

The Transformational Role of Artificial Intelligence in E-Commerce Financial Services

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Abstract: *This paper discusses the higher requirements for recommender systems in the context of the increasing volume of e-commerce users, information and commodities. The article focuses on the intelligent recommendation method based on collaborative filtering technology, which can be combined with the user's personal preferences and habits for personalized recommendation, while using the recommendation system to discover and display long-tailed commodities, promote the utilization and transformation of commodities, