

Mutual Benefits and Risk Governance between AI Applications and Online E-Commerce under Marketing Perspective

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Abstract:

From the perspective of marketing, the integration of AI technology and online e-commerce has given rise to a mutually beneficial and win-win situation. AI helps e-commerce companies achieve accurate user profiling and personalized marketing by virtue of its data analysis capabilities, while optimizing supply chain management and user experience to improve operational efficiency; and e-commerce companies' rich application scenarios and massive consumption data provide important support for the training and iteration of AI algorithms, which promotes the continuous upgrading of the technology. The rich application scenarios and massive consumption data of e-commerce also provide important support for the training and iteration of AI algorithms, promoting the continuous upgrading of technology. However, the process of integration of the two has also exposed the risks of data leakage, privacy infringement, algorithmic bias, etc., which may affect the marketing effect and user trust. Therefore, it is necessary to build a risk governance system through sound regulations, strengthened technical protection and industry self-regulation to ensure the compliant application of AI in the field of e-commerce, and safeguard the healthy development of the industry while consolidating the win-win results.

Keywords: E-commerce; synergistic; technology's growth; self-regulation; artificial intelligence.

1. Introduction

1.1 Background and the Theme

In the rapid development of the digital economy, network e-commerce has become the focus form

of global business, and the continuous iteration of artificial intelligence (AI) technology is bringing disruptive changes to the e-commerce industry. To begin with, AI with the help of user behavior analysis, personalized recommendations, intelligent customer service and other applications, which significantly

improve the operational efficiency of the e-commerce platform and user experience. For example, Taobao with the help of ai using the “guess what you like” function, so that the click rate of commodities more than 40%. Besides, the huge amount of transaction data and the complexity and variety of scenes in the field of e-commerce have created a rich scenario for the actual landing of AI technology, promoting the deepening of the application of AI in the fields of demand forecasting and supply chain optimization.

However, the deep integration of AI and e-commerce is also hidden risks. Algorithmic bias may cause homogenization of recommended content, data privacy leakage will trigger a crisis of trust, and over-automation may also discount the user experience. In this case, how to reach a mutually beneficial win-win situation between AI technology and online e-commerce, and build an effective risk management mechanism, has become a key issue that needs to be urgently solved by both academia and industry. So this research focuses on the mutual benefits and risk governance between AI applications and online e-commerce under marketing perspective.

1.2 Research Aims and Significance

Firstly, the purpose is to analyze the specific application scenarios of AI technology in online e-commerce marketing, reveal the logic of its mutual benefit with e-commerce platforms, and analyze the specific performance of mutual benefit and win-win between them. Secondly, the purpose is to identify the risks of AI based on e-commerce model in the marketing segment. Finally, the purpose of the research is to propose an effective solution, taking into account the efficiency and fairness of the risk governance framework, to provide theoretical and practical reference for e-commerce enterprises to optimize the application of AI and achieve sustainable development. What's more, there are two meanings of the research. Theoretical significance, which is to build a synergistic model of AI and e-commerce from the perspective of marketing, enriching the theoretical business system in the intersection of AI and e-commerce marketing. Additionally, the practical significance: to provide e-commerce enterprises with optimization paths for AI marketing tools, helping them to improve conversion rates while reducing compliance risks.

1.3 Research Methods and Structure

The research use two methods to support the claim. Firstly, literature research method: combing the existing results on the application cases, risk governance and mutual benefit mechanisms of AI in e-commerce marketing to lay the theoretical foundation. Secondly, the case study method: to taobao, amazon and other e-commerce platforms of AI marketing practice, analyze ai in personalized recommen-

dation, intelligent customer service, the success of experience and risk countermeasures.

The research talks about AI and e-commerce development in current status, their existing strengths, and the problems of them.

2. Current Status of AI and E-Commerce Development

2.1 Technical Application

Firstly, the “guess what you like” recommendation system, which mainly relies on machine learning, big data analysis technology, by mining the user's historical behavior, which can build user profiles and achieve accurate recommendations.

