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Research on Security Challenges of Intelligent Advertising Algorithm Traps and Multilateral Collaborative Governance Approaches

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Abstract: In the fourth technological revolution driven by artificial intelligence, intelligent advertising relies on technologies such as programmatic purchasing, RTB bidding, cloud computing, and deep learning to achieve intelligent upgrading of the entire industry chain. However, this has led to the dilemma of "transparent people" caused by illegal data collection and abuse. There are three major limitations in existing research: a lack of systematic theoretical construction, micro level privacy research, and a single governance path. This study focuses on the security challenges and multilateral collaborative governance of intelligent advertising algorithm traps. Content analysis is used to analyze corporate privacy policies, and user privacy attitudes are deeply described through focus group interviews. Multi subject dynamic analysis is conducted based on privacy relationship theory and contextual integrity theory. Research has found that under the paradigm shift of technology, advertising privacy presents new characteristics such as infringement of personal dignity, weakening of subjectivity, and plundering of free will; The contradiction between enterprises and users focuses on conflicts between subjectivity and data centralization, intelligent marketing and privacy protection, attitudes and behaviors, etc; The root cause lies in the empowerment of technology, where enterprises become holders of big data power and users become "digital laborers", with lagging institutional supervision and the existence of subjective destruction and "privacy cynicism" among users. The research proposes a three-dimensional solution path of power balance (with public power constraints as the main focus and industry self-discipline as a supplement), spatial reconstruction (supported by technologies such as federated learning, dynamic protection framework for enterprises, and improvement of user literacy), and ethical export (technical ethical guarantee operation framework, return to humanism). There are shortcomings in the research, such as insufficient practical insights, lack of theoretical models, and sample limitations. In the future, it is necessary to expand the scope of privacy ethics relationships and construct a theoretical framework

1. Introduction

In the fourth scientific and technological revolution driven by artificial intelligence, intelligent advertising, relying on programmed purchase, RTB bidding [1], cloud computing and deep learning and other technologies to achieve intelligent upgrading of the whole industry chain, has become the

core revenue pillar of global Internet giants, but at the same time, it has also derived serious privacy ethics challenges - from multinational enterprises being heavily fined for avoiding privacy settings due to the "mandatory consent" mechanism, to social platform user data being abused to affect political elections and other events, all highlight that illegal data collection and abuse driven by enterprises' profit has become the core crux of the "transparent person" dilemma in the intelligent era. Although existing research has accumulated some experience in advertising ethics and technology, there are three major limitations: firstly, it focuses on describing multiple phenomena or single technical solutions, lacking a systematic theoretical construction of privacy ethics issues in intelligent advertising; Secondly, privacy research is often discussed as a micro branch of advertising ethics, with few independent chapters and a lack of dynamic analysis from multiple subject perspectives; Thirdly, the governance path often remains at the level of legal constraints, without fully integrating the multilateral collaborative mechanisms of technological ethics, corporate responsibility, and user cognition. The theme of this study is "Security Challenges and Multilateral Collaborative Governance of Intelligent Advertising Algorithm Traps". The motivation for the work stems from the urgent practical needs of technology empowerment and privacy conflict, as well as the theoretical gaps in existing research. The goal is to reveal the evolutionary logic of advertising privacy from scratch and the new characteristics of the intelligent era through a historical review of technological paradigm changes. Based on privacy relationship theory and contextual integrity theory, content analysis method [2]is used to analyze enterprise privacy policies, and user privacy attitudes are deeply described through focus group interviews. From the dual perspectives of enterprise data attitudes and user cognition, the essence of privacy ethical contradictions is revealed. Finally, a collaborative governance framework of "rights regulation technology support ethical review" is constructed through the analysis of social, technological, and individual roots. Its innovative value lies in the systematic exploration of privacy ethics as the core dimension of intelligent advertising research for the first time, breaking through the limitations of traditional phenomenon description; Deepen the understanding of the essence of the problem from the perspective of the dual subject relationship between enterprises and users, and make up for the lack of multi-dimensional dynamic analysis; Propose an operational dynamic protection mechanism that integrates legal, technological, and ethical multilateral governance paths, based on technological ethical safeguards.

