**Journal of Information Systems Engineering and Management**
2025, 10(38s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

**Research Article**

# Algorithmic Monopolization and Antitrust Regulation in the AI Industry

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**ARTICLE INFO**

Received: 17 Dec 2024

Revised: 18 Feb 2025

Accepted: 24 Feb 2025

**ABSTRACT**

Since the birth of Chat GPT in 2022, artificial intelligence (AI) has led global industrial upgrading, in which algorithms play a key role, but the problem of algorithmic monopoly has also come to the forefront, and antitrust regulation is necessary. This paper discusses the formation mechanism and manifestation of algorithmic monopoly in the AI industry, analyzes the theory and international experience of antitrust regulation, studies the dilemma of identifying and determining algorithmic monopoly and data privacy security, and proposes corresponding regulatory strategies. This paper comprehensively utilizes literature research, comparative method, and interdisciplinary data collection method to obtain data. It conducts theoretical analysis from the perspectives of computer science, economics, jurisprudence, and other multidisciplinary perspectives, to build a brand new antitrust analytical framework and put forward prospective regulatory strategies. As far as the research results are concerned, this paper clarifies the types of algorithmic monopoly behaviors and the theoretical challenges to the antitrust law, combs through typical cases to reveal their manifestations, harmful consequences, and regulatory difficulties, and proposes a sound classification and comprehensive

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regulation model and a collaborative governance strategy for multiple subjects. Based on this, this paper enriches the theoretical system of AI and antitrust, supports the improvement of antitrust law, and helps regulators formulate policies and law enforcement, maintain fair competition in the market, and protect the rights and interests of enterprises and consumers.

**Keywords:** AI, Algorithmic Monopoly, Antitrust Regulation, Market Competition, Data Privacy

## 1. INTRODUCTION

Since the birth of Chat GPT in 2022, artificial intelligence (AI) has been leading the global industrial upgrade (Ricardo Silva Peres et al., 2020). In 2014, AI showed a pattern of simultaneous development of software and hardware. In the software field, super AI applications have emerged one after another as phenomenal and profitable companies in the fields of marketing and promotion, assisted office, intelligent decision-making, and video production (M. A. Talib et al., 2020). In the hardware field, AI consumer electronics products are beginning to be created, and smart devices such as AI glasses, AI headphones, and brain-computer interface technology are bringing new experiences (L. Morra et al., 2020). The scale of China's AI industry is also expanding, penetrating traditional industries, continuing to be applied in areas such as AI robotics, AI education, and AI medical care, accelerating the optimization and upgrading of industries, and bringing a wide range of innovation opportunities to all areas of society. Algorithms, as one of the core elements of AI, play a key role in the industry (N. Ahmed et al., 2023). Algorithms are the key technology for realizing automated decision-making in AI, which enables computers to simulate human intelligent behaviors (e.g., learning, reasoning, and prediction) through the analysis and processing of large amounts of data. Algorithms can improve the efficiency of social operations and save users a lot of money, time, and resources (e.g., e-commerce, smart travel, etc.). In addition, algorithms are also an important means of innovation and competition for enterprises. By continuously optimizing algorithms, enterprises can improve the quality and competitiveness of their products and services, and gain more market share and profits (J. Sánchez-Cartas et al., 2022).

However, the problem of algorithmic monopolization has also gradually come to the fore. Some enterprises with the dominant market positions may use algorithms to implement monopolistic behaviors (e.g., algorithmic collusion, algorithmic abuse, algorithm-driven operator concentration, etc.) (Hongfu Liu, 2024). Algorithmic monopoly is characterized by novelty, professionalism, complexity, and concealment, and is not easy to identify and regulate, bringing serious harm to market competition and consumer rights. Algorithmic monopoly will lead to the distortion of market competition, limit the development space of small and medium-sized enterprises (SMEs), and reduce market efficiency and innovation (Yijun Yuan, 2024). It also jeopardizes consumers' right to choose and fair trade, resulting in higher prices, lower quality, and fewer choices for consumers. Algorithmic monopoly also raises data privacy and security issues, such as the use of algorithms by companies to collect and analyze user data to promote accurate advertising and price discrimination (S. Loertscher et al., 2020).

Given the harm of algorithmic monopoly behavior, it is particularly necessary to carry out anti-monopoly regulation on it (Lingxiao Wu, 2023). It can maintain the means of fair competition in the market, and by restraining the relevant behavior, it can prevent enterprises from abusing their dominant market position, protect the legitimate rights and interests of small and medium-sized enterprises, and promote the healthy development of the market. It can protect the rights and interests of consumers, through the constraints of relevant behavior, to ensure that consumers enjoy fair prices, quality products, and services, and to protect the consumers' right to choose and the right to know. Finally, it can promote the sustainable development of the AI industry, encourage enterprises to innovate and compete, improve the overall efficiency and competitiveness of the industry, and promote the development of AI.

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This paper enriches the theoretical system of AI and antitrust by expanding the research perspective from multidisciplinary integration. The problem of algorithmic monopoly in the AI industry involves the fields of computer science, economics, law, and other disciplines. The research on this issue can help break the disciplinary barriers, promote interdisciplinary cross-fertilization and synergistic development, analyze the formation mechanism, behavioral characteristics, and consequences of algorithmic monopoly from different disciplinary perspectives, provide new theories for interdisciplinary research, and enrich and improve the theoretical system of related interdisciplinary disciplines. In addition, the research results of this paper can deepen the understanding of the law of competition in the digital economy. Under the background of the rapid development of the AI industry, traditional competition theory and market law are facing brand new challenges and opportunities (R. Molski, 2022). Through the research of algorithmic monopoly and antitrust regulation, it can more deeply understand the new characteristics and new trends of market competition in the digital economy, such as the dynamics of the market driven by algorithms, the importance of data elements, etc., to further enrich and improve the theory of competition in the digital economy.

This paper provides theoretical support for the improvement of antitrust law. It fills the gaps in the antitrust law, and there are certain limitations in the existing antitrust law when facing the problem of algorithmic monopolization in the AI industry. For example, there is ambiguity in the legal definition of new monopoly behaviors such as algorithmic collusion and algorithmic abuse, and the provisions of legal responsibility are not clear enough. The in-depth research of algorithmic monopoly in this paper can systematically sort out the relevant behavioral manifestations and legal characteristics, provide specific legislative proposals for the revision and improvement of relevant laws, fill the legal gaps, and make the antitrust law better able to cope with the challenges of AI. Algorithmic monopoly has the characteristics of technical complexity and concealment, and the traditional antitrust law has difficulties in identifying and evaluating it in terms of analytical methods and tools, this paper optimizes the relevant analytical framework through research. Through the introduction of new technical means and economic analysis methods (such as big data analysis, algorithmic simulation, etc.) to optimize the analysis means, improve the accuracy and scientific of the application of the law, and provide more solution paths for the determination of algorithmic monopoly behavior.

