

The Ethical Boundaries and Governance Paths of Intelligent Algorithms in Financial Decision-making

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Abstract: With the rapid development of artificial intelligence technology, the application of intelligent algorithms in the field of financial decision-making has become increasingly widespread and in-depth. While bringing many conveniences and innovations to the financial industry, it has also raised a series of ethical issues. This article delves deeply into the ethical boundaries of intelligent algorithms in financial decision-making, analyzes key ethical issues such as algorithmic discrimination, algorithmic black boxes, and responsibility attribution, and proposes corresponding governance paths from multiple levels including technology, law, regulation, and industry self-discipline, aiming to promote the healthy and sustainable development of intelligent algorithms in financial decision-making and ensure the fairness, justice, and stability of the financial market.

Keywords: Intelligent Algorithm; Financial Decision-Making; Ethical Boundaries; Governance Path

1. Introduction

Driven by the digital wave, artificial intelligence (AI) technology has become one of the most transformative forces of the present era, profoundly influencing the development patterns of various industries, and the financial sector is no exception. Intelligent algorithms, as a core component of artificial intelligence, have been widely applied in financial decision-making due to their powerful data processing capabilities, efficient decision-making models, and precise predictive analysis [1]. From credit approval, investment decision-making to risk assessment, intelligent algorithms are gradually changing the operation mode of traditional financial business, bringing unprecedented convenience and opportunities to financial institutions and consumers.

In terms of credit approval, the traditional model relies on manual review of a large amount of paper materials, which is not only inefficient but also highly subjective, easily leading to inconsistency and unfairness in the approval results. The application of intelligent algorithms has realized the automation and intelligence of the credit approval process [2]. Financial institutions can quickly and accurately assess the credit risk of applicants by collecting multi-dimensional data such as their basic information, credit records, and consumption behaviors, and using machine learning algorithms to build credit scoring models. They can also decide whether to approve loan applications and determine loan amounts and interest rates. For instance, some Internet finance platforms have utilized big data and intelligent algorithms to achieve "instant approval" of loans, significantly enhancing the efficiency and accessibility of credit services, especially providing financing opportunities for long-tail customers that are difficult to be covered by the traditional financial system.

The field of investment decision-making is also a stage where intelligent algorithms can fully demonstrate their capabilities. Quantitative investment strategies utilize algorithms to analyze and mine massive amounts of financial data, identify investment opportunities and patterns in the market, and automatically generate investment portfolios and trading instructions [3]. High-frequency trading utilizes algorithms to complete a large number of transactions in an extremely short period of time, capturing minute price fluctuations to make profits. In addition, intelligent investment advisory services provide personalized investment portfolio suggestions for investors based on their risk preferences, financial conditions and other factors through algorithms, lowering the investment threshold and enabling more investors to enjoy professional investment services. According to statistics, the global

robo-advisory market size has shown a rapid growth trend in the past few years and is expected to maintain a relatively high growth rate in the future [4].

Risk assessment is a crucial link in financial business, and intelligent algorithms also play a significant role. Financial institutions need to accurately assess various risks in order to formulate effective risk management strategies. Intelligent algorithms can conduct real-time monitoring and early warning of market risks, credit risks, operational risks, etc. [5] For instance, by using deep learning algorithms to analyze historical data and real-time market conditions of the financial market, market trends and price fluctuations can be predicted, helping financial institutions adjust their investment portfolios in a timely manner and avoid market risks. Meanwhile, intelligent algorithms can also monitor the internal operation processes of financial institutions, identify potential operational risk points, and enhance the refinement level of risk management.

However, the wide application of intelligent algorithms in financial decision-making has not been smooth sailing and has also raised a series of ethical issues. Algorithmic discrimination, algorithmic black boxes, unclear responsibility attribution, and data privacy and security issues have gradually become prominent. These problems not only infringe upon the legitimate rights and interests of financial consumers but may also affect the stability and healthy development of the financial market. [6] For instance, algorithmic discrimination may lead to unfair treatment of certain groups in areas such as credit applications and investment opportunities, exacerbating social inequality. The algorithmic black box makes it difficult for financial institutions and regulators to understand the decision-making basis of algorithms, increasing the uncertainty of financial risks. Unclear attribution of responsibility may lead to mutual buck-passing among all parties and harm the interests of consumers. Data privacy and security issues may lead to the leakage of consumers' personal information, causing them economic losses and privacy violations.

2. The Current Application Status of Intelligent Algorithms in Financial Decision-Making

2.1 Credit Approval Field

The traditional credit approval process is cumbersome and inefficient, mainly relying on manual review of the paper materials submitted by applicants. This approach not only consumes a great deal of time and manpower, but also, due to the subjective judgment and experience differences of the reviewers, is prone to cause inconsistency and unfairness in the approval results [7]. For instance, different reviewers may have different evaluations of the credit status of the same applicant, which can affect whether the loan is approved or not and the loan conditions.