2. Correlation theory

2.1. Definition of Core Concepts and Theoretical Framework

This article takes conceptual definition [3] as the logical starting point, clarifies the research scope and constructs a theoretical analysis framework by sorting out the core connotations of technological paradigms, intelligent advertising, and privacy ethics. As the core driving force of the evolution of the advertising industry, the concept of technological paradigm can be traced back to Thomas Kuhn's "paradigm" theory [4] - originally referring to research methods and paradigms commonly accepted by the scientific community. Later, it was expanded to the field of technology by scholars such as Konstant and Dorsey, forming the concept of "technological paradigm", which is a "model for solving technological and economic problems" and further evolving into the "technological and economic paradigm", emphasizing the collaborative transformation of technological clusters and social systems.

The basic structure of the technological paradigm presents a trinity form of "technology cluster social industry social system": technology clusters constitute infrastructure and key production factors, driving changes in social productivity; The reshaping of the new industrial ecology will ultimately lead to profound changes in social governance and lifestyle patterns. This structure

provides a dynamic perspective for analyzing privacy ethics issues in intelligent advertising. As a product of technological paradigm shift, intelligent advertising encompasses the evolutionary stages from computational advertising to cognitive intelligent advertising. It relies on technologies such as programmatic purchasing and deep learning to achieve full process intelligence, becoming the core source of revenue for the digital economy. However, technological empowerment also brings privacy ethical challenges - illegal data collection and abuse driven by profit driven enterprises constitute the core contradiction of the "transparent person" dilemma. Privacy ethics [5]needs to be defined from a relational perspective: the essence of privacy is a dynamic relationship between the subject (user), the proposition (privacy content), and the individual (data acquirer), rather than an absolute state; The theory of contextual integrity further emphasizes that privacy protection needs to maintain the normative appropriateness and transmission criteria of information flow in specific social and technological scenarios.

2.2. The Evolution of Intelligent Advertising Concept and Core Operating Mechanism

As a product of the deep application of artificial intelligence technology in the advertising field, the concept of intelligent advertising has undergone a dynamic evolution from technology driven to industry integration. Early definitions focused on emerging advertising forms based on Web3.0, such as widget ads and search engine ads; With the development of big data, cloud computing, and natural language processing technologies, academia has proposed that intelligent advertising is a product of the dynamic integration of artificial intelligence and modern advertising, emphasizing the computerization, automation, precision, and intelligence in the creative, production, delivery, dissemination, and interactive aspects. The current mainstream definition regards it as a brand communication activity that relies on intelligent Internet, integrates big data, artificial intelligence and other technologies, and realizes intelligent operation in the whole process of advertising for specific users and environments, covering all-round upgrading from user insight, content production to delivery feedback, and promoting the development of advertising industry towards platform and integration.Its development stage can be divided into three periods: the information push stage represented by programmatic advertising, which achieves precise marketing through real-time bidding of RTB; The dynamic scene matching stage based on machine learning emphasizes the native integration and multimodal interaction of advertising; The brand value co creation stage based on social information flow algorithm and emotion computing technology, adjusts advertising decisions by capturing users' emotional states in real time, and achieves value co creation between the brand and users. In terms of operational mechanism, intelligent advertising relies on large-scale machine learning, Generative Adversarial Networks (GANs)[6], Convolutional Neural Networks (CNNs)[7], and emotion encoding technologies to achieve intelligent insights from experience to science, algorithm driven intelligent production and distribution, as well as intelligent interaction and feedback through spatiotemporal integration, ultimately promoting the intelligent reconstruction of the advertising industry chain and the value upgrade of brand strategy.