The research results of this paper can help regulators formulate policies and antitrust enforcement. It provides comprehensive and accurate information support and a decision-making basis for regulators to formulate antitrust policies for the AI industry. Through an in-depth analysis of the status quo, trend, and impact of algorithmic monopoly, this paper clarifies the focus and direction of policy formulation and promotes the introduction of targeted and forward-looking policy measures to guide the development of AI. It helps regulators understand the behavioral patterns and technical means of algorithmic monopoly and improves their ability to identify monopoly behavior and investigate and collect evidence. At the same time, it combines advanced technological means and data analysis methods to build an intelligent regulatory platform and law enforcement tools, realizing real-time monitoring and dynamic supervision of market entities, timely detection and investigation of algorithmic monopoly behaviors, and enhancing law enforcement effectiveness and precision.

The research results of this paper can effectively maintain fair competition in the market. It prevents excessive concentration of market power. Algorithm monopoly will lead to a small number of enterprises controlling the market by technical advantages and data resources, forming market barriers, restricting the entry and development of other enterprises, and destroying fair competition. Through antitrust regulation, it can effectively curb the excessive concentration of market resources, promote market diversification and healthy competition, and provide fair development opportunities for all types of enterprises. It promotes technological innovation. By regulating the monopolistic behavior of algorithms, breaking the technological monopoly and market blockade, encouraging enterprises to increase R&D investment and technological innovation, promoting the technological progress and

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product upgrading of the AI industry, improving the competitiveness of the industry and its innovation ability, and realizing the sustainable development of the industry.

The research results of this paper can protect the rights and interests of enterprises and consumers. For small and medium-sized enterprises (SMEs), algorithmic monopolization will expose them to unfair competitive pressure, leading to a decline in market share and operational difficulties. Antitrust regulation can provide legal protection and policy support for them, safeguard their legitimate rights and interests, promote enterprise development, and increase market vitality. Algorithmic monopolization can lead to problems such as non-transparent information and limited choices for consumers when purchasing goods or services, e.g., induced consumption and price discrimination. By strengthening anti-monopoly regulation and regulating the behavior of enterprises in terms of algorithms, it safeguards consumers' right to know and right to choose, so that consumers can make rational consumption decisions based on fully understanding information and improve their welfare level.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### *2.1 Antitrust Regulation Theories*

*Economic Theories*

Structuralism emphasizes the impact of market structure on competition, arguing that a market structure with a high degree of concentration and a small number of firms is likely to lead to monopolistic behaviour and abuse of market power (Ahmed Saeed Rashied et al., 2024). For example, Bain's Structure-Conduct-Performance paradigm argues that a highly concentrated market structure gives firms more market power, which may raise prices and limit output through collusion, to the detriment of consumer welfare and market efficiency (Wang Qing-xiang, 2009). Behaviorism focuses on the analysis of firms' specific behaviors rather than just market structure (Irina Surdu et al., 2020). It believes that the monopolistic behavior of enterprises, such as collusion and abuse of dominant market position, is the focus of antitrust attention. Represented by the Chicago School, which emphasizes the self-correcting ability of the market, it believes that even if a certain monopoly structure exists in the market, as long as the behavior of the enterprise does not substantially restrict competition, it should not intervene excessively (A. Triggs et al., 2019). However, anti-competitive behavior such as apparent collusion should still be regulated.

The traditional economic theory of antitrust faces many challenges in the age of AI (R. Molski, 2022). First, collusive behavior has become more insidious and harder to detect. Traditional antitrust enforcement relies heavily on the discovery of clear communications and agreements between firms, but algorithmic collusion can be realized through complex algorithms and data interactions that do not require direct, clear communications from firms (Li Cheng, 2023). Second, market definition and market assessment are difficult. Market boundaries in the AI industry are often blurred, and it is difficult to accurately define the scope of an enterprise's business and market influence (Sonali Yadav et al., 2024). The application of algorithms makes the scope of enterprise competition and the way of competition change, and the traditional market definition method of opportunity products and geography is no longer used (J. Sánchez-Cartas et al., 2022). At the same time, the dynamics and complexity of the algorithm also increase the difficulty of assessing the enterprise market, and the enterprise market power will continue to change with the optimization of the algorithm and data accumulation. Third, AI is a field of rapid innovation, and algorithmic innovation and parameter advancement have far-reaching impacts on the competitive landscape of the market (Endalkachew Desta et al., 2024). The traditional antitrust theory is relatively simple in assessing monopoly behavior, considering the innovation factor and focusing mainly on short-term price and output effects. In the age of AI, algorithmic monopolization may have a more complex impact on innovation, either inhibiting it or promoting it to a certain extent, and thus requires in-depth analysis.

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The impact of algorithmic collusion on market efficiency is reflected in three aspects: short-term price distortion, resource allocation distortion, and long-term dynamic efficiency loss (Cristian Chica et al., 2024). Algorithmic collusion can lead to market prices being artificially too high and consumers having to pay higher prices for goods or services, thus reducing consumers' real purchasing power and welfare levels (Emilio Calvano et al., 2020). In addition, due to the distortion of price signals, leads to an over-concentration of resources in the monopoly firms, and other more promising innovative firms or projects cannot be supported by sufficient resources, resulting in inefficient allocation of resources. Finally, by restricting competition, short-haired monopolies reduce market incentives and pressures to innovate, leading to a slowdown in technological progress, which in the long run can undermine the efficiency of market dynamics.

The impact of algorithms on innovation is reflected in three aspects: inhibiting innovation incentives, hindering innovation diffusion, and facilitating innovation investment (I. Cockburn et al., 2018). Firms with algorithmic monopoly status may restrict the innovation space of other firms by controlling data and algorithmic resources, making potential innovators tender to obtain sufficient data and technical support, thus inhibiting the innovation drive of the whole market. In addition, to maintain their monopoly position, algorithm monopoly enterprises will hinder the diffusion and application of new technologies and algorithms, reducing the social benefits of innovation (C. Hutchinson et al., 2021). Of course, algorithmic monopoly enterprises will increase their investment in R&D to ensure their leading position, which to a certain extent will also promote innovation. However, the purpose of their innovation is to consolidate their monopoly position, not to improve market competition as well as social welfare.

*Jurisprudential Theory of Antitrust*

In China, anti-monopoly legislation has gone through a long history of development. On June 24, 2022, China amended the Anti-Monopoly Law, Article 9 which explicitly prohibits operators from using algorithms to exclude or restrict market competition. Article 22(2) prohibits operators with a dominant market position from using algorithms to commit an abuse of the dominant market position. In addition, China has also made clear provisions on the use of algorithms by operators to reach monopoly agreements, as well as the use of algorithms to carry out acts such as refusing to deal, restricting transactions, and differential treatment. It is stated in the law that the factors that can be taken into account to constitute differential treatment include operators in the platform economy implementing differentiated transaction prices or other transaction conditions based on big data and algorithms, with the payment ability, consumption preferences, and usage habits of the counterparty to the transaction. In addition, on June 24, 2024, in the judicial interpretation of civil dispute cases involving monopoly, the Supreme People's Court made special provisions on the use of technical means by operators to reach and implement horizontal or vertical monopoly agreements. It pointed out that horizontal monopoly agreements include monopoly conspiracies reached by using data, algorithms, technology, platform rules, and other means. Vertical monopoly agreements, on the other hand, include agreements reached by operators using technological means to achieve limited or automated setting of resale prices of goods.