Amazon integrates multi-dimensional data such as user purchase history, browsing behavior, real-time interaction, etc. through AI's big data analysis technology to build user interest profiles. For example, when a user browses a certain product, the system will instantly recommend related products based on collaborative filtering algorithms combined with the preferences of similar users, and the system contributes about 35% of its revenue, which is a typical application of the “Guess Your Favorite” model [1]. Taobao's recommendation mechanism. Using AI to analyze user consumption habits, geography and other factors to dynamically adjust the recommended content. For example, for family users with children, toys and children's clothing will be recommended according to the age of the child, and seasonal products will be pushed to the user when the season changes to improve the relevance of the recommendation [2].

Second, 24-hour AI customer service .AI customer service mainly relies on natural language processing (NLP), speech recognition, knowledge mapping and other technologies to realize the understanding of user text inquiries and rapid response based on a preset knowledge base, supporting 24-hour uninterrupted service.

Jingdong JIMI Intelligent Customer Service. Employs NLP technology to parse user questions, and can handle real-time order inquiries, logistics tracking, product inquiries and other needs. For example, when the user asks, “when will the order be shipped”, JIMI can quickly access the order system data to inform the shipment time and expected delivery information, and complex issues are automatically transferred to manual customer service to achieve efficient triage [2].

AI SmartMee Intelligent Customer Service. Integrates knowledge mapping technology, covering a huge amount of commodity information and business process knowledge. When users consult commodity material, size and other issues, AI can accurately match the answer, such as

the user asked, “whether the clothes are pure cotton”, can directly return to the details of the commodity material, which can enhance the efficiency and accuracy of the service [3].

2.2 Market Size

Explosive growth of the AI advertising market. Global AI-driven ad spending has demonstrated a huge volume and strong growth rate. In 2022, the size of the AI advertising market has reached US\$370 billion, covering the entire chain of services [4]. With a compound annual growth rate of more than 13%, becoming one of the fastest-growing areas in the digital economy. Behind this expansion is the urgent need for enterprises to accurately acquire customers and optimize costs - AI technology can increase the efficiency of advertising by 30%-50%, while reducing ineffective expenditures by 20%-40% [4,5]

3. Existing Strengths of AI and E-Commerce Market Economy

3.1 Highly Efficient Services

As for the real-time, AI customer service can respond 24 hours a day, such as the LazzieChat chat robot of South-east Asian e-commerce platform Lazada, based on the ChatGPT technology to compress the average response time to within 10 seconds, compared with the 5-10 minutes of manual customer service to improve nearly 30 times, significantly reducing the cost of waiting for the users [4]. In terms of synergistic capabilities, AI customer service can integrate multi-channel data, such as Shopify's Shopify Magic which can link order, inventory and logistics systems to automatically generate targeted responses, shortening the complex issue handling cycle from 1-2 days to the minute level [4].

On the technical level, the application of the BERT model enables AI customer service to classify customer interaction text with an accuracy of 97%, accurately identifying needs and match solutions [5]. This efficiency not only reduces the manual workload by 60%-80%, but also promotes process optimization through data feedback, forming a positive cycle of “service-improvement”, highlighting the core value of AI in improving service efficiency.

3.2 Precise Recommendation

AI through mining user behavioral data and product characteristics, realizes personalized content distribution for “thousands of people, thousands of faces”, which significantly improves user experience and commercial conversion efficiency.

From the perspective of technical implementation, the integration of graph neural networks (GNNs) and natural

language processing (NLP) provides strong support for accurate recommendation, and GNNs can model complex purchase patterns and associated preferences by constructing a user-commodity relationship graph. For example, identifying hidden associations, such as “users who buy sports shoes tend to buy sports socks at the same time”. The average precision (MAP) of the recommendations can reach 0.92, and the correlation of the top 5 recommendations is as high as 93%. Meanwhile, the BERT model's sentiment analysis of user comments and consultation texts can further extract potential needs and provide a fine-grained basis for recommendation strategies [5].

In business practice, accurate recommendation has become a key engine to improve conversion. For instance, Amazon's AI recommendation system has increased the “purchase rate” by 35%, while Wayfair's GAI tool “Decorify” recommends suitable products based on users' uploaded photos of their homes, increasing the browse-to-buy conversion rate by 27% [4,5]. This accuracy not only reduces the cost of user information screening but also reduces the marketing redundancy of the enterprise through “on-demand recommendation”, which increases the efficiency of advertisement placement by more than 40% [6].

