

The Ethical Dilemma of Machine Learning: A Study on the Algorithmic Power Alienation of "Big Data Price Discrimination" in Financial Digitalization

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Abstract

This article focuses on the phenomenon of "big data price discrimination" triggered by machine learning algorithms in the process of financial digitalization and deeply analyzes the problem of algorithmic power alienation behind it. Through the presentation and characteristic analysis of the "big data price discrimination" phenomenon, this paper reveals the process by which algorithmic power has evolved from a technical tool to a dominant force in the financial field, as well as the ethical dilemmas it brings about, such as the infringement of consumer rights and interests, the destruction of market fairness, and the crisis of social trust. Further explore the root causes of the alienation of algorithmic power, including the subjective intentions of algorithm designers, data bias, algorithmic black boxes, and the lack of supervision, etc. Finally, strategies to deal with the alienation of algorithmic power are proposed, aiming to promote the ethical application of machine learning algorithms in financial digitalization and achieve the harmonious development of technology and society.

Keywords: Machine learning; Financial digitalization; Big data price discrimination; Algorithmic power alienation; Ethical Dilemma.

1. Introduction

In today's digital age, the financial industry is undergoing unprecedented changes, and financial digitalization has become an unstoppable development trend. As one of the core technologies of artificial intelligence, machine learning has been widely applied in the financial field due to its powerful data processing and pattern recognition capabilities^[1]. From risk assessment, credit approval to personalized recommendation, machine learning algorithms run through every link of financial business, providing more efficient and accurate decision support for financial institutions and bringing more convenient and personalized financial service experiences to customers.

However, with the in-depth application of machine learning algorithms in the digitalization of finance, a series of ethical issues have gradually emerged, among which the phenomenon of "big data price discrimination" has drawn particular attention. "Big data price discrimination" refers to the practice where enterprises use machine learning algorithms to conduct in-depth analysis of user data. Based on factors such as users' consumption habits and payment capabilities, they charge higher prices or provide worse services to existing or high-value users than to new or low-value users^[2]. This phenomenon not only violates business ethics and the principle of fair trade, but also infringes upon the legitimate rights and interests of consumers, posing a potential threat to the stability and healthy development of the financial market.

From an ethical perspective, "big data price discrimination" reflects the alienation of algorithmic power in the financial sector. Algorithms originally existed as auxiliary tools for human decision-making, but in the process of financial digitalization, they gradually acquired the ability to make autonomous decisions and began to have a significant impact on users' economic interests. When the decision-making of algorithms deviates from the principles of fairness, impartiality and transparency and instead pursues the maximization of commercial interests, the alienation of algorithmic power occurs^[3]. This kind of alienation not only leads to a trust crisis between consumers and financial institutions, but also undermines the fair competitive environment of the market and hinders the sustainable development of financial innovation.

The study of the algorithmic power alienation problem of "big data price discrimination" in financial digitalization has significant theoretical and practical significance. From a theoretical perspective, this research is conducive to a deeper understanding of the operational mechanism and ethical impact of

algorithmic power in the financial field, and enriches and develops the theoretical system of artificial

intelligence ethics. From a practical perspective, this research can provide guidance for financial institutions to standardize algorithm application and enhance ethical construction, and offer a basis for regulatory authorities to formulate relevant policies and strengthen market supervision, thereby promoting the healthy and orderly development of financial digitalization ^[4].

2. Presentation and Characteristic Analysis of the "Big Data Price Discrimination" Phenomenon

2.1 The Manifestation of the "Big Data Price Discrimination" Phenomenon

In the field of financial digitalization, the phenomenon of "big data price discrimination" is not uncommon. In terms of online travel platforms, air ticket and hotel reservations are high-risk areas for "big data price discrimination". Studies have shown that when old users search for the same flight or hotel, the prices displayed by the system are often higher than those of new users ^[5]. This is because online travel platforms collect users' browsing history, purchase records, search frequency and other data, and use machine learning algorithms to conduct user profiling analysis to determine users' loyalty and price sensitivity. For long-term users, the platform believes that they are highly dependent on it. Even if the price is slightly higher, they may still choose to make reservations on this platform. Therefore, the platform will increase the price to obtain higher profits. For instance, a user who frequently uses a certain online travel platform to book air tickets found that after multiple reservations, the price of the same flight gradually increased, while newly registered users could enjoy a lower price.