The above legislative developments reflect China's strategy in dealing with algorithmic monopolization in the age of AI. The legal recognition of monopoly agreements has become more comprehensive, covering not only traditional oral or written monopoly agreements but also new types of invisible conspiracies reached using data, algorithms, technology, and other means (G. Colangelo et al., 2021). The abuse of a dominant market position is refined to comprehensively regulate unfair prices, selling below cost, refusing to trade, limiting trading, tying, and attaching unreasonable conditions and differential treatment. Finally, it focuses on the emerging field of platform economy, taking into account the characteristics of bilateral or multilateral market competition and non-price competition in the platform economy, and provides specific guidelines for the determination of algorithmic monopolistic behavior.

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*International experience*

In 2017, the European Commission issued a €2.42 billion fine against Google for abusing its dominant position in the search engine market to optimize its price comparison services (Penelope A. Bergkamp, 2019). In October 2020, the U.S. Department of Justice filed a lawsuit against Google alleging unlawful abuse of its dominant position in the search engine market (Germán Bet et al., 2022). In January 2023, the U.S. Department of Justice, in conjunction with eight states, filed a lawsuit against Google again, alleging an illegally monopolizing the digital advertising market and demanding a breakup of its ad technology business. On April 30, 2024, the U.S. Federal Court in San Francisco accepted an antitrust class action lawsuit filed by eight individual consumers alleging that six hotel chains, including Hilton, violated U.S. antitrust laws by using AI software to manipulate the price of guest rooms in a way that allegedly constituted concerted fixed-price behavior. In November 2024, the European Commission imposed a $7.98 million fine against Meta with a €798 million fine for violating EU antitrust regulations by bundling its online classified ad service Facebook Marketplace with its social platform Facebook, and imposing unfair trading conditions on other online classified ad service providers.

By integrating the above cases, it is possible to identify the strategies held by international regulation on algorithmic monopoly. First, in terms of ex-ante intervention in dynamic regulation, the relevant agencies adopt early intervention and continuous tracking to avoid the occurrence of algorithmic monopoly phenomenon. European and American regulators tend to intervene before tech companies succeed in dominating the AI market (Aleksandra Kuzior, 2024). For example, the European Commission sent formal requests for information to Google, Facebook and TikTok, and Microsoft in March and May 2024, respectively, asking for information about the risks and mitigation measures posed by generating AI. It conducts dynamic monitoring of corporate market behavior to identify potential monopoly risks promptly. For example, when the U.S. Department of Justice and the FTC investigated Nvidia, Microsoft, and Open AI, they not only paid attention to the current cooperation and business model but also assessed their future development strategies and market layout.

Second, multi-agency synergy and international cooperation are considered in the regulatory strategy. In terms of multi-agency synergy, multiple agencies, including the European Commission, the UK Competition and Markets Authority, the US Federal Trade Commission, and the US Department of Justice, have signed a joint statement aiming to ensure fair competition in the AI market, protect the interests of enterprises and consumers, and strengthen the regulation of the AI industry. It has actively carried out international regulatory coordination and cooperation to jointly respond to the monopolistic behavior of multinational technology enterprises (Shashwat Tiwari et al., 2024). For example, the EU and the U.S. have shared information in antitrust investigations in the field of AI and promoted the establishment of a unified international digital regulatory framework.

Third, consider a combination of focus area regulation and comprehensive review. In the focus areas, the main focus is on the key aspects of the AI industry, such as data and algorithms, for attention and review. For example, the EU's AI Act requires model developers to comply with the Copyright Directive and regulate the use of data (A. Manchev, 2024). Further, it conducts a comprehensive review of all types of transaction behavior of technology companies, including investment, mergers and acquisitions, and cooperation agreements. For example, the EU has conducted several reviews of Microsoft's partnership with Open AI, focusing on whether there are exclusivity clauses and other issues. In addition, strict enforcement and high fines will be adopted as a deterrent, and once monopolistic behaviors are found, they will be resolutely departed to create a deterrent effect on the offending enterprises.

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## 3. RESEARCH DESIGN AND METHODS

In terms of data acquisition, this study comprehensively utilizes a variety of research methods, including literature research, comparative method, and interdisciplinary data collection method, to dialectically view the issue of algorithmic monopoly and legal regulation in the AI industry from multiple perspectives, to construct a brand-new analytical framework, and to put forward targeted and prospective regulatory strategies. Secondly, through literature research, we extensively collect and systematically sort out relevant academic literature, policy documents, industry reports cases, etc. in China and other countries, to comprehensively understand the current research status, theoretical foundation, time-pressing experience, and existing problems of algorithmic monopoly and anti-monopoly regulation in the AI industry. Through in-depth analysis, generalization, and summarization, the relevant literature provides a solid theoretical foundation and time reference for this study, while avoiding repetitive research and ensuring innovation and cutting-edge. Furthermore, data collection on algorithmic monopoly and related laws, regulatory systems, and enforcement cases in the AI industry in different countries and regions is conducted. Analyze the differences in their objectives, scope, determination standards, penalties, etc., and summarize their respective advantages and shortcomings. In addition, the characteristics, manifestations, and harmful consequences of traditional monopoly behavior and algorithmic monopoly behavior are compared to reveal the specificity and complexity of algorithmic monopoly and to provide a basis for the development of targeted regulatory strategies. Finally, the relevant issues involve multiple disciplines such as computer science, economics, law, management, etc. Therefore, this paper adopts the method of interdisciplinary data collection, integrates the theories and methods of different disciplines, and researches the relevant issues.

In terms of data analysis, this paper mainly utilizes a multidisciplinary perspective for theoretical analysis. In the field of computer science, this paper discusses in depth the technical principles, architectural design, and data processing of AI algorithms, and analyzes how algorithms can achieve automated decision-making through the learning and analysis of large amounts of data. In addition, it analyzes the characteristics of autonomy, complexity and opacity of algorithms, and discusses how they lead to monopolistic behavior, as well as the problem of concealment. It also focuses on the impact of deep learning, reinforcement learning, etc. on the market competition pattern to provide a technical level understanding of antitrust. In the field of economics, this paper analyzes the impact of algorithmic monopoly on market structure, market behavior, and market performance regarding the theories of industrial economics and information economics. It examines how algorithms change the dynamics of market competition, resulting in over-concentration of the market, reducing market efficiency and incentives to innovate, and causing harm to consumer welfare. Accordingly, we assess the consequences of algorithmic monopoly behavior and provide economic evidence for the

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necessity and rationality of antitrust regulation. In the field of jurisprudence, this paper studies the legal nature, identification criteria and legal responsibility of algorithmic monopoly behavior from the aspects of antitrust law, data protection law and intellectual property law. It analyzes the deficiencies and challenges of the existing legal system in dealing with the algorithmic problem and explores how to improve the antitrust legal system, coordinate the relationship between different laws, and construct an effective legal system.