3. Research method

3.1. The Stage Evolution and Core Challenges of Advertising Privacy Ethics

From the paradigm of mechanical technology to the paradigm of intelligent technology, the ethical issues of advertising privacy have shown clear phased characteristics with technological iteration: in the mechanical era, typical examples include the appropriation of portraits in newspaper advertisements and the exposure of privacy details, where privacy awareness has emerged but ethical issues have not yet emerged; In the era of electricity, radio and television advertisements

expand their intrusion through image appropriation and address leakage, legalize the concept of privacy, and focus on individual rights and interests under the clear boundary between public and private in ethical issues; In the early information age, Internet advertising realized virtual space intrusion by means of cookie tracking, targeted direct mail and other technologies, the public and private boundaries melted, the intrusion subject and field expanded, and the risk of human dignity damage increased; In the era of intelligence, intelligent advertising is driven by data and algorithm matching as its core, forming a full chain intrusion of "mining integration flow calculation". Privacy has become a commercialized data asset, and pan temporal and spatial infringement and covert technology have complicated ethical issues, manifested as damage to personal dignity, limited freedom of consciousness, and ambiguous ownership of rights. The shift in technological paradigms has propelled privacy from a "right to solitude" to a "dynamic data asset," with intrusion methods shifting from explicit content appropriation to full process data infiltration. Ethical challenges have escalated from individual disputes to systemic social issues, necessitating interdisciplinary regulation and ethical reconstruction.

3.2. Dual dimensional analysis of privacy ethics in AI advertising

Focusing on advertising privacy ethics in the era of artificial intelligence, this study reveals the real dilemma through a dual dimensional system of corporate policy and user perspective, adopts a content analysis method combining synchronicity and diachrony, and takes 124 APP privacy policies of the top 10 global Internet advertising revenue enterprises as samples to build an analysis framework covering 35 indicators in five dimensions, namely, privacy policy representation, information collection and processing, information storage and protection, information sharing and circulation, and user information rights, and conducts reasoning analysis in combination with international privacy protection guidelines and global norms. The specific indicators of the research framework include update date, historical version archiving, cookie interpretation, third-party sharing mechanism, and user rights implementation details, which meet international standards; The sample selection follows the principle of comprehensive coverage, eliminating invalid or duplicate policies to ensure industry representativeness, covering multiple business scenarios such as e-commerce, social networking, and short video. The core discovery is supported by visual charts, showing that the number of APPs under the enterprise varies from 26 to 1, forming a diversified cluster. Table 1 to Table 2 compare the data (as shown in Tables 1 and 2)

Table 1. Privacy Policy Characterization Comparison

Variable Category	Ali (26)	ByteDance (13)	Tencent (27)	Baidu (20)	JD (11)	Meiuan (9)	Kuaishou (4)	Xiaomi (6)	Sina (7)	Pinduoduo (1)
Update Date	24	13	26	16	11	3	4	6	7	1
Historical Versions	19	0	3	0	8	1	3	0	0	1
Key Points Excerpt	24	13	25	20	11	7	4	0	7	0
Contact Information	25	13	27	20	11	9	4	6	7	1
Disclaimer	0	13	8	15	0	0	1	1	7	0
Child Privacy Statement	26	13	27	20	11	9	4	6	7	1

Table 2. Information Collection Comparison

Variable Category	Ali (26)	ByteDance (13)	Tencent (27)	Baidu (20)	JD (11)	Meituan (9)	Kuaishou (4)	Xiaomi (6)	Sina (7)	Pinduoduo (1)
Data Type	20	13	27	20	11	9	4	6	7	1
Information Classification	5	7	0	0	11	9	4	0	3	1
Collection Method	25	13	10	20	11	9	4	3	6	1
Collection Purpose	25	13	26	20	11	9	4	5	7	1
Cookie Explanation	25	10	10	20	11	9	4	1	4	1
Cookie Restriction	1	0	0	20	11	6	4	0	0	0
Third-Party Collection	26	13	27	20	6	0	1	6	7	1
Advertising Services	26	13	27	20	11	9	4	5	7	1

Revealing significant barriers to privacy policy search (over 30% without backend access), historical version archiving rate less than 30%, insufficient third-party transparency in information collection, significant differences in storage security measures, and widespread lack of implementation details for user rights (only some companies provide operational processes). The conclusion shows that corporate policies perform well in basic elements such as contact information and child privacy statements, but there are significant shortcomings in historical archives, reasonableness of disclaimer statements, and details of user rights. There are also significant differences in completeness between companies. This study provides empirical basis for future research on user privacy concerns and has reference value for global smart advertising privacy protection practices.

