integration, which greatly improves the efficiency of supervision.

3.2 Data analysis and risk prediction

The analytical and learning capabilities of big data technology help to regulate the "in-process" and "before-the-fact" stages of transactions. [24] The high degree of

concealment of insider trading depends on the insiders of insider information to spread the information "wide range" and "nepotism" and indirectly participate in trading. This makes it difficult for traditional regulators to track down real leaks, although they can detect unusual fluctuations in securities prices. The transaction network diagram built by big data technology and the multi-dimensional and cross-category data analysis ability of artificial intelligence technology make the above problems easily solved [25]. Through continuous learning and strengthening, the accuracy and effectiveness of artificial intelligence will gradually improve, which makes it possible for "in-process" dynamic supervision, that is, insider trading is successfully identified and detected during the occurrence of insider trading, thus avoiding the dilemma brought by the pre- and post-supervision mentioned above.

By digging deeper and analyzing information, AI can also fix vulnerabilities in the current system itself and predict future risks. These characteristics of artificial intelligence have led to its application in fields such as weather forecasting and fraud detection. In the field of securities supervision, artificial intelligence can alert and warn of the violations and related risks of the relevant entities of insider trading, so as to improve the detection ability of insider trading.

Moreover, the information disclosure system of listed companies is the legal obligation of listed companies, but in reality, listed companies often process and disguise their information, thus misleading investors to make wrong expected judgments. Relevant senior management also often release some "suggestive information" to disturb investors and even regulators, thus affecting the effectiveness of supervision [26]. Big data technology can avoid such problems. Since big data is to collect the whole category of data and conduct correlation analysis on it, it will easily eliminate the wrong interference information and reduce the interference of wrong information.

4 The Pros and Cons of using AI in Finance

For the financial system, artificial intelligence is a "double-edged sword", bringing outstanding opportunities and risks. Opportunities include:

4.1 Opportunities

First, promote financial inclusion. Under the traditional model, the cost of providing services to some "long-tail customers" is greater than the benefit, resulting in some people being excluded from the financial system. AI technology has greatly improved the availability of data and the ability to process data, and the marginal cost of providing services is very low, so it can bring [27]"long tail customers" into the scope of business, such as AI credit scoring can provide loans to people without bank accounts, and intelligent investment advisers can allow small investors

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Will improve the effectiveness of financial regulation. In theory, large models can help financial authorities obtain diversified data from multiple channels and monitor the operation of the financial system. Its strong analytical and forecasting capabilities can assist financial management departments to conduct policy simulations and select the best policies from a variety of policy combinations. Large models can also identify and predict risks in advance, helping financial authorities to better maintain financial stability through prior supervision.

4.2 Challenges

First, it makes financial risks more difficult to identify. Artificial intelligence (AI) technologies such as neural networks commonly suffer from the problem of "algorithmic black box", that is, it is difficult to explain the causal relationship between input variables and output variables, or elucidate its transmission mechanism. This can lead to financial risks that are difficult to identify before or during events, that can be observed only after they have occurred, and that make it difficult to explain how these risks arose. If AI technology is used for a number of financial businesses at the same time, it may also lead to more hidden cross-contagion of risks, and once the risk occurs, the impact on the financial system may be greater.

Second, data security. The training and use of AI requires a large amount of user data, and there are also data sharing problems between different AI models. This puts forward higher requirements for financial institutions to collect, store, use and share users' personal information and transaction data. Previously, there have been frequent examples of financial institutions or fintech companies abusing user data and leaking personal privacy. In this regard, major economies have introduced relevant laws on data security and privacy protection, but the implementation of these laws in the financial sector and the compliance of financial institutions remains to be seen.

Third, it breeds financial crimes. At present, there have been a number of cases of using AI technology to "change faces" that have caused serious violations of personal privacy and reputation. If criminals use it in the financial field, such as using "face change" technology to deceive face recognition and impersonate oneself for withdrawal or transfer; Deliberately inserting "toxic" information in the training of the large model, misleading the judgment of the large model and seeking their own interests[29]; Or through the algorithm recommendation function to mislead customers, which may seriously damage the interests of consumers.

Fourth, algorithmic discrimination. If the data set used for training is not inclusive and diverse, or the programmer intentionally or unconsciously introduces bias when writing algorithms based on their own values, experience, and

background knowledge, it may cause algorithmic discrimination and lead to unfair results. For example, there have been many cases of gender discrimination in AI recruitment. In the credit scoring business, if the algorithm is biased, it may tend to give lower scores to certain groups or genders, reducing the availability of credit.

5 Conclusion

In conclusion, the integration of artificial intelligence (AI) into the finance industry presents both significant opportunities and challenges. [30] On one hand, AI technologies such as machine learning and big data analytics have the potential to enhance business efficiency, promote financial inclusion, and improve the effectiveness of financial regulation. These advancements enable faster, more accurate processing of financial transactions, extend financial services to underserved populations, and empower regulators with better tools for monitoring and managing risks.

However, on the other hand, there are notable challenges associated with the widespread adoption of AI in finance. These include the difficulty in identifying financial risks due to the opaque nature of AI algorithms, concerns about data security and privacy, the potential for AI to facilitate financial crimes, and the risk of algorithmic discrimination. [31,32] Addressing these challenges will require a concerted effort from both financial institutions and regulatory authorities to ensure responsible use of AI technologies while safeguarding the integrity and stability of the financial system.

Acknowledgments

I would like to express my sincere gratitude to the authors of the cited literature, especially Zheng Haotian Huiming Zhou ,Yufu Wang and colleagues, for their paper titled "Medication Recommendation System Based on Natural Language Processing for Patient Emotion Analysis" published in the Academic Journal of Science and Technology. Their research provides valuable insights into medication recommendation systems utilizing natural language processing for patient emotion analysis. This work serves as an important reference and inspiration for my research. I extend my heartfelt appreciation to them for their contributions to this field. Furthermore, I extend my sincere thanks to the authors of the cited literature, particularly Wang Hongbo Wenran Lu,Chenwei Zhang,Jiang Wu,Chunhe Ni and co-authors, for their paper titled "Intelligent Security Detection and Defense in Operating Systems Based on Deep Learning" published in the International Journal of Computer Science and Information Technology. Their research offers significant advancements in the application of deep learning for intelligent security detection and defense in operating systems. Their work serves as a cornerstone for my research, and I am truly

grateful for their efforts in pushing the boundaries of knowledge in this area.

Funding

Not applicable.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

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

Not applicable.

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