3.3 Scene-Driven

Relying on computer vision, deep learning and other technologies, it accurately solves the core pain points of online shopping such as “size fit” and “pre-judgement of body effect” and has become a key scenario to promote the transformation of e-commerce and upgrade of user experience.

From the demand side, the “difficulty of trying on clothes” in online shopping has long constrained the turnover rate of apparel products. The analysis of user interaction text through the BERT model in the study shows that “size fit” and “fit effect” are the high-frequency pain points of apparel consulting, and it is hard to eliminate users' concerns about “ill-fitting” in traditional graphic display, which leads to a high turnover rate of apparel products [5]. AI fitting technology solves this pain point through virtual scene restoration: For example, Google launched the “virtual fitting tool”, which generates different body types based on diffusion models. It generates the upper-body effects of models with different body types and skin colors, and users can upload their own photos to realize “virtual trying on” and intuitively check the presentation effect of the clothing type and color in themselves [4].

At the level of technical support, the accuracy of AI fitting relies on multimodal data fusion and model optimization. The GNNs model correlates users' body type data with product parameters to build a “user-product” matching map, so that the error of the fitting effect can be controlled within 2cm. At the same time, the BERT model analyzes keywords such as “fabric elasticity” and ‘looseness’ in the

user comments, and guides the AI to adjust the details of the fitting scene [5].

4. Problems of AI and E-Commerce Market Economy

4.1 Data Security

As for the data collection process, AI systems need to collect massive amounts of private user information, including basic information, behavioral data and even biometric features in order to achieve accurate services. Once these data are improperly stored or leaked in transmission. It may lead to users experiencing fraud, harassment or even identity theft. For example, when AI customer service handles return and exchange inquiries, it records the user's address and order information, which may be illegally crawled and used for malicious marketing if the database protection is insufficient [5].

At the data processing level, the "black-box characteristics" of AI models may exacerbate security risks. For instance, GNNs models need to integrate data from multiple sources. When constructing user-goods relationship maps, and if the model's permissions are not strictly managed, it may lead to cross-border data flow violation, which do not transmit user data to overseas servers through compliant channels, violating the EU General Data Protection Regulation (GDPR) [4,5].

4.2 High Cost and Immature Technology

In terms of cost, the deployment and maintenance costs of AI systems remain high, significantly raising the entry threshold for enterprises. On the one hand, the R&D investment in core technology is huge - for example, the training of the BERT model needs to process millions of user interaction data, and the cost of single model training is more than \$100,000, while the arithmetic consumption of the GNNs recommendation system has increased by 50% per year on average [5]; On the other hand, enterprises need to equip a professional team for the landing of the technology, the labor cost increases by 30%-50% compared to traditional business [4].

In terms of technological maturity, the "limitations" of existing AI systems are still relatively prominent. First, the processing capacity of complex scenes is insufficient - for example, when the virtual customer service digital person responds to ambiguous needs, the accuracy of the answer plummets to less than 50%, and manual intervention is required to remedy the situation [6]. Secondly, there is "semantic distortion" in multilingual conversion. Finally, the stability of the model needs to be improved - the BERT model has an error rate of 15%-20% in recognizing sentiment when analyzing dialects and slang, and the GNNs

recommender system may generate incorrect associations due to data bias [5].

5. Solutions and Future Development of AI and E-Commerce Market Economy

5.1 Transparent Operation, Government Supervision, Technical Encryption

Transparent operations can employ Explainable Artificial Intelligence (XAI), such as generating visual explanatory reports of recommendation results, to allow users to understand decision-making factors [2].

Government oversight requires improved regulations, the establishment of specialized agencies to verify platform compliance, and severe penalties for violators, as demonstrated by Amazon's €746 million fine for data non-compliance.

In terms of technical encryption, end-to-end encryption guarantees the security of data transmission and storage, homomorphic encryption supports analysis under encrypted state, differential privacy adds noise and dynamic access control to protect individuals [2].

