The Impact of Rapidly Developing Artificial Intelligence on the Financial Field

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Abstract—**Artificial intelligence has made great progress in recent years and is increasingly being applied in the financial field, gradually becoming an indispensable part of the financial sector. However, artificial intelligence still has many shortcomings, such as opacity and data reliability, which hinder its further development in the financial field. Therefore, the research question is how to apply artificial intelligence to the financial field better. This article reviews the literature on the definition of artificial intelligence, its development history, and operating principles, gradually introducing it into finance applications. It summarizes how artificial intelligence is applied in the financial field and analyzes existing problems, providing possible directions for future breakthroughs. I hope that this paper could, to some extent, alleviate the obstacles caused by these problems to the development of artificial intelligence in the financial field.**

Keywords—**Artificial Intelligence (AI), finance, application, machine learning**

I. INTRODUCTION

Artificial Intelligence has gotten wide attention nowadays. We have witnessed the rapid development of this century's most important technological achievements in the past few decades. As artificial intelligence technology becomes increasingly mature, more and more fields are starting to use it. Among them, artificial intelligence has made great contributions to the financial field. It has brought enormous benefits to the financial field in various aspects. The most common algorithms for artificial intelligence include machine learning, deep learning, and reinforcement learning. Artificial intelligence can assist in predicting market trends and reducing risks by analysis market data or improving user experience through personal data. The emergence of AI has greatly reduced the financial industry's costs and improved enterprises' operational efficiency.

However, artificial intelligence has a recognized flaw in the academic community: there are still many security risks in its operation. To some extent, it is uncontrollable, and people do not fully understand its thinking mode, and there is even a risk of being attacked by hackers. And finance is a very important industry for a country. Once technology loses control, it may bring huge losses to the financial industry and even the country. Therefore, the research question of this paper is: How to improve the application of artificial intelligence in the financial field

To solve this question, this article uses literature review and literature review methods to review the development of artificial intelligence and its practical applications in the financial field. It summarizes and analyzes some of the main existing problems of artificial intelligence in the financial field, including data dependency, algorithms, legislation, black box problems, etc. This article discusses these aspects, and some possible solutions were provided.

Through research on this topic, this article hopes to provide assistance for developing the combination of artificial intelligence and finance and improving the problems involved.

II. THE ARTIFICIAL INTELLIGENCE

A. Concept and Turing Testing

Firstly, we need to understand the broad concept of artificial intelligence clearly. In short, AL is the study of building or programming computers to enable them to do what minds can do. The technology allows machines to fit human intelligence as closely as possible to complete certain tasks (Boden, 1987). It can be regarded as a collection of human intelligence capable of performing calculations at ultra-fast speeds. Due to its high efficiency and precise results, it has achieved success in different fields in a short period of time.

Researchers in the United Kingdom had been exploring "machine intelligence" for up to ten years prior to the founding of the field of Artificial Intelligence (Al) research in 1956 (Crevier, 1993). And among these people, Alan Turing must be an important and special person. In 1950, Alan Turing suggested a definition for deciding whether software is intelligent or not. In his theory, the software's intelligent behavior can be measured a human intellectual efficiency (Benko & Lányi, 2009). We have to mention the Turing test here. The Turing test, originally called the imitation game by Alan Turing, is an experimental method for exploring artificial intelligence to test whether robots can think like humans. The process of the experiment is as follows—There are three characters in the experiment, two people and one computer. One person is responsible for asking questions, while the other person and the computer both answer his questions. They will use three terminals, which will be isolated from each other. After asking a certain number of questions, the "questioner" will be asked to distinguish which one is a computer and which one is a person. If the "questioner" makes the wrong choice in a series of tests, this largely indicates that this computer possesses artificial intelligence. (Intelligence has been defined in many ways: the capacity for abstraction, logic, understanding, self-awareness, learning, emotional knowledge, reasoning, planning, creativity, critical thinking, and problem-solving. It can be described as the ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context (Sharma, 2008). Although the Turing test has not been highly regarded for

many years, it is often not a good standard for judging whether a computer has artificial intelligence without setting limitations on the problem.