3.3. Research on the Three Dimensional Dilemma and Collaborative Intervention of Privacy Governance in Intelligent Advertising

This study reveals the practical difficulties of privacy governance in intelligent advertising from three dimensions: information storage and protection, sharing and circulation, and user rights, and constructs a quantitative formula system. In terms of storage protection dimension, only 21% of the samples have clear storage time limits, and 82.3% promise to delete/anonymize beyond the deadline but give the platform explanatory power through vague expressions such as "necessary period"; Technical measures cover 74.2% of the samples, management measures only 58.1%, and accountability system clarity rate is only 21.8%. The degree of imbalance is quantified through a formula:

$$S_{imbalance} = \frac{Technical\ measure\ coverage\ rate - management\ measure\ coverage\ rate}{Technical\ measure\ coverage\ rate} \times 100\% \quad (1)$$

The higher the value, the more severe the imbalance between security measures and accountability mechanisms. Dimension of shared circulation: 95.9% of samples share data with third parties/affiliated institutions, but only 48.4% provide third-party lists and 20.2% implement supervision; Advertising services (95.2%) and feature optimization are the main purposes, but 77 texts conceal the commercial essence through sentence structures such as "help you...". The transparency gap is quantified by the formula:

$$F_{transparent} = 1 - (\frac{Third\ party\ list\ provision\ rate}{48.4\%} + \frac{Supervision\ implementation\ rate}{20.2\%}) \times 50\% \quad (2)$$

In the dimension of user rights, 49% of the samples provide personalized advertising management rights but the operation is cumbersome (such as requiring identity proof and 15 working days to respond), data portability rights are only 37.9%, forgetting rights are 61.2%, reauthorization rate is 82.2%, but necessary information cannot be revoked, and the degree of rights virtualization. The higher the value, the more formalized the rights are granted. Byte series performs outstandingly in advertising management rights (11/13) and data portability rights (9/13). The comprehensive governance dilemma index integrates three dimensions, and the larger the value, the higher the urgency of multilateral collaborative intervention. Currently, there is a significant imbalance in the three dimensions of storage protection, sharing and circulation, and user rights in governance practice, which needs to be resolved through the collaborative path of public power constraints, technological empowerment, and user empowerment. (As shown in Figure 1 and Table 3)