5.2 Government Subsidies, Product Research Cooperation

In terms of government subsidies, to address the problems faced by e-commerce platforms in user information management, such as data privacy leakage and algorithmic bias [2], the government can set up a special subsidy to encourage enterprises to deploy end-to-end encryption, differential privacy. For example, enterprises that use homomorphic encryption technology for data analysis will be subsidized in proportion to their technology investment, helping them complete user behavior analysis in an encrypted state, which protects privacy without affecting the realization of the intelligent recommendation function. At the same time, for the fragmentation of user profiles caused by data silos, subsidies can be tilted toward cross-platform data integration projects, supporting enterprises to build a unified data platform, referring to the deployment cost of Apache Hadoop and other distributed computing frameworks to give financial support to improve the marketing conversion rate.

As for product research cooperation, combined with the pain points of AI application in digital marketing. Enterprises can be promoted to carry out joint research with universities and research institutions. Through the cooperative development of explainable AI (XAI) components, the decision logic of intelligent recommendation can be visualized [2], which not only solves the problem of algorithmic black box but also provides students with prac-

tice scenarios. For example, e-commerce platforms and universities to build “intelligent marketing laboratory”, research team based on the platform of real data to optimize the recommendation algorithm, to reduce gender, price and other dimensions of implicit discrimination, the government can subsidize the site rental, equipment procurement of this type of cooperation projects, reduce the threshold of cooperation between schools and enterprises [7, 8].

5.3 Development of Synergistic Governmental, Sustainable Technological in Harmony Nature

Government Collaboration to Build a Support Framework. To address the problems of data silos and algorithmic bias, the government can formulate unified data standards, incentivize cross-platform collaboration through subsidies, establish an algorithmic auditing system, and give policy preference to compliant enterprises, as well as take the lead in university-enterprise research and development cooperation to accelerate the implementation of technology [2,9].

Second, technology continues to break through bottlenecks. Continuously optimize privacy protection technology to mine value while safeguarding data security; upgrade models such as LSTM to improve supply chain efficiency and promote the research and development of interpretable AI to enhance user trust [10,11].

Third, coordinate with nature to realize symbiosis. Using AI to optimize logistics paths to reduce carbon emissions, improving packaging design and energy management through algorithms, balancing industrial development and ecological protection, and forming a benign interaction between technology, policy and nature [1,7].

6. Conclusion

This study analyzes the development of “AI + e-commerce”, revealing its current situation, advantages, problems and development path. In terms of the current development situation, and the technology application. “Guess Your Favorite” recommendation system, 24-hour AI customer service and so on have become the mainstream; the market scale has shown a rapid expansion trend, showing huge growth potential; business model innovation, such as digital human generation of multi-language copy, oral content, which is a powerful impetus to international trade. At the advantage level, taking Taobao, Jitterbug and other platforms as examples, AI improves service efficiency, realizes accurate recommendation, enriches consumption scenes, and drives decision-making optimization through real-time data statistics. However, there are still significant problems in this field: challenges in data privacy and security, high and immature technology costs,

and high system failures and operational risks. To address these problems, the study proposes the following solutions: safeguard data security through transparent operation, government supervision, and technical encryption; reduce costs and promote technology iteration through subsidies and product research and development cooperation; and achieve synergistic progress in technology and ecology by relying on the concepts of policy synergy and sustainable development in the future.

But there are some limitations. First, the study takes Taobao and other head platforms as examples and does not cover the current situation and dilemmas of AI+ application in small and medium-sized e-commerce platforms, which may not reflect the overall situation of the industry. Second, the analysis of technical aspects such as the principles of AI algorithms and the difficulty of the actual implementation of encryption technology is not in-depth enough and fails to fully reveal the details of the technical bottlenecks.

The future can be developed through two ways. To begin with, deepen technical research: further explore the application of AI big models in e-commerce scenarios, analyze its impact on consumer experience and operational efficiency, and focus on the actual landing effect of federal learning, differential privacy and other technologies. Besides, expand the research object: the research sample to cover platforms of different sizes and segments, and compare and analyze the differentiated paths and challenges of “AI+” applications.

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