B. The Current Situation of Artificial Intelligence

Artificial intelligence technology is gradually maturing, and mainstream robot algorithms include deep learning, machine learning, reinforcement learning, etc.

Machine learning is mainly used to describe pattern recognition tasks that provide "learning" components on groundbreaking Artificial Intelligence (AI) systems (Gogas & Papadimitriou, 2021). The machine learning method does not require too much data investment. Using algorithms enables computers to learn from data and improve the accuracy of their predictions or decisions.

Deep learning is a branch of machine learning. It should be based on artificial neural networks (Deng & Yu 2014). It simulated the learning, this learning method requires much more data input. Image recognition, speech recognition, and some other technologies are all based on this algorithm.

Artificial neural networks are a research hotpot emerging in the field of artificial intelligence, and their self-learning capabilities and other characteristics are indispensable in the financial field. These artificial networks may be used for predictive modeling, adaptive control and applications where they can be trained via a data set. Self-learning resulting from experience can occur within networks, which can derive conclusions from a complex and seemingly unrelated set of information ("Neural Net or Neural Network–Gartner IT Glossary"). When dealing with numerous and chaotic market data, functions such as prediction and self-learning seem to become particularly important.

Reinforcement learning, which It is also a field of machine learning, on the other hand, is relatively easy to understand. In computer tasks, setting a reward for completing a certain task and then setting the goal to obtain the maximum reward, the computer continuously adjusts parameters during the process to achieve the purpose of training (Littman & Moore, 1996). These training methods can support the relatively stable development of computers in various industries and have become a very important part of industries in various countries.

III. AI IN FINANCE

As the proportion of technology in the financial field increases, the term "fintech" gradually appears in the public eye; according to the explanation provided by Baidu, financial technology is to apply a series of technological innovations to the financial field, including artificial intelligence. Artificial intelligence, which has its foundations in computer science, linguistics, psychology, mathematics, and philosophy, has proved to be a powerful tool in financial services (Tadapaneni, 2019).

A. Manages Risks

Financial market data is usually massive. The stability and sustainability of banks and financial institutions largely depend on their risk management capabilities. Based on this theory, it's vital to have a clear judgment on the market situation. Artificial intelligence can analyze and calculate massive amounts of data in the financial market, combine

past market trends or trends, accurately analyze the current market situation and predict future market trends, helping the financial industry to manage risks. This is usually attributed to the deep learning of artificial intelligence. Deep learning models have gained attention in the field of finance due to their out performance over classical models, leading to numerous studies and research opportunities in this area, which can help to simulate different market situations to judge and evaluate risks (Ozbayoglu *et al.*, 2020).

B. Customer Service

Artificial intelligence can greatly improve customer service experience. For example, by analyzing personal past data such as investment preferences and tolerance of risks, chatbots can provide customers with relatively reliable personalized services, such as providing investment advice and helping them increase returns or avoid risks. When customers make complaints, replacing real person customer service for acceptance can help solve most of the problems encountered by customers, although it is not as good as manual customer service in many places. This efficient service model can save a lot of labor costs and provide customers with a relatively comfortable experience. The market size of the chatbot industry is also rapidly increasing. Data shows that the market size of China's dialogue robot industry increased from 1.4 billion yuan to 4.47 billion yuan from 2019 to 2022. The market size of China's dialogue robot industry is expected to reach 9.85 billion yuan in 2025. (Analysis of the Current Situation of China's Dialogue Robot Industry: The Track is Rapidly Rising, with Finance as the Main Downstream Application Field, 2023)

C. Investment

With the help of artificial intelligence, the education and investment of financial institutions will be more precise and efficient. By relying on neural networks, AI can conduct deep learning on historical market data, predict future risks and trends, and assist financial institutions in formulating strategies. In this way, the threshold for investment will be greatly reduced. With the help of precise and clear data, even those without a lot of knowledge in this area can relatively easily make investments. In addition, the intelligent services of some robots greatly increase the convenience and accuracy of investment.