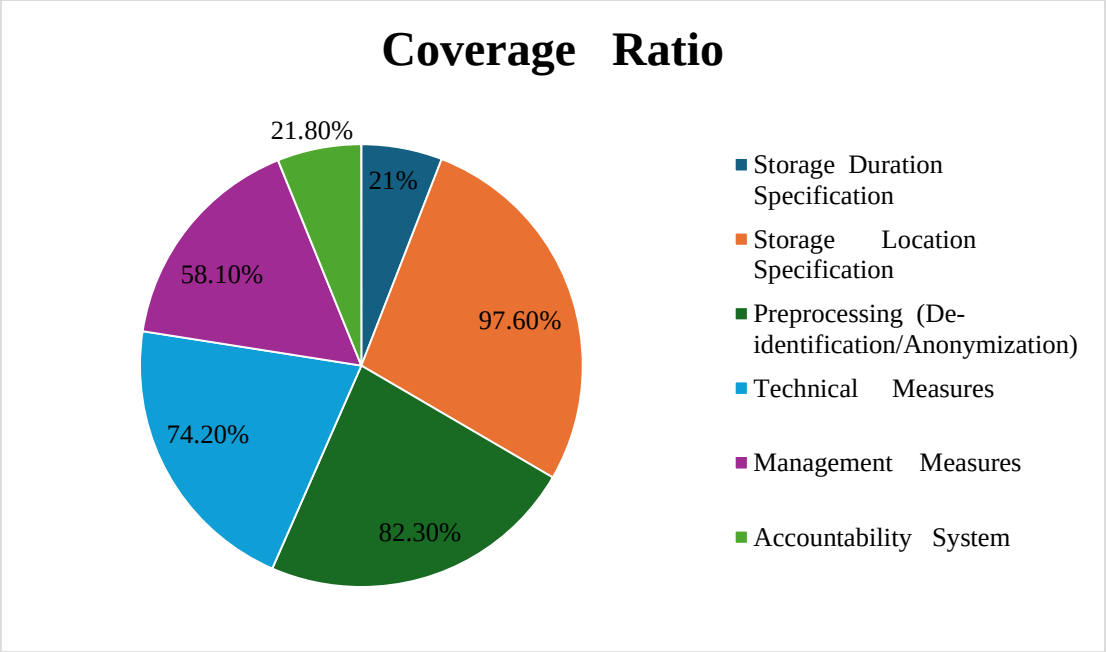

Figure 1. Information Storage & Protection Analysis

Table 3. Smart Advertising Data Sharing Governance Framework

Indicator	Coverage Ratio
Sharing Data with Third Parties/Affiliates	95.90%
Provision of Third-Party List	48.40%
Provision of Affiliate List	43.50%
Specification of Shared Information Types	45.90%
Third-Party Supervision	20.20%
Explanation of Sharing Purposes	95.20%

The research conclusion indicates that corporate policies need to improve privacy governance by clarifying storage standards, strengthening third-party supervision, simplifying rights operation processes, and providing empirical reference for global intelligent advertising privacy protection.

4. Results and discussion

4.1. Research on the governance path of traps in intelligent advertising algorithms

The core contradiction of privacy ethics in intelligent advertising stems from the fundamental conflict between the centralization of enterprise data and the subjectivity of users - enterprises construct a "super panoramic monitoring" network through technologies such as big data monitoring and intelligent algorithms, and under the privacy policy of "use and consent", transform users' digital personalities into "pseudo subjects", forming an implicit regulation of individual freedom through "centralized monitoring"; However, users are trapped in the "privacy paradox"[8], where while enjoying the convenience of personalized services, they show weak attention and lagging pain towards institutional privacy intrusion due to technological black boxes, privacy ignorance, and a "digital resignation" mentality. From a social perspective, advertising platforms achieve economic dominance through big data rights, transforming users into "digital laborers" and achieving unequal exchange of privacy transactions under the discourse of "free services"; At the institutional level, solid systems in the context of mobile time and space are difficult to constrain mobile privacy, and the time difference between technological iteration and legal lag exacerbates governance disorder; At the individual level, 'privacy cynicism' and a lack of privacy literacy lead to the loss of user autonomy, forming a vicious cycle of 'powerless resistance passive acceptance'. To solve this dilemma, it is necessary to establish a multilateral collaborative governance system: enterprises should strengthen algorithm transparency and accountability mechanisms to avoid "big data killing" and algorithm discrimination; At the institutional level, a dynamically adapted privacy protection framework needs to be established to balance technological innovation and rights boundaries; At the individual level, it is necessary to enhance privacy literacy, cultivate "digital resilience" [9], and ultimately achieve an ethical transformation from "technological regulation" to "value symbiosis".

4.2. Model experiment

The resolution of privacy ethical issues in intelligent advertising needs to be carried out from three dimensions: power balance, spatial reconstruction, and ethical exit. At the level of power balance, it is necessary to draw on the strict regulation of the European Union's General Data Protection Regulation and the comprehensive governance model of Japan, and construct an administrative regulatory system with public power constraints as the main focus and industry self-discipline as a supplement. Through legislation, it is necessary to clarify the user's right to self-determination of data, the principle of minimizing the use of enterprise data, and the accountability mechanism for violations, in order to avoid disorderly expansion of capital. In terms of technical support, privacy enhancement technologies (such as federated learning, homomorphic encryption, differential privacy) and privacy computing technologies can achieve a balance between data fusion and privacy protection. For example, Apple PCM technology protects user privacy by constraining information scope, event aggregation, and delayed transmission, while Google FLoC technology avoids individual tracking through anonymous group federated operations. Enterprises need to establish a dynamic protection framework based on the theory of contextual integrity, which runs through the entire process of user authorization, intelligent insight, creation, delivery, and feedback, ensuring that information collection complies with the principle of minimum necessity and the circulation scenario is consistent with the initial context. At the same time, users' control rights are enhanced through multiple authorization mechanisms, information payment models, and personalized advertising fine management. At the user level, it is necessary to cultivate a culture of privacy and self-restraint ethics, enhance digital literacy to identify privacy risks under the