In terms of the presentation of research results, this paper aims to build a new antitrust analysis framework and propose targeted and forward-looking strategies. The analytical framework part, mainly explores the behavior of market players (such as algorithm developers, enterprises, data suppliers, users, etc.), analyzes the roles of various types of market players in the formation of algorithmic monopoly, as well as the relationship of the relevant interest game, and provides a micro-foundation for the formulation of targeted strategies. In addition, this paper aims to establish an analytical framework for comprehensively assessing the impact of algorithmic monopoly on market competition, taking into account market concentration, barriers to entry, innovation capacity, consumer choice and other indicators, to provide evidence for antitrust enforcement. Based on the above results, this paper builds a governance path for algorithmic monopoly, including technological governance, legal regulation, and industry collaboration.

## 4. RESULTS

### *4.1 Algorithmic Monopoly Mechanisms and Manifestations*

*Algorithm monopoly*

Algorithmic monopoly refers to the phenomenon whereby operators in the AI industry take advantage of algorithmic technology and, through a data-driven automated decision-making process, engage in conduct that excludes or restricts competition, thereby acquiring or maintaining a monopoly position in the relevant market (Li Cheng, 2023). Its specific manifestations are varied and include algorithmic collusion, personalized pricing, self-preferential treatment, predatory pricing, exploitative abuse and algorithm-driven operator concentration.

Distinguished from the traditional industry monopoly, algorithmic monopoly has some different characteristics. First, in the subject and mode of behavior. Traditional monopoly is usually implemented by enterprises with obvious market dominance through agreements or abuse of market dominance, such as inter-enterprise monopoly agreements, production restrictions, market division and so on (Zhiyong Liu et al., 2011). But in the algorithmic monopoly, the algorithm to a certain extent instead of the traditional decision-making, enterprises can realize the monopoly purpose through complex computer design and automated decision-making, the actors are more hidden and even appear in the lack of obvious meaning of liaison through the algorithm of interaction and convergence to form a monopoly (Kathleen A. Creel et al., 2021). Second, in terms of market structure and competitive environment. Traditional monopoly tends to appear in industries with high market concentration and large barriers to entry. Enterprises restrict new entrants by controlling production factors, technology patents and other means. An algorithmic monopoly, it is presented in a relatively more open and competitive digital market (Lingxiao Wu, 2023). Enterprises take advantage of algorithms to quickly collect and analyze market data, adjust business strategies, and achieve monopoly effects through the precise operation of algorithms even when their market share is not high, which is more likely to result in monopoly conspiracy. Third, in terms of behavioral qualities. Traditional monopoly behavior is more intuitive, easy to be detected, such as the abuse of market dominance, usually requires the existence of a clear subject and behavior. While algorithmic monopoly has strong concealment and complexity, algorithmic black box characteristics lead to its decision-making process being difficult to completely understand by the outside world and

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e-ISSN: 2468-4376
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supervision, enterprises can use the complexity and opacity of the algorithm to cover up its monopoly behavior, which increases the difficulty of supervision and identification (Yadong Song et al., 2024).

It is worth noting that algorithmic monopolies remain closely linked to traditional monopolies in some respects. First, there is a congruence between the two in terms of purpose and outcome. Whether algorithmic monopoly or traditional monopoly, their essential purpose is to obtain or maintain the dominant position of enterprises in the market, so as to achieve profit maximization or other economic interests. In terms of results, both will have the effect of restricting or excluding market competition, which will lead to the reduction of market efficiency, consumer interests, and other problems. Secondly, they are similar in behavior. Algorithmic monopoly also contains, to a certain extent, the behavioral characteristics of traditional monopolies, such as price fixing, market segmentation, and abuse of market position. For example, algorithmic conspiracy is essentially a kind of price fixing or concerted behavior, only through the algorithm as a means to achieve the above purposes. Algorithmic self-preferential treatment is similar to the abuse of dominant market position of traditional monopoly, i.e., firms use their algorithmic advantages based on more favorable treatment of their own products or services.

In algorithm monopoly, algorithm technology is at the core. First of all, algorithms can quickly process and analyze large amounts of data, helping enterprises to deeply understand market dynamics, consumer demand and competitors. Through the mining of data, enterprises can discover marketing opportunities and development trends, providing a basis for the formulation of monopoly strategy (Alexandra Amado et al., 2018). Secondly, algorithms can automatically make decisions and perform corresponding operations according to preset rules and goals. Enterprises can realize automated price adjustment, market access restriction, resource allocation and other behaviors through specific algorithms, thus improving the efficiency and accuracy of monopoly behaviors. Further, firms are able to use similar algorithms or through interactions between algorithms to enter into collusion to jointly restrict market competition without explicit communication. For example, algorithms between competitors will monitor and adjust market prices, ultimately leading to price convergence and the formation of a de facto monopoly agreement. Finally, algorithms, as a technical means, can help enterprises improve production efficiency, reduce costs, and improve product quality and service level through their optimization and innovation, but at the same time, they can also lead to the establishment and consolidation of market barriers by enterprises, preventing new entrants from competing and further reinforcing the monopoly position of enterprises (O. Bakanach et al., 2019).

*Formation factors*

Data dominance is an important reason for the formation of algorithmic monopoly. Data resources are characterized by scarcity and exclusivity (Yijun Yuan, 2024). The development of AI relies on a large amount of data for training and learning, so data becomes a key production factor. The larger, higher quality, and richer variety of data owned by an enterprise, the more accurate and smarter algorithmic models can be trained. However, data is not easy to acquire. Some enterprises have mastered a large amount of user data, industry data, and other scarce resources through long-term accumulation or mergers and acquisitions, and have formed exclusivity through technical means and legal restrictions, preventing competitors from acquiring the same data and creating conditions for algorithmic monopoly. In addition, the data advantage will form a positive feedback effect. Enterprises use a large amount of data to optimize their algorithms, improve the quality of their products and services, and attract more users to use them, which in turn generates more data, forming a virtuous cycle. However, at the same time, the concentration of data will also lead to market concentration, resulting in a small number of enterprises with data advantages to dominate the market, and it is easier to implement algorithmic monopoly behavior.

Technical barriers are another cause of algorithmic monopoly. Algorithm technology is characterized by complexity and specialization (O. Hornyák, 2022). The development and optimization of algorithms require professional technical knowledge and a large amount of research and

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development investment, involving deep learning, machine learning, data mining and other areas of technology. Enterprises mastering such technologies have a certain scale of team and R&D resources, and can continuously innovate and optimize algorithms to improve performance and efficiency, thus forming technical barriers. In addition, technological innovation and algorithm iteration update speed. Through continuous technological innovation, high-tech enterprises can maintain their advantages in algorithm technology and expand the gap with competitors. Small and medium-sized enterprises are difficult to keep up with technological development in a short period of time and face a higher technological threshold, making it easier for enterprises with technological advantages to form a monopoly in the market.

In addition, the market structure can also lead to algorithmic monopolies. The AI industry is characterized by significant network effects and economies of scale. For some Internet platforms, as the number of users increases, the value and attractiveness of the platform will also increase significantly, attracting more resources. Under this market structure, enterprises can make better use of the network effect and economies of scale through algorithm optimization to further expand their market share and consolidate their monopoly position. And the degree of concentration of the market structure also has an important impact on the formation of algorithmic monopoly. In industries with high market concentration, enterprises can effectively control market resources and restrict the development of new entrants through the application of algorithmic technology, to maintain or enhance their monopoly position (Georgii V. Kolesnik, 2024).