D. Fraud Detection

Anomaly detection is an important problem that has been well-studied within diverse research areas and application domains (Chalapathy & Chawla, 2019); fraud detection is usually classified as a type of anomaly detection. Artificial intelligence also plays a very important role in fraud detection in the financial field. Firstly, artificial intelligence identifies fraudulent behavior by processing a large amount of financial data, and analyzing and detecting abnormal or unusual places, such as analyzing a customer's transaction history or behavior to determine potential fraudulent transaction activities. Secondly, through natural language processing and sentiment analysis techniques, artificial intelligence can derive possible emotional trends from certain words and, based on this, determine the possibility of fraudulent behavior.

Artificial Intelligence can monitor all financial

transactions in real-time and take action with high efficiency in the event of suspicious or potentially fraudulent behavior, typically by reminding traders, issuing warnings, and preventing or terminating transactions. And evaluate the customer's risk level through these historical transaction data. These undoubtedly greatly improve the security of the financial system.

IV. SOME DRAWBACKS

The history of artificial intelligence is not long; It can be traced back to the 1950s; at that time, scientists, mathematicians, and philosophers only integrated the concept of artificial intelligence into their minds (Anyoha, 2017). The field of artificial intelligence research was established in the summer of 1956 at a seminar at Dartmouth College in the United States (Kaplan & Haenlein, 2019). And the time when artificial intelligence is truly applied in the financial field is shorter than this. In just a few decades, people have created something that can be described as great or even miraculous. But it is obvious that there are still some shortcomings in this technology. Although it may not seem serious in the face of the huge benefits it brings us, we still need to face these shortcomings or challenges.

The effective operation of artificial intelligence largely depending on factors such as accuracy and the number or the representative of the data trained by its model. If poor quality data is used, it may lead to inaccurate calculations in artificial intelligence. The current amount of data on the internet is enormous, and different data flows from various channels to the internet, making it difficult to ensure that every piece of information is true and reliable. There are also many errors in the process of filtering data. When it is applied in the financial field, it is also necessary to consider the complexity of transactions or the limitations of data caused by some privacy issues. These false or unofficial data may cause deviations or errors in the final results obtained by artificial intelligence. I believe that the quality of data is not only related to its accuracy, but also to its effectiveness. The same batch of data may not be applicable to all regions, for example, when artificial intelligence provides personalized services to customers, data from one region, such as people's investment preferences, level of investment, or their money concept, cannot be applied to all regions of the world. Errors in these details are likely to affect the customer's user experience, so the validity of these data is equally important.

When there are errors or errors in the results of artificial intelligence, it is actually difficult for people to verify its authenticity. The results of intelligent algorithms are opaque and not verifiable (Meunier, 2019). We can easily obtain the desired results, but we cannot know how the results came about, which creates some uncertainty. This is called the black box effect. As black box models are increasingly used for decision-making in the field of economics and finance, concerns about this will also increase. Imagine when the computer gives a result that contradicts the customer's judgment, which makes people feel confused. The customer may feel that their judgment is not as good as the computer and cannot receive a reasonable explanation to verify whether the computer's results are true, which undoubtedly increases people's concerns. So the difficulty in assessing its potential risks has also become a major challenge for

artificial intelligence in the financial field.

In addition, the laws related to artificial intelligence are still incomplete. For example, when errors in artificial intelligence cause economic losses, it is not easy to determine whose responsibility it belongs to. If there is no clear division of responsibility, it will be difficult for victims to receive corresponding compensation when artificial intelligence misjudges.