technological black box, and use the privacy functions and legal channels of mobile phone systems to protect their rights. On the ethical level, it is necessary to establish an operational framework that is guaranteed by technological ethics. Through value sensitive design (VSD)[10], the principles of autonomy, fairness, and transparency should be embedded in technological design, while returning to humanism to avoid the loss of subjectivity caused by technological alienation. Ultimately, a balance between commercial interests and humanistic care should be achieved, promoting the transformation of intelligent advertising towards "technology for good".

4.3. Effect analysis

The reconstruction of privacy space in intelligent advertising needs to be based on technological support, with enterprise empowerment as the focus and user enhancement as the guarantee, forming a tripartite co construction structure. On a technical level, privacy enhancing technologies (such as federated learning, homomorphic encryption, differential privacy) and privacy computing technologies (such as secure multi-party computation, trusted execution environment) can balance data fusion and privacy protection. For example, Apple PCM technology protects privacy by constraining information scope, event aggregation, and delayed transmission, Facebook AEM and Google FLoC technologies avoid individual tracking through anonymous group operations, and first party landing page technology restricts information flow within a single entity. Enterprises need to build a dynamic protection framework based on situational context theory, which runs through the entire process of user authorization, intelligent insight, creation, delivery, and feedback: the user stage should set privacy preferences and run through the entire information flow process, the intelligent insight stage should follow the principle of minimum necessity and distinguish between private and non private information, the creation stage should avoid using private or unauthorized information, the delivery stage should ensure information anonymity and de identification and implement a responsibility system, and the feedback stage should provide sufficient feedback channels and control rights. At the same time, enterprises should improve the one-time authorization mechanism, clarify the types of information and management methods through the "Summary Table", and establish a multiple authorization/revocation mechanism; Standardize commercial utilization, implement "secondary authorization" for non original purposes, and explore information payment mechanisms; Improve personalized advertising management by providing an "advertising information collection menu" and a "interest preference menu" to enhance control; Establish a timely relief system, requiring companies to demonstrate compliance throughout the entire data processing process and provide clear procedures for safeguarding rights. At the user level, it is necessary to cultivate a privacy culture, change the concept of "public-private dichotomy", and regard privacy as a dynamic data asset; Enhance privacy literacy, identify technological black box risks, and utilize system privacy functions and legal channels to protect rights; Establish self-restraint ethics, avoid giving up privacy for small gains, and enhance awareness of rights protection to achieve rights remedies.

5. Conclusion

With the fourth industrial revolution driving artificial intelligence from concept to implementation, intelligent advertising has built a new advertising ecosystem. However, technological development has made privacy boundaries increasingly blurred, and ethical issues related to privacy in intelligent advertising have become a new academic focus. This study traces the evolution logic of privacy ethics through historical tracing, and analyzes the specific manifestations of advertising privacy issues in combination with technological paradigm changes (in the era of machinery, electricity, information, and intelligent technology). It is found that the

core manifestations are infringement of personal dignity, weakening of subjectivity, and plundering of free will. By analyzing the synchronicity and diachronicity of corporate privacy policies, issues such as vague information usage rules, insufficient user authorization, excessive data sharing among affiliated companies, and rampant advertising service information are revealed; Through focus group interviews, it was found that users generally experience privacy intrusion, with phenomena of surveillance apathy and lack of control. The conflicts between enterprises and users focus on subjectivity and data centralization, intelligent marketing and privacy protection, attitude and behavior, and other conflicts. The root of the problem lies in the fact that under technological empowerment, enterprises become holders of big data power, while users become "digital laborers"; At the institutional level, there is a lag in supervision across time and space; At the user level, there are characteristics of subjectivity destruction and 'privacy cynicism'. Research proposes a three-dimensional solution path of power balance, spatial reconstruction, and ethical exit. Due to practical experience and interdisciplinary limitations, the research has shortcomings such as insufficient insights into advertising industry practices, lack of depth in theoretical models, and limited representativeness of interview samples. Future research can expand the scope of privacy ethics relationships, construct theoretical frameworks, and enhance the theoretical application value.