Further, operator strategy can also affect the formation of algorithmic monopolies. Operators can use algorithms to coordinate market behavior and maximize monopoly profits through explicit or implicit collusion. Explicit collusion, such as agreements between firms to fix prices and divide markets through algorithms. Implied collusion, such as collusion formed by enterprises through the use of similar algorithms or interactions between algorithms without explicit communication. In addition, operators with a dominant market position can use algorithms to self-prefer their products or services, such as prioritizing their display in web searches, system recommendations, etc., or exclude competition by restricting competitors' products or services from accessing the platform through algorithms.

Finally, market demand can lead to algorithmic monopoly. The development of the trend of market demand concentration and differentiation, enterprises through algorithms to accurately grasp the market demand, to provide products and services more in line with the personalized needs of consumers. This leads enterprises with advantages in meeting specific needs to seek a larger market share and profits through algorithmic monopoly. In addition, AI technology continues to create and lead emerging market needs. Enterprises are the first to introduce products or services that meet emerging needs through algorithms, quickly capturing the market and forming a first-mover advantage. If these companies can continue to innovate and optimize their algorithms to meet the changing needs of the market, they will be able to form a monopoly in the emerging market.

*Typical cases*

Algorithmic collusion

The case of U.S. Department of Justice v. David Tompkins is an important sample for studying algorithmic collusion. In that case, the conspiring enterprises utilized computer algorithms as a tool to achieve the conspiracy. The algorithm primarily monitors and whether the behavior between a particular enterprise deviates, similar to the role of monitoring and maintaining the actions of cartel members in traditional conspiracies is assumed by a computer program. In this model, the intent of the conspiracy comes from the user of the algorithm, which is essentially similar to traditional conspiracy, but with the help of the algorithmic tool. It is characterized by the fact that the algorithm is relatively simple and straightforward, and mainly follows predefined rules for monitoring and feedback. The harm lies in the fact that it makes the collusive behavior more hidden and difficult to detect, increasing the difficulty of supervision, and at the same time, destroying the fair competition environment in the

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market, which may lead to the artificial manipulation of prices and the interests of consumers are damaged.

In addition to the monopolization patterns presented in the cases described above, algorithmic collusion includes the hub-and-spoke model, the predictable agent model, and the electronic eye model.

The hub-and-spoke model usually occurs in vertically linked firms. A common upstream firm provides the same pricing software or algorithmic strategy to numerous downstream firms. While there is no apparent direct and collusive agreement between the downstream firms, the horizontal collusive outcome is achieved indirectly through an agreement with the parent firm. It is characterized by a certain degree of covertness in that horizontal collusion is achieved indirectly through vertical linkages. The harm is that it can limit the degree of competition in the market, making it difficult for consumers to obtain preferential prices and diversified choices due to the lack of effective price competition among downstream enterprises.

In the predictable agent model, firms develop computerized algorithms independently. However, because they face similar competitive market situations, the developed algorithms are often designed to include price-following behavior and deviation penalties, and the extensive use of similar algorithms can lead to a high degree of convergence in operator behavior. This is characterized by the absence of an explicit collusion agreement between firms, but the similarity of the algorithms leads to collusion-like results. The harm is that it can lead to the rigidity of market prices, reduce the incentive to innovate in the market and be detrimental to the long-term development of the market.

The electronic eye model, on the other hand, focuses on monitoring market dynamics and competitor behavior in real-time through algorithms. Enterprises will quickly adjust their strategies according to the algorithmic feedback to achieve the purpose of coordinating with competitors, similar to a more covert tacit collusion. It is characterized by a high degree of real-time flexibility, allowing companies to react quickly to real-time changes in the market. The harm is that it can lead to market competition becoming opaque, making it difficult for consumers to judge the true state of the market, and it can also lead to market instability.

Algorithmic Abuse

The case of Google comparison shopping service is a typical case of algorithmic abuse. In this case, it mainly reflects self-preference in algorithm abuse. Google used the advantage of the search algorithm to prioritize the display of its comparison-shopping service in the search results and downgraded or hid the competitor's service. In the page, Google highlights its own comparison-shopping services, directing user traffic to its services, while competitors' services are placed in an inconspicuous position or even excluded from the home page. This behavior essentially uses control of the algorithm to provide an unfair competitive advantage to its own business.

Algorithmic abuse can result in price discrimination. By collecting data such as users' browsing history and purchasing behavior, algorithms are used to accurately profile different users, and then charge different prices to different users for the same or similar goods or services based on factors such as users' willingness to pay and price sensitivity. Price discrimination is characterized by a high degree of personalization and refinement, which is often difficult for consumers to detect. Algorithmic abuse can harm competition in the market and inhibit competitors' room for growth. It makes it difficult for other comparison-shopping service providers to gain sufficient user traffic and market share, and reduces the level of competition and incentive to innovate in the market. It also makes it difficult for new entrants to succeed in an uneven playing field as the incentive to innovate in the market is diminished. On the part of consumers, their inability to see comprehensive and fair price comparison results makes it difficult to find the most cost-effective goods or services, reduces the range of choices, and jeopardizes the economic interests of consumers.

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Operator Concentration

Microsoft's acquisition of Activision Blizzard is a classic example of an operator concentration. 2022 On December 8, the U.S. Federal Trade Commission (FTC) filed an antitrust lawsuit against Microsoft aimed at blocking its $69 billion acquisition of Activision Blizzard. It argued that the acquisition would give Microsoft an unfair competitive advantage in key emerging areas of the gaming industry. With the application of AI technology in the gaming industry, mergers and acquisitions between gaming companies have been influenced by algorithmic factors, making this case an important one to study algorithm-driven operator concentration.

Both Microsoft and Activision Blizzard possess a large amount of algorithmic technology and data resources in game development, distribution and operation. After the acquisition, the integration and synergy of algorithmic technology can be realized to enhance Microsoft's algorithmic competitiveness in the game field. By acquiring Activision Blizzard's popular game IPs and user base, Microsoft can utilize its algorithmic advantages to better provide accurate marketing and services to users and further expand its market share. If the acquisition is successful, Microsoft's market power in the gaming industry will be significantly enhanced. It will form a stronger dominant position in the game market, game subscription and other emerging areas, which will have a significant impact on the existing market competition pattern. The competitive pressure on competitors will increase dramatically, market entry barriers will be further raised, and the development of small and medium-sized gaming enterprises may be further squeezed, thus losing the opportunity for independent development.

### *4.2 Current Situation of Monopolization in AI industry*

*Dilemma of identifying and determining algorithm monopoly*

Algorithms are highly specialized and complex, and their operation process is often difficult to be fully understood by outsiders, forming the so-called algorithm black box (C. Schinckus et al., 2022). Enterprises deliberately hide the working principle and specific parameters of the algorithm, making it difficult for regulators to know whether the algorithm has monopoly intentions and behavior. AI algorithms have the ability of self-learning and self-optimization, which leads to the strong dynamism and multilateralism of algorithmic monopoly behavior, which is different from the fixed pattern and characteristics of traditional monopoly behavior. Compared with traditional monopoly behavior, algorithmic monopoly manifests itself in more diversified forms and line camps and has not yet formed a clear and unified behavioral pattern. Some algorithmic monopoly behaviors may be realized through indirect ways, such as using algorithms to collect and analyze data, so as to realize market prediction and accurate pricing, and it is difficult to clearly distinguish such behaviors from normal market competition behaviors.