Artificial intelligence has shown great potential in the financial field, but to further improve its application in the financial field, our article will focus on data quality and numbers, the opacity of intelligent algorithms, relevant legislation, and some other potentially effective methods.

V. IMPROVE THE RELIABILITY OF DATA

Artificial algorithms rely heavily on the reliability of their data, In the previous section, we mentioned that due to the privacy and complexity of transactions in the financial field, obtaining comprehensive, accurate, and large amounts of data may encounter many difficulties. To address these issues, we have some possible effective solutions.

A. Strengthening the Security and Reliability of Artificial Intelligence and Finance through Data Verification Technology

Data validation technology can check the accuracy and credibility of data during its transmission, storage, and processing. Digital verification technology includes.

Rule based validation: It sets a rule in advance to compare the obtained data with this rule. This can detect the logical rationality of the data and prevent logical conflicts in the data. If there are any deviations or anomalies from the rule, it is considered as lacking accuracy or credibility (Chell, 2021).

Range verification: it can also perform range verification and set a range, which can be year, age, or other. For example, if we need financial transaction records from 2000 to 2022, we will exclude data from other years. It can effectively prevent inputting data beyond a reasonable range, leading to system errors.

Statistical method: It's also a way of verifying data. It calculates the probability distribution of data, or uses statistical indicators to form a model, and determines whether there are anomalies in these data by comparing them with normal models.

Machine learning-based data verification method: The machine learning method is a more complex data detection technique that utilizes algorithms and models to learn normal data patterns and determine whether there are anomalies by comparing new data with the learned model. The usual ML-based data detection technology requires collecting data first, followed by data cleaning to improve the quality and availability of the data. Mark these normal data and let the model learn to process them. After training a standard data model, compare the new, unlabeled data with the model. (Weiss & Indurkhya, 1995). If abnormal data is detected, different measures can be taken, such as alarming or labeling (Urbano *et al.*, 2014).

B. Increasing the Breadth of Artificial Intelligence Data in the Financial Field through Data Sharing Helps to Enhance the Robustness of Artificial Intelligence Systems

By encouraging and promoting cooperation between

different financial institutions and enabling them to share data, the breadth of data accepted by artificial intelligence can be increased. Data sharing involves establishing compliant data sharing mechanisms and protocols between different organizations, which need to clearly define the purpose of data usage, access permissions, time frame for sharing, and other related matters. At the same time, it is necessary to determine the confidentiality of the data, prevent it from being leaked or abused, and comply with relevant laws, regulations, and privacy regulations (Zhang, 2014). These organizations need to ensure the accuracy and quality of the data they invest in. In this way, the breadth of data that can be received will increase, allowing artificial algorithms to learn within a wider range of data, resulting in more accurate results, and the establishment of the model will also be more comprehensive and representative.

One fact is that the information of financial institutions cannot be shared with each other because the essence of financial company profits is the utilization of information gaps. However, I believe that although financial companies may not be able to open up all information, they can share some information. This not only helps the development of artificial intelligence in the financial field, but also contributes to the stability of the financial market and avoids systemic financial risks.

C. Data Synthesis Technology Can Be Used to Increase the Quantity and Diversity of AI and Finance

Data synthesis technology can provide more training data in situations of data scarcity or imbalance, and can also help us better understand the patterns and characteristics of data. Thus improving the performance of machine learning models and making their applications more efficient. It plays a certain role in the financial field where data is scarce, numerous, chaotic, and restricted everywhere.

Generative Adversarial Networks (GAN) is a commonly used method for synthesizing data, which is a deep learning model. We have been making progress on GAN, which enables us to generate images of unprecedented quality (Karras *et al.*, 2017). The two most important things that make it work are the generator and discriminator. Below, this paper will briefly introduce its principle.