The application of intelligent algorithms has brought revolutionary changes to credit approval. Financial institutions build a comprehensive and multi-dimensional credit assessment system by integrating multi-channel data, including applicants' basic information, credit records, social network data, consumption behavior data, etc. By using machine learning algorithms such as logistic regression, decision trees, and neural networks, a large amount of historical credit data is analyzed and modeled to uncover hidden patterns and rules in the data, thereby accurately predicting the default probability of applicants.

2.2 Investment Decision-Making Field

Intelligent algorithms also play a significant role in investment decisions. Quantitative investment strategies utilize algorithms to analyze and mine massive amounts of financial data, identify investment opportunities and patterns in the market, and automatically generate investment portfolios and trading instructions. High-frequency trading utilizes algorithms to complete a large number of transactions in an extremely short period of time, capturing minute price fluctuations to make profits. In addition, intelligent investment advisory services provide personalized investment portfolio suggestions for investors based on their risk preferences, financial conditions and other factors through algorithms, lowering the investment threshold and enabling more investors to enjoy professional investment services.

2.3 Risk Assessment Field

Financial institutions need to accurately assess various risks in order to formulate effective risk management strategies. Intelligent algorithms can conduct real-time monitoring and early warning of market risks, credit risks, operational risks, etc. For instance, by using deep learning

algorithms to analyze historical data and real-time market conditions of the financial market, market trends and price fluctuations can be predicted, helping financial institutions adjust their investment portfolios in a timely manner and avoid market risks. Meanwhile, intelligent algorithms can also monitor the internal operation processes of financial institutions, identify potential operational risk points, and enhance the refinement level of risk management.

3. Ethical Issues faced by Intelligent Algorithms in Financial Decision-making

3.1 Algorithmic Discrimination

Algorithmic discrimination refers to the unfair treatment of specific groups by intelligent algorithms in the decision-making process due to data bias or unreasonable algorithm design. In financial decision-making, algorithmic discrimination may manifest as credit restrictions or investment discrimination against certain groups based on race, gender, age, region, etc. For instance, some credit algorithms may, based on biases from historical data, give lower credit scores to certain ethnic minorities or low-income groups, making it difficult for them to obtain loans or only allowing them to get loans at higher interest rates. This kind of algorithmic discrimination not only violates the principle of fairness but may also exacerbate social inequality.

3.2 Algorithm Black Box

Intelligent algorithms usually have complex structures and operating mechanisms, and their decision-making processes are often difficult to explain and understand, thus forming what is called an "algorithm black box". In financial decision-making, algorithmic black boxes may prevent financial institutions and regulators from accurately understanding the decision-making basis and logic of algorithms, making it difficult to assess the rationality and fairness of decisions. For financial consumers, they also have no idea why they were refused a loan or received specific investment advice, which infringes upon their right to know and choose. In addition, algorithm black boxes may also mask errors and flaws in algorithms, increasing financial risks.

3.3 Issues of Responsibility Attribution

The decision-making process of intelligent

algorithms involves multiple entities, including algorithm developers, data providers, financial institutions, etc. When there are problems with algorithmic decisions or losses occur, it is difficult to determine the attribution of responsibility. For instance, if there is an error in the credit algorithm, leading to the generation of a large number of non-performing loans, should the algorithm developers, data providers or financial institutions be held responsible? This ambiguity in the attribution of responsibility may lead to mutual buck-passing among all parties, harming the interests of financial consumers and being detrimental to the stability of the financial market.

3.4 Data Privacy and Security Issues

The operation of intelligent algorithms relies on a large amount of financial data, which contains consumers' personal sensitive information, such as ID numbers, bank card numbers, transaction records, etc. During the process of data collection, storage and use, if the security measures of financial institutions are not in place, it may lead to data leakage, causing serious economic losses and privacy violations to consumers. Furthermore, some financial institutions, in pursuit of algorithm accuracy, may over-collect consumers' data, infringing upon consumers' privacy rights.

4. Ethical Boundaries of Intelligent Algorithms in Financial Decision-making

4.1 Fairness Boundary

Fairness is one of the fundamental principles of financial decision-making. Intelligent algorithms in financial decision-making should ensure that all consumers are treated equally, without discrimination based on factors such as race, gender, age, and region. Algorithm developers should take measures to eliminate biases in the data, conduct fairness evaluations and tests on the algorithms, and ensure the fairness of algorithm decisions. When financial institutions use algorithms for decision-making, they should establish a fair decision-making mechanism, supervise and review the results of algorithmic decisions, and promptly identify and correct problems of algorithmic discrimination.