The AI industry is characterized by cross-border integration and multilateral markets, leading to difficulties in defining related markets Traditional market definition methods are mainly based on the analysis of the substitutability of products or services. However, in the field of AI, different algorithms and technologies may have competitive or synergistic effects in multiple market areas, making it difficult to accurately define the scope of the relevant market to which they belong. In addition, due to the rapid development and innovation of the AI industry, the calculation of market share has become more complicated. Market share statistics may have a lag and cannot even reflect the true market position of a company. The market share of AI companies is often affected by a variety of factors, such as the quality of the algorithm, the size and quality of the data, and the stickiness of the users, which makes it difficult to measure the market power simply by the traditional market share indicators. Factors such as dynamic competition are taken into account when assessing market power, which further increases the complexity and uncertainty of the assessment.

The damaging outcomes of algorithmic monopolistic behavior on competitors are varied, including both direct price increases, output restrictions, etc., as well as indirect inhibitions of

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innovation, higher barriers to market entry, and so on. Moreover, these damages are often not immediately apparent, but have a certain lag and hidden nature, and are difficult to be accurately quantified and recognized in the short term. In addition, it is often very difficult to determine the causal relationship between monopolistic behavior and competition harm. Based on the complexity and dynamics of the AI market, there are a variety of factors that can affect the outcome of competition in the market, and it is difficult to attribute competition harm entirely to algorithmic monopolistic behavior. Finally, the impact of algorithmic monopolistic behavior on consumer welfare is also difficult to measure accurately. Consumers benefit in the short term from personalized recommendations and price concessions brought by algorithms. However, in the long run, they will face problems such as higher prices and limited choices. On the other hand, the measurement of consumer welfare includes not only economic benefits, but also non-economic factors such as privacy protection and information security, which further increases the complexity of measurement.

*Data privacy and security*

In 2018, hackers exploited a vulnerability in Facebook's code to steal access tokens through the 'views' feature and take control of affected accounts. The breach affected approximately 29 million accounts globally, of which approximately 3 million were located in the European Union, and compromised information including users' full names, email addresses, phone numbers, locations, workplaces, dates of birth, religious affiliations, gender, and other sensitive data. The incident aroused great concern about data privacy and security globally, and highlighted the importance and urgency of safeguarding data security in regulating algorithmic monopolization.

In order to cope with the above problems, it is necessary to improve laws, regulations and regulatory mechanisms. In terms of clarifying data privacy protection standards, the EU's General Data Protection Regulation (GDPR) provides more stringent standards for data privacy protection (H. Bentzen et al., 2019), for example, stipulating those enterprises should follow the principles of legality, legitimacy and transparency in handling user data, and requiring explicit user harmonization. China has also introduced laws such as the Civil Code and the Personal Information Protection Law to regulate the collection, storage and use of personal information. In terms of strengthening the powers and responsibilities of regulators, the Irish Data Protection Commission played an important regulatory role in the Facebook data breach case, imposing a €251 million fine on Meta. Regulators are strengthening the daily supervision and inspection of enterprise data processing activities, establishing a sound data security assessment mechanism, and penalizing non-compliant enterprises.

In addition, enhance corporate data governance capabilities. Enterprises should strengthen data security management, establish a sound data security management system, and adopt advanced encryption, access control, data backup and other technical means to guarantee the security of data storage and transmission. For example, Facebook should strengthen the detection and repair of code vulnerabilities and conduct regular data security audits after the user data leakage incident. In addition, it is especially necessary to standardize the design and application of algorithms. When designing and applying algorithms, enterprises should follow the principle of data minimization, collect and use only the necessary data, and ensure the transparency and interpretability of the algorithms to avoid the risk of data leakage caused by algorithm abuse.

## 5. DISCUSSION

### *5.1 Constructing an Algorithmic Monopoly Assessment System*

This paper argues that an algorithmic monopoly assessment system should be constructed to cope with the above problems. In terms of evaluation indexes, market share indexes should be considered first, and traditional market share calculation should be refined. In terms of sales and sales volume, in addition to calculating the annual sales and sales volume market share, the trend of quarterly, monthly and other shorter cycles should also be analyzed, as well as the sales and sales volume share of different product lines and business segments. In terms of market scoping, the method

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of defining the relevant market should be clarified. Not only the geographical market scope is considered, but also the share of different segments needs to be analyzed. For example, in the global AI chip market, it can be subdivided into high-end, mid-range, and low-end markets, and the share of enterprises in each segment can be calculated separately. Considering user activity and traffic, in addition to the number of monthly active users and page views, attention should also be paid to indicators such as the length of use, frequency of visits, and number of interactions. In ecosystem regulation, factors such as the number of users, the number of partners, and the number of applications within the ecosystem of the enterprise platform should be considered. In terms of fine-tuning the analysis of market concentration, the dynamic monitoring and optimization of the HHI index can be considered. Calculate and update the HHI index regularly to analyze the trend of market concentration. At the same time, different HHI index thresholds are set in combination with the stage of development and characteristics of the industry to more accurately determine the degree of market competition. Separate HHI indices for different market segments, such as in the AI speech recognition market, image recognition market, etc., to assess the competition pattern and monopoly risk of each market segment.

In terms of algorithmic characteristic indicators, the first consideration is to refine the transparency and interpretability of the algorithm. Enterprises are required to provide detailed technical documentation of algorithms, including the design principles of algorithms, data processing flow, model structure, parameter settings, etc. At the same time, the format and content of the technical documentation are standardized to facilitate review by regulatory agencies and third-party organizations. In terms of interpretive tools and methods, companies are encouraged to adopt interpretable algorithm design and tools, such as Local Interpretable Model Irrelevant Interpretation (LIME), SHAP (SHapley Additive exPlanations), etc., to provide intuitive explanations of algorithmic decision-making for users and regulators. Next, consider refining the data dependencies of the algorithms. Analyze the source channels of the data on which the algorithm relies and assess its dependence on but art theaters. And establish data quality assessment standards to evaluate the accuracy, completeness, and timeliness of the data used by the algorithm. At the same time, strengthen the supervision of data authenticity to prevent companies from training algorithms through false data or low-quality data to gain an unfair competitive advantage. Finally, consider refining the update frequency and adaptability of algorithms. Understand in detail the update cycle of the enterprise's algorithms and analyze the main content and improvement points of each update, such as whether the algorithms are effectively updated in terms of performance optimization, function expansion, and security enhancement. Through case studies and simulation experiments, assess the corresponding speed and adaptability of the algorithms to market changes, for example, whether the algorithms can adjust and maintain competitiveness even when market demand changes or competitors launch new strategies.