We need to train the generator to generate as realistic data as possible. The purpose is to make it more difficult for the discriminator to distinguish it from real data. And we need to train the discriminator simultaneously, which needs to maximize the differentiation between the data generated by the generator and the real data. This is a dynamic process of mutual training. Generators will learn how to generate more realistic data. This process is relatively complex in actual operation, with a certain risk of mode collapse. It needs to be cautious in practical application, but at the same time, it brings huge returns.

In summary, the use of digital generation technology can greatly expand the quantity and diversity of artificial intelligence financial data, thereby promoting the development of AI in the financial field.

VI. THE OPACITY OF INTELLIGENT ALGORITHMS

The opacity of artificial intelligence, also known as the black box problem, has always been a hidden danger for the application of artificial intelligence. If this problem is solved, artificial intelligence will be more trustworthy and can eliminate some hidden dangers that are difficult to evaluate the rationality and risks of the results due to lack of evidence. Below, this paper will introduce some mainstream methods to reduce the black box attribute of artificial intelligence.

A. Interpretable Artificial Intelligence

The use and research of interpretable artificial intelligence can make the models of intelligent algorithms more transparent and interpretable. This technology allows us to have a deeper understanding of the operating rules of artificial intelligence (Molnar, 2020). There are two commonly used interpretable artificial intelligence, ad-hoc and post-hoc.

There are significant differences between ad-hoc interpretability methods and post-hoc interpretability methods, but both belong to interpretable artificial intelligence. The ad-hoc interpretability method can determine which step has been taken in the huge algorithm of artificial intelligence, and it can break down the black box itself. Usually, interpretability needs to be one of the goals in the modeling process, which is closely integrated with the training of the model. The results provided by it will be more intuitive and interpretable, but it will give additional workload and low efficiency in the modeling process. The post-hoc interpretability method explains the process after a series of steps and results have been obtained, similar to deduction. This is an independent model that utilizes interpretable techniques such as local sensitivity analysis or local model interpretation to analyze the input and output of data (Du *et al.*, 2019). It doesn't need to modify the original modeling, which is fast, but it hasn't solved the black box problem, and it's not as in-depth as the ad-hoc interpretability method, and these explanations are sometimes unreliable and may be misleading (Rudin, 2019).

At present, the essence of the black box of artificial intelligence cannot be changed. Some people believe that AI should not be introduced into Finance, as these uncertainties will bring uncontrollable risks to the financial field. However, I believe that the application of AI in the financial field is an irreversible trend. Our focus should be on developing and modifying AI technology to make it more effective and reliable, as well as human in the loop methods to enhance the security of AI financial instruments.

B. Education and Training

In addition to these technological applications, the transparency of artificial intelligence decision-making processes can also be increased through education and training of relevant technical personnel. It can enable relevant personnel to learn about artificial intelligence, strengthen their understanding and application of artificial intelligence calculation models, enable them to better understand the logic of artificial intelligence, increase experiments on artificial intelligence, record different results obtained from different inputs, and better understand and review the decision-making process of artificial intelligence.

VII. LEGISLATIVE ISSUE OF ARTIFICIAL INTELLIGENCE

In order to address the legislative issue of artificial intelligence, it is necessary first to establish a legal

framework for AI. Artificial intelligence is still a relatively vague thing in the legal field, and it is difficult to judge who should bear the responsibility when AI causes losses, and artificial intelligence creates valuable outputs, who should become the owner (Turner, 2018). For example, when problems arise in AI, they can be subdivided into four major areas: research and development department, operation department, external factors, and other factors. By constructing a legal framework, artificial intelligence can have a relatively complete system of accountability. Secondly, international cooperation should be strengthened, as the impact of artificial intelligence is global and there are significant differences in legal systems across countries and even regions. Strengthening international exchanges can help improve the legal system for artificial intelligence and broaden its coverage. Government departments can also strengthen the supervision of artificial intelligence by establishing regulatory departments to reduce the probability of accidents occurring through strict regulatory testing by these regulatory departments.