References

[1] *Privacy-preserving of user profile and Real-Time Bidding (RTB) based ad delivery system through Functional Encryption (FE) and Method for the same:KR1020230115408; KR202300000115408A;KR20230115408A;[P]. KR20240100215A;KR2024100100215A;KR20240100215A;[2025-11-08].*

[2] *Garg C, Bansal V, Gera N, et al. A Deep Learning and Image Content Analysis enabled approach for Sustainable Transportation. 2024 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), 2024:1-6.*

[3] *Hinton M, Macagno F. Arguing with Engineered Concepts. An Introduction to Conceptual Engineering and the Strategies of Definition. Topoi: An International Review of Philosophy, 2024, 43(5).*

[4] *Soffer A. A new paradigm for scattering theory of linear and nonlinear waves: review and open problems. Advances in Difference Equations, 2024, 2024(1).*

[5] *Su H, Luo W, Mehdad Y, et al. Llm-friendly knowledge representation for customer support[C]//Proceedings of the 31st International Conference on Computational Linguistics: Industry Track. 2025: 496-504.*

[6] *Z Zhong. AI-Assisted Workflow Optimization and Automation in the Compliance Technology Field. International Journal of Advanced Computer Science and Applications (IJACSA), 2025, 16(10): 1-5.*

[7] *Huang, J. (2025). Research on Cloud Computing Resource Scheduling Strategy Based on Big Data and Machine Learning. European Journal of Business, Economics & Management, 1(3), 104-110.*

[8] *Chang, Chen-Wei. "Compiling Declarative Privacy Policies into Runtime Enforcement for Cloud and Web Infrastructure." (2025).*

[9] *Sun, Jiahe. "Research on Sentiment Analysis Based on Multi-source Data Fusion and Pre-trained Model Optimization in Quantitative Finance." (2025).*

[10] *Chen X. Research on the Integration of Voice Control Technology and Natural Language Processing in Smart Home Systems. European Journal of Engineering and Technologies, 2025, 1(2): 41-48.*

[11] Xu, H. (2025). Research on the Implementation Path of Resource Optimization and Sustainable Development of Supply Chain. International Journal of Humanities and Social Science, 1(2), 12-18.

[12] Chen M. Research on the Application of Privacy-enhancing Technologies in AI-driven Automated Risk Detection Systems. Advances in Computer and Communication, 2025, 6(4).

[13] Qi, Y. (2025). Data Consistency and Performance Scalability Design in High-Concurrency Payment Systems. European Journal of AI, Computing & Informatics, 1(3), 39-46.

[14] Jiang, Y. (2025). Application and Practice of Machine Learning Infrastructure Optimization in Advertising Systems. Journal of Computer, Signal, and System Research, 2(6), 74-81.

[15] Zou, Y. (2025). Automated Reasoning and Technological Innovation in Cloud Computing Security. Economics and Management Innovation, 2(6), 25-32.

[16] An, C. (2025). Study on Efficiency Improvement of Data Analysis in Customer Asset Allocatior. Journal of Computer, Signal, and System Research, 2(6), 57-65.

[17] Huang, J. (2025). Optimization and Innovation of AI-Based E-Commerce Platform Recommendation System. Journal of Computer, Signal, and System Research, 2(6), 66-73.

[18] Zhang, X. (2025). Optimization of Financial Fraud Risk Identification System Based on Machine Learning. Journal of Computer, Signal, and System Research, 2(6), 82-89.

[19] Wang, Y. (2025). Exploration and Clinical Practice of the Optimization Path of Sports Rehabilitation Technology. Journal of Medicine and Life Sciences, 1(3), 88-94.

[20] Li W. The Influence of Financial Due Diligence in M&A on Investment Decision Based on Financial Data Analysis. European Journal of AI, Computing & Informatics, 2025, 1(3): 32-38.