In terms of innovation capability indicators, the first step is to refine the R&D investment and innovation resources. Not only pay attention to the total R&D investment funds of the enterprise but also analyze the investment structure of its R&D funds, including the proportion of investment in basic research, applied research, technology development and other aspects. And examine the staff size, professional structure and talent training mechanism of the enterprise's R&D team. Secondly, we should refine the results of technological innovation. Establish a unified algorithm performance evaluation standard to quantitatively evaluate the accuracy, efficiency, stability, etc. of enterprise algorithms, for example, in the field of image recognition, the performance of algorithms can be measured by indicators such as accuracy, recall, and F1 value. Analyze the role and influence of the enterprise's technological innovation achievements on the development of the industry, such as whether it leads the direction of technological development of the industry, and whether it promotes the formulation of relevant technical standards. Finally, innovation cooperation and ecological construction should be refined. In-depth study of the innovation cooperation mode between enterprises and other enterprises, universities, research institutions, etc., including joint R&D, technology transfer, and co-built laboratories. Also assess the depth and duration of cooperation, as well as the sharing and

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transformation of cooperation results. In addition, analyze the role and contribution of the enterprise in the AI industrial ecology, such as whether it promotes the synergistic development of upstream and downstream enterprises in the industry, and whether it promotes the prosperity of the open source community.

In terms of assessment methods, the first step is to refine the comprehensive assessment model. Hierarchical analysis, principal component analysis and other scientific methods are used to determine the weights of each indicator, such as market share, algorithmic characteristics and innovation ability, by combining industry characteristics and expert opinions. The comprehensive assessment model is verified and optimized through a large amount of case data and simulation data to ensure the accuracy and reliability of the model. At the same time, the model is regularly updated and adjusted to adapt to market changes and technological development. Secondly, refine the case analysis and simulation analysis. Establish an algorithmic monopoly case database, covering different industries and different types of algorithmic monopoly behaviors. Conduct detailed analysis and summary of each case to extract key information such as its behavioral characteristics, market impact, and regulatory measures. Advanced simulation and analysis techniques, such as multi-intelligence body-based simulation and system mechanics simulation, are used to dynamically simulate and analyze algorithmic monopoly behaviors. Simulate the evolution process and market impact of algorithmic monopoly behavior under different market environments by changing different parameters and conditions. Finally, refine the dynamic assessment and continuous monitoring. Establish a perfect data collection system to regularly collect market data, algorithmic data, and innovation data from enterprises. Meanwhile, strengthen information sharing and communication with enterprises, industry associations, regulatory agencies, etc., to ensure the timeliness and accuracy of data. Utilizing technical means such as big data analysis and AI to conduct real-time monitoring of enterprises' market behavior and algorithmic applications. Establish an early warning mechanism to issue timely warning signals when enterprises are found to have algorithmic monopoly risks or abnormal behaviors and provide decision-making support for regulators.

### *5.2 Strengthening Law Enforcement Supervision*

First, strengthen the construction of law enforcement agencies. Establish a specialized AI algorithmic monopoly enforcement department and make clear its core responsibilities and authority in antitrust enforcement, such as being responsible for investigating, collecting evidence, and punishing algorithmic monopoly behavior. Meanwhile, it should strengthen coordination and cooperation with other relevant departments, such as market supervision and network information, and establish a regularized collaborative working mechanism to form regulatory synergy. The government should increase the financial investment in law enforcement agencies to ensure that they have sufficient funds for the purchase of equipment, technology research and development, and personnel training. It should also equip law enforcement agencies with advanced law enforcement equipment and technical tools, such as high-performance computers, data storage equipment and network monitoring equipment. It actively participates in international anti-monopoly law enforcement cooperation organizations and activities, establishes close cooperation with law enforcement agencies in other countries and regions, and strengthens information sharing and experience exchange. On transnational issues such as algorithmic monopolization, joint law enforcement activities have been carried out to jointly respond to the algorithmic monopolistic behavior of multinational enterprises and to maintain the order of fair competition in the global market.

Second, enhance the professional quality of personnel. In view of the characteristics of AI and algorithmic monopoly, law enforcement personnel are provided with systematic professional training courses, including knowledge of the principles of high technology of AI, algorithm design and application, data analysis and mining, and anti-monopoly laws and regulations. Many professionals with multidisciplinary backgrounds in AI, computer science, economics, law and other disciplines have been introduced from colleges and universities, scientific research institutions, enterprises, and other

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channels to enrich the law enforcement team. These professionals can provide technical support and professional advice for law enforcement, and enhance the overall professional level of law enforcement agencies. Form an expert consulting team composed of AI experts, economists, jurists, etc., to provide professional technical advice opinions, and recommendations to law enforcement agencies when dealing with complex algorithmic monopolization cases. The expert team can assist law enforcement officials in conducting technical analysis of algorithms, assessing market impacts, and providing legal interpretations, etc., so as to improve the scientific and accuracy of law enforcement.

Third, the use of big data, AI, and other technologies to improve regulatory effectiveness and accuracy. Use big data technology to build a comprehensive market data monitoring and analysis platform that integrates market data from different channels, such as transaction data of enterprises, user behavior data, and algorithm operation data. Through real-time monitoring and analysis of these massive data, abnormal trading behavior and potential signs of algorithmic monopoly in the market can be detected in a timely manner. Use AI technology to develop a series of intelligent regulatory tools, such as algorithm identification and analysis tools, market power assessment models, and competition damage early warning systems. These tools can automatically analyze the algorithms of enterprises, identify the characteristics of monopolistic behavior in them, and assess the market power and degree of competition damage of enterprises, providing law enforcement officers with precise enforcement bases. Based on the analysis results provided by big data and AI technologies, law enforcement agencies can realize precise enforcement, conduct targeted investigations and penalties on enterprises suspected of algorithmic monopoly, and improve the efficiency and effectiveness of law enforcement. At the same time, technical means are used to carry out dynamic supervision of the market, tracking in real-time the algorithmic adjustments of enterprises and changes in market behavior, and adjusting supervision strategies promptly to ensure the effectiveness and timeliness of supervision.

### *5.3 Promote the synergistic participation of multiple actors in algorithmic governance*

First, advocate enterprises to strengthen self-discipline. Enterprises should establish a specialized algorithm governance committee or a similar body responsible for formulating and enforcing norms and processes for algorithm development, application and management. The body should cover professionals in multiple fields, such as technology, law, and ethics, to supervise the whole process of algorithm design, training, deployment, and updating to ensure the fairness, transparency, and security of algorithms. Regularly conduct internal audits and assessments of the algorithms it uses to check whether there is a potential risk of monopolistic behavior in the algorithms, such as whether there is an abuse of market dominance and whether there is algorithmic discrimination. At the same time, assess the impact of algorithms on market competition and consumer rights and interests, and identify and correct problems in a timely manner. Improve the data governance system to ensure the legality, accuracy and integrity of data. In the data collection process, users are clearly informed of the purpose of the data and their explicit consent is obtained; in the data storage and use process, strict security measures are taken to prevent data leakage and misuse.