4.2 Transparency Boundary

Transparency requires that the decision-making process and results of intelligent algorithms can

be understood and interpreted. Algorithm developers should make the structure and operation mechanism of the algorithm as transparent as possible and provide interpretable decision-making basis. Financial institutions should disclose to financial consumers the basic principles and key factors of algorithmic decision-making to safeguard consumers' right to know. Regulators should also require financial institutions to disclose information related to algorithms in order to supervise and evaluate algorithmic decisions.

4.3 Responsibility Boundaries

Clarifying the attribution of responsibility is the key to ensuring the legal and compliant operation of intelligent algorithms in financial decision-making. Algorithm developers, data providers and financial institutions should clearly define their respective responsibilities and obligations in algorithmic decision-making. Algorithm developers should ensure the quality and security of their algorithms and be responsible for any defects or errors in the algorithms. Data providers shall ensure the authenticity and accuracy of the data and be responsible for data quality issues. Financial institutions should make reasonable use of algorithms for decision-making and be responsible for the results of algorithmic decisions. At the same time, a corresponding accountability mechanism should be established to punish behaviors that violate ethical and legal provisions.

4.4 Privacy Boundaries

Protecting the data privacy of financial consumers is an important ethical requirement for intelligent algorithms in financial decision-making. Financial institutions should strictly abide by relevant laws and regulations and collect, store and use consumers' data in a legal and compliant manner. During the data collection process, the purpose and scope of data usage should be clearly informed to consumers, and their explicit consent should be obtained. At the same time, effective security measures should be taken to ensure the security and confidentiality of data and prevent data leakage and abuse.

5. Governance Path of Intelligent Algorithms in Financial Decision-Making

The application of intelligent algorithms in

financial decision-making is becoming increasingly widespread. To ensure their healthy and orderly development, it is necessary to build governance paths from multiple aspects such as technology, law, regulation and industry self-discipline.

From a technical perspective, algorithm developers should intensify research on explainable algorithms, adopt methods such as decision trees, and enhance the transparency of algorithmic decisions, for instance, by constructing explainable credit scoring models. At the same time, strengthen the quality management of financial data, establish a review and cleaning mechanism, correct deviations with technologies such as data augmentation, and reduce discrimination in credit algorithms. In addition, financial institutions should enhance the security protection of algorithms, adopt measures such as encryption and access control, and establish a monitoring and early warning mechanism to prevent algorithms from being tampered with or abused.

At the legal level, the government should accelerate the formulation and improvement of relevant laws and regulations to clarify the legal responsibilities for algorithm development, use and supervision, such as formulating algorithm fairness laws and data privacy protection regulations. An algorithm review system should also be established. Before financial institutions use intelligent algorithms, they need to submit them to the regulatory authorities for review. The review contents include fairness, transparency, security, etc. Those that fail the review are not allowed to use them.

At the regulatory level, given that the application of intelligent algorithms involves multiple fields, it is necessary to enhance cross-departmental regulatory collaboration, establish a unified framework and coordination mechanism, clarify the division of responsibilities, and strengthen information sharing. Regulatory authorities should strengthen on-site inspections and off-site supervision. They should understand the actual situation through on-site inspections and monitor risks in real time through off-site supervision. At the same time, regular algorithm audits and evaluations should be carried out, and the results should be used as an important basis for the regulatory ratings and access and exit of financial institutions.

At the industry self-discipline level, financial industry associations should organize their

member units to formulate standards and norms for the application of intelligent algorithms, clearly defining requirements for development, use, and management, such as setting fairness standards and privacy protection norms. Carry out industry training and exchange activities to enhance the algorithmic literacy and ethical awareness of practitioners, enabling them to master ethical governance methods and skills and share application experiences. In addition, an industry self-discipline mechanism should be established to impose self-disciplinary actions on member units that violate standards and norms, such as warnings, public criticism, and fines, in order to maintain industry order and a fair competitive environment.

Through the above multi-level governance paths, the application of intelligent algorithms in financial decision-making can be effectively regulated, promoting the healthy and stable development of the financial industry.

6. Conclusion

The application of intelligent algorithms in financial decision-making has brought huge opportunities and changes to the financial industry, but it has also triggered a series of ethical issues. Clarifying the ethical boundaries of intelligent algorithms in financial decision-making and exploring effective governance paths from multiple aspects such as technology, law, regulation, and industry self-discipline is the key to ensuring the healthy and sustainable development of intelligent algorithms. Through the joint efforts of all parties, establishing and improving the ethical governance system for intelligent algorithms can promote the rational application of intelligent algorithms in financial decision-making, maintain the fairness, justice and stability of the financial market, protect the legitimate rights and interests of financial consumers, and drive the high-quality development of the financial

industry. In the future, with the continuous advancement of artificial intelligence technology and the continuous expansion of application scenarios, the ethical governance of intelligent algorithms will also face new challenges and opportunities, which require continuous attention and research, as well as the continuous improvement of governance mechanisms and methods.

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