However, the law may be a double-edged sword for artificial intelligence. While strengthening legal supervision, it may also limit the development of artificial intelligence to some extent, such as affecting the amount of data collected by intelligent algorithms to maintain some privacy data. The legislation of artificial intelligence is bound to be a long-term issue, and laws should be constantly reformed, striving to minimize the harm it brings and find a balance between the development of artificial intelligence and its legislation.

VIII. Some Other Potentially Effective Methods

In addition to the above arguments, there are also some measures that can strengthen the application of artificial intelligence in the financial field. For example, developing specialized models for the application of artificial intelligence in the financial field. Because some universal models may have some limitations when applied to the financial field, which is a highly specialized field, vigorously developing specialized models for artificial intelligence in the financial field can greatly improve the applicability, accuracy, and efficiency of artificial intelligence.

Alternatively, enhancing collaborative innovation, increasing cooperation between financial institutions, technology companies, and academia, and exchanging more technology and professional knowledge can promote the development and innovation of artificial intelligence in the financial field.

IX. Future Outlook

With the penetration of artificial intelligence, the proportion of artificial intelligence in major financial industries is increasing. Even changing the structural framework of the financial industry, gradually becoming the core technology of this industry. According to Dongfang Wealth Network, not just finance, the future industry may present a tripartite situation with internet technology giants, financial technology groups, and artificial intelligence technology providers as the main participants. AI has greatly promoted economic development. There is a prediction that the artificial intelligence system market for enterprises will grow rapidly at an annual average rate of 56.1%, from $200 million in 2015 to $11.1 billion in 2024, which is astonishing data (Tractica, 2015).

Technology will become the core driving force for the sustainable development of the financial industry in the future. A series of new technologies represented by artificial intelligence, on the one hand, bring huge benefits to financial institutions, and on the other hand, regulatory agencies face greater challenges due to issues such as black boxes. Strengthening technology regulation seems to have become one of the inevitable choices for the future development of the financial industry. As the computational models of artificial intelligence continue to be updated and iterated, their usage areas become clearer and more proficient, or information accuracy is better guaranteed, this technology that benefits humanity will have very bright development prospects.

X. Conclusion

In recent years, artificial intelligence has made tremendous progress in various fields, especially in the financial sector. However, in the financial field, the application of artificial intelligence is still in its early stages. Therefore, I believe that in order to artificial intelligence to achieve greater development in the financial field, breakthroughs need to be made in the following aspects. Firstly, strengthening the reliability of data is crucial. Therefore, it is necessary to ensure the accuracy, breadth, and credibility of the data. The established data management mechanism enhances data quality and collection through technological means, promotes financial data sharing, and facilitates communication between different institutions, which can, to some extent, enhance data quality. Improve the transparency of artificial intelligence algorithms. Due to the complexity and black-box nature of artificial intelligence algorithms, it is difficult to explain and understand the decision-making process involved. Therefore, it is necessary to research and develop algorithms with strong interpret-ability to make the decision-making process of artificial intelligence more transparent and trustworthy. Furthermore, improving the legislative issues of artificial intelligence is also crucial. Due to the rapid development of artificial intelligence technology, the current legal framework often cannot adapt in a timely manner. Therefore, it is necessary to strengthen the supervision and legislation of artificial intelligence in the financial field, promote communication between countries, and build a legal system suitable for artificial intelligence. Finally, studying specialized models of artificial intelligence in the financial field can greatly increase the efficiency of AI usage or promote communication between different fields. Promote innovation in artificial intelligence. By strengthening the reliability of data, improving the transparency of algorithms, improving legislative issues, and researching specialized models for finance, breakthroughs will be made in the development of artificial intelligence in the financial field. This article researches the historical development, algorithm models, and applications of artificial intelligence technology in the financial field through literature review and information retrieval. It analyzes the obstacles of data quality, black box, and legislation to the development of artificial intelligence. I hope that the work in

this article can provide suggestions and references for the future development of artificial intelligence in the financial field.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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