Second, industry organizations play an active role. Industry organizations should formulate detailed self-regulatory norms and standards for algorithm governance based on the characteristics and development needs of the AI industry. These norms should cover the design principles of algorithms, operation rules, data usage requirements, and competitive codes of conduct, providing clear behavioral guidelines for enterprises. Regularly organize training and exchange activities targeting algorithm governance to improve enterprises' understanding of and ability to respond to algorithmic monopoly risks. Share best practices and lessons learned on algorithm governance through seminars, lectures and case studies, and promote mutual learning and reference among enterprises. Set up a specialized industry oversight body or platform to monitor and inspect the algorithmic behavior of member enterprises. For enterprises that violate the self-regulatory norms, take corresponding disciplinary

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measures, such as warnings, fines, and cancellation of membership, etc., to maintain the normal order of the industry.

Third, consumer participation in supervision. Through various channels, such as media campaigns, public service advertisements, community activities, etc., strengthen the education and training of consumers to improve their understanding of algorithmic monopoly behavior and their ability to identify it. Let consumers understand how algorithms are applied in their daily lives and the possible impact they may bring, and enhance their awareness of self-protection. The government and enterprises should work together to establish convenient and efficient complaint channels to facilitate consumers' complaints and reporting of algorithmic monopoly behaviors found. For example, special complaint hotlines and online complaint platforms should be set up, and it should be ensured that complaint information can be handled and fed back in a timely manner. Establish corresponding incentive mechanisms to encourage consumers to actively participate in algorithmic monitoring. For example, certain rewards are given to consumers who provide effective clues or assist in the investigation, so as to increase the enthusiasm of consumers to participate in the supervision.

Through the above measures, advocate enterprises to strengthen self-discipline, give full play to the positive role of industry organizations, and encourage consumers to participate extensively in supervision, so as to form a good pattern of collaborative governance of algorithmic monopoly by multiple main bodies, such as the government, enterprises, industry organizations, consumers, etc., and to jointly promote the healthy development of the AI industry.

## 6. CONCLUSION

In terms of theory, this paper analyzes the formation mechanism and various types of algorithmic monopoly behaviors in the AI industry, such as algorithmic conspiracy, algorithmic personalized pricing, algorithmic self-preferential treatment, etc., and clarifies the challenges it poses to the theory of the current antitrust law. On this basis, an analytical framework of 'market power-market behavior-competitive damage' is constructed, which provides theoretical support for the identification and assessment of algorithmic monopoly behavior. At the same time, it distinguishes between the judgment standard of monopoly behavior and the legislative goal of antitrust law, and emphasizes the competition damage as the fundamental standard of monopoly behavior, which further improves the theoretical foundation of algorithmic monopoly regulation.

In terms of practice, this paper combs through the typical cases of algorithmic monopoly at home and abroad, such as the U.S. Department of Justice v. David Tompkins. Tompkins used an algorithm to fix the sales price of classic movie posters, Spencer Meyer v. Youbao allegedly used the algorithm to fix the sales price of classic movie posters. Meyer v. Youbu allegedly used algorithms to manipulate taxi prices, etc. Through the analysis of these cases, it reveals the manifestation of algorithmic monopoly behavior in the real market, the harmful consequences and regulatory difficulties. Meanwhile, China's practical exploration in the regulation of algorithmic abuse is summarized, including a series of regulations and documents jointly issued by the Antimonopoly Committee of the State Council and multiple departments, such as the Antimonopoly Guidelines on the Field of Platform Economy and the Guiding Opinions on Strengthening Comprehensive Management of Algorithms in Internet Information Services, which reflect China's positive action and regulatory determination in the regulation of algorithmic monopoly.

In terms of strategy, this paper puts forward a strategic proposal for a sound categorized and comprehensive regulatory model and establishes a comprehensive regulatory mechanism that is mainly based on legal regulation, supplemented by technological and ethical regulation, as well as mainly based on antimonopoly law regulation and supplemented by other legal regulation. At the level of legal regulation, it emphasizes the improvement of the antitrust law and related supporting rules to adapt to the specificity and complexity of algorithmic monopoly behavior; at the level of technological regulation, it advocates the use of emerging technological means, such as big data and AI, to enhance the

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effectiveness and precision of regulation; and at the level of ethical regulation, it pays attention to guiding enterprises to establish correct algorithmic values and ethical norms. In addition, suggestions are also made to promote the collaborative participation of multiple actors in algorithmic governance, including advocating enterprises to strengthen self-discipline, industry organizations to play an active role, and consumers to participate in supervision, so as to form a good pattern of collaborative governance by the whole society.

The regulation of algorithmic monopoly is of crucial significance to the development of the AI industry and social welfare. From the perspective of industrial development, effective regulation of algorithmic monopoly can create a market environment of fair competition, stimulate the innovation vitality of enterprises, avoid excessive concentration of market power in the hands of a few enterprises, and thus promote the diversified and sustainable development of the industry. From the perspective of social welfare, the regulation of algorithmic monopoly can help protect the legitimate rights and interests of consumers and prevent them from being subjected to unfair treatment such as algorithmic discrimination and exploitative pricing, at the same time, it is also conducive to enhancing the efficiency of resource allocation in the whole society, promoting the extensive sharing of the fruits of technological innovation, and enhancing the overall welfare level of the society.

With the wide application of AI technology, algorithmic decision-making plays a key role in many fields, but algorithmic unfairness is becoming more and more prominent, such as the problem of algorithmic discrimination in the fields of recruitment, loan approval, judicial sentencing and other areas. In the future, it is necessary to further study in depth the connotation and standards of algorithmic fairness, establish a scientific and reasonable algorithmic fairness assessment index system, and not only pay attention to the fairness of the results but also consider the fairness of the process and the fairness of the opportunity. At the same time, it is necessary to explore how to integrate the principle of fairness in the design and development phase of algorithms and reduce algorithmic bias and discrimination through technical means such as optimizing algorithmic models and adjusting data samples, to ensure the fairness and reasonableness of algorithmic decision-making.

In addition, many complex AI algorithms such as deep learning algorithms are highly black-boxed, making it difficult to understand their decision-making process and rationale, which poses a huge challenge to the regulation and accountability of algorithms. Therefore, in the future, it is necessary to increase research efforts on algorithm interpretability and develop effective algorithm interpretation techniques and tools to make the decision-making process of algorithms more transparent and understandable. For example, research should be conducted on how to explain the input, output and decision-making logic of algorithms to users and regulators through visualization techniques, feature importance analysis and other methods, so as to improve the interpretability and credibility of algorithms.

Finally, in the face of the rapid development of AI technology and the increasing complexity and variability of algorithmic monopoly behavior, there is a need to continuously explore more forward-looking and adaptable regulatory models and methods. Continue to pay attention to the international advanced regulatory experience and trends, combined with China's national conditions to carry out localized innovation, and improve the existing anti-monopoly legal system and regulatory mechanism. Strengthen interdisciplinary and cross-field research cooperation, integrate multidisciplinary knowledge of law, economics, computer science, and other disciplines, and innovate regulatory ideas and means. For example, study how to make use of the decentralized and tamper-proof characteristics of blockchain technology to strengthen the management and supervision of algorithmic data; explore how to establish incentive-compatible regulatory mechanisms to guide enterprises to consciously comply with anti-monopoly regulations, and realize the coordinated development of corporate interests and social public interests.

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