In the field of Internet finance lending, the phenomenon of "big data price discrimination" also exists. Some lending platforms will set different loan interest rates and loan amounts for different users based on factors such as their credit records, consumption capacity, and asset status. For old users with good credit records and strong repayment abilities, the platform may offer relatively lower loan amounts or higher interest rates, while for users with average credit status but newly registered, more favorable loan terms will be provided. This is because the platform believes that the repayment ability of old users is guaranteed. Even if the interest rate is raised, they can still repay on time. Meanwhile, to attract new users to use the platform's services, certain discounts will be offered. This practice not only harms the interests of existing users but also undermines the fair competitive environment of the market.

In terms of financial product recommendations, the algorithm will also make differentiated recommendations based on the user's asset status and consumption preferences. For high-net-worth clients, the platform may recommend high-risk, high-return products with relatively high transaction fees, while for ordinary clients, it may recommend more conservative products with lower returns and relatively lower transaction fees ^[7]. However, such recommendations may not necessarily meet the actual needs and risk tolerance of the clients. High-net-worth clients may not necessarily be suitable for high-risk products, while ordinary clients may also have the willingness to invest in high-yield products. This kind of differentiated recommendation by the algorithm is actually a manifestation of "big data price discrimination", with the aim of obtaining higher handling fee income.

2.2 Characteristics of "Big Data Price Discrimination"

2.2.1 Concealment

"Big data price discrimination" is often achieved through complex algorithmic models, making it difficult for consumers to directly notice that they are being treated differently. The algorithm conducts dynamic pricing and personalized recommendations based on a large amount of user data. Its decision-making process is opaque, and consumers cannot understand the specific reasons for price differences or service differences ^[8]. For instance, the price display on online travel platforms may be influenced by various factors, including users' search history, geographical location, device type, etc. It is difficult for consumers to determine whether the price fluctuations are due to market supply and demand or the "price gouging" behavior of algorithms. Even if consumers suspect that they have been "price gouged", it is very difficult for them to collect sufficient evidence to prove it.

2.2.2 Targeting

The algorithm can accurately identify user features and formulate different strategies for different user groups based on these features. By analyzing users' consumption behavior, preferences, payment capabilities and other data, algorithms can classify users into different levels and implement a "price gouging" strategy for high-value users or old users to obtain higher profits ^[9]. This targeted approach makes the harm of "big data price discrimination" to specific user groups more obvious. For instance, for long-term users who frequently use a certain financial service, the algorithm will consider that they have

a high dependence on the service. Even if the price is raised or the service quality is reduced, users will not give up using it easily. Therefore, these users will be subject to "price discrimination".

2.2.3 Universality

With the popularization of financial digitalization, an increasing number of financial institutions and Internet platforms have begun to apply machine learning algorithms, and the phenomenon of "big data price discrimination" has also shown a trend of widespread spread. It not only exists in traditional fields such as tourism and e-commerce, but also gradually emerges in core financial businesses such as financial lending and investment and wealth management. This universality has seriously affected the fairness and stability of the financial market, causing consumers to have concerns and distrust about the development of financial digitalization.

3. The Process and Manifestations of Algorithmic Power Alienation

3.1 The Evolution of Algorithmic Power from a Technical Tool to a Dominant Force

In the early stage of financial digitalization, machine learning algorithms were mainly used as a technical tool to assist financial institutions in data processing and decision-making analysis. The algorithm calculates and predicts the input data based on preset rules and models, providing decision-making references for financial institutions. However, with the continuous development of algorithmic technology and the explosive growth of data volume, algorithms have gradually gained the ability to make autonomous decisions. Algorithms can continuously adjust model parameters through self-learning and optimization to adapt to different market environments and user demands. In this process, algorithms are no longer merely passively performing tasks set by humans, but have begun to actively influence and shape the operational rules of financial markets and users' consumption behaviors, gradually evolving into a dominant power form.

3.2 Manifestations of Algorithmic Power Alienation

The most direct manifestation of "big data price discrimination" is the infringement upon consumers' rights and interests. Consumers are charged higher prices or receive worse services without their knowledge, and their rights to fair trade and information have been seriously violated. In addition, algorithms conducting precise marketing and pricing based on users' personal information may also lead to the leakage of consumers' privacy and the abuse of personal information.

The alienation of algorithmic power undermines the fair competitive environment of the financial market. Through "big data price discrimination", enterprises can implement differentiated pricing strategies for different user groups, thereby gaining an unfair competitive advantage. This kind of behavior not only harms the interests of other enterprises, but also hinders the innovation and development of the market. In the long term, it will lead to the distortion of market resource allocation and reduce market efficiency.

The frequent occurrence of the "big data price discrimination" phenomenon has led to the public's distrust of financial institutions and Internet platforms. Consumers are beginning to doubt the fairness and transparency of algorithmic decisions and are cautious about the development of financial digitalization. This trust crisis will not only affect the reputation and business development of financial institutions, but also have a negative impact on the economic order and stability of the entire society.

4. Root Cause Analysis of the Alienation of Algorithmic Power

4.1 The Subjective Intention of the Algorithm Designer

Algorithms are designed and developed by humans. The subjective intentions and values of algorithm designers will directly affect the design and application of algorithms. In some cases, algorithm designers, in pursuit of maximizing the commercial interests of enterprises, may deliberately set up a "price gouging" mechanism in the algorithm, and increase the profits of enterprises by offering differentiated pricing for different user groups. Furthermore, algorithm designers may lack sufficient consideration of ethical issues and fail to recognize the negative impacts that algorithmic decisions could have on consumers and society.

4.2 Data Bias

Data is the foundation of machine learning algorithms, and the quality and bias of data will directly affect the decision-making results of the algorithms. If the training data is biased, such as unbalanced data samples or inaccurate data labeling, the algorithm may learn incorrect patterns and rules, thereby leading to unfair treatment of different user groups. For instance, in the field of financial lending, if there are too many samples of high-income groups and too few samples of low-income groups in the training data, the

algorithm may discriminate against low-income groups, granting them lower loan amounts or higher interest rates.

4.3 Algorithm Black Box

Machine learning algorithms usually have complex structures and models, and their decision-making processes are difficult to explain and understand, thus being called "algorithm black boxes". Due to the black box nature of algorithms, financial institutions and regulatory authorities find it difficult to supervise and review the decisions made by algorithms, and consumers are also unable to understand how algorithms make decisions. This opacity provides space for the alienation of algorithmic power, allowing unfair phenomena such as "big data price discrimination" to be concealed and perpetuated.

4.4 Regulatory Deficiencies

At present, there are still many deficiencies in the supervision of the alienation of algorithmic power in financial digitalization. On the one hand, the current laws and regulations do not provide clear norms and constraints on algorithmic decision-making, lacking specific definitions and penalty measures for behaviors such as "big data price discrimination". On the other hand, the technical capabilities and regulatory means of the regulatory authorities are relatively lagging behind, making it difficult to effectively monitor and evaluate complex algorithm models. In addition, the cross-industry and cross-regional characteristics of the financial digitalization field have also increased the difficulty of supervision, leading to problems of poor coordination among regulatory authorities.

5. Strategies for Dealing with the Alienation of Algorithmic Power

5.1 Strengthen Algorithmic Ethics Education

Enhancing the ethical awareness of algorithm designers and related practitioners is an important prerequisite for dealing with the alienation of algorithmic power. Colleges and training institutions should incorporate algorithm ethics into the relevant professional curriculum systems to cultivate students' ability to consider ethical issues in the process of algorithm design and application. Financial institutions and enterprises should also enhance ethical training for their employees, establish ethical standards and behavioral norms, and guide employees to establish correct values and professional ethics.

5.2 Optimize Data Quality

To reduce the impact of data bias on algorithmic decisions, it is necessary to enhance data management and optimize data quality. Financial institutions and enterprises should establish sound data collection, storage and processing mechanisms to ensure the accuracy, completeness and representativeness of the data. During the data collection process, the characteristics and demands of different user groups should be fully considered to avoid the imbalance of data samples. At the same time, it is necessary to strengthen the review and supervision of data annotation to improve the quality of data annotation.

5.3 Enhance Algorithm Transparency

Solving the black box problem of algorithms is the key to dealing with the alienation of algorithmic power. On the one hand, algorithm designers should adopt interpretable algorithm models so that the decision-making process of the algorithm can be understood and interpreted. For instance, use algorithm models with strong interpretability such as decision trees and logistic regression, or develop specialized algorithm interpretation tools to explain and illustrate the decision-making results of complex algorithms. On the other hand, financial institutions and enterprises should proactively disclose to consumers and regulatory authorities information such as the basic principles, decision-making basis and influencing factors of algorithms to enhance the transparency of algorithms.

5.4 Improve the Regulatory System

Establishing and improving a regulatory system for the alienation of algorithmic power in financial digitalization is an important guarantee for ensuring market fairness and consumer rights and interests. The government should accelerate the formulation of relevant laws and regulations, clarify the norms and standards for algorithmic decision-making, and provide clear definitions and penalties for unfair behaviors such as "big data price discrimination". Regulatory authorities should enhance technological investment, improve their own technological capabilities and regulatory means, establish an algorithm monitoring and evaluation mechanism, and conduct real-time monitoring and regular assessment of the algorithm application of financial institutions and enterprises. At the same time, it is necessary to enhance coordination and cooperation among regulatory authorities, establish a cross-departmental and cross-regional regulatory linkage mechanism, and form a regulatory synergy.

5.5 Strengthen Consumer Protection

Strengthening the protection of consumers is an important goal in addressing the alienation of algorithmic power. The government and regulatory authorities should establish and improve consumer complaint and rights protection mechanisms, smooth out consumer complaint channels, and handle consumers' complaints and reports in a timely manner. Financial institutions and enterprises should enhance the protection of consumers' rights and interests, establish consumer information protection systems, and strictly keep consumers' personal information confidential. At the same time, it is necessary to enhance the education and guidance for consumers, improve their algorithmic literacy and risk awareness, so that consumers can better cope with the impact brought by algorithmic decisions.

6. Conclusion

The issue of algorithmic power alienation in "big data price discrimination" in financial digitalization is a complex problem involving multiple aspects such as technology, ethics, law and society. The evolution of algorithmic power from a technical tool to a dominant force has led to ethical dilemmas such as the infringement of consumer rights, the disruption of market fairness, and the crisis of social trust. The subjective intentions of algorithm designers, data bias, algorithm black boxes, and the lack of supervision are the root causes of the alienation of algorithmic power. To address the alienation of algorithmic power, efforts need to be made in multiple aspects, including strengthening algorithmic ethics education, optimizing data quality, enhancing algorithmic transparency, improving the regulatory system, and reinforcing consumer protection. Only through the joint participation and collaboration of all parties can the ethical application of machine learning algorithms in financial digitalization be promoted, and the harmonious development of technology and society be achieved. In future research, it is necessary to further delve into the essence and operational mechanism of algorithmic power, and continuously improve strategies and measures to deal with the alienation of algorithmic power, in order to meet the demands of the rapid development of financial digitalization.

REFERENCES

- [1] Ahmed, S., Alshater, M. M., El Ammari, A., & Hammami, H. (2022). Artificial intelligence and machine learning in finance: A bibliometric review. *Research in International Business and Finance*, 61, 101646.
- [2] Zuboff, S. (2019). *The age of surveillance capitalism: The fight for a human future at the new frontier of power*, edn. PublicAffairs, New York.
- [3] Balch, A. (2024). Why algorithms remain unjust: Power structures surrounding algorithmic activity. arXiv preprint arXiv:2405.18461.
- [4] Eubanks, V. (2018). *Automating inequality: How high-tech tools profile, police, and punish the poor*. St. Martin's Press.
- [5] Hannak, A., Soeller, G., Lazer, D., Mislove, A., & Wilson, C. (2014, November). Measuring price discrimination and steering on e-commerce web sites. In *Proceedings of the 2014 conference on internet measurement conference* (pp. 305-318).
- [6] Fourcade, M., & Healy, K. (2013). Classification situations: Life-chances in the neoliberal era. *Accounting, organizations and society*, 38(8), 559-572.
- [7] Barocas, S., & Selbst, A. D. (2016). Big data's disparate impact. *Calif. L. Rev.*, 104, 671.
- [8] Pasquale, F. (2015). *The black box society: The secret algorithms that control money and information*. Harvard University Press.
- [9] Noble, S. U. (2018). Algorithms of oppression: How search engines reinforce racism. In *Algorithms of oppression*. New York university press.
- [10] Verma, S. (2019). Weapons of math destruction: how big data increases inequality and threatens democracy. *Vikalpa*, 44(2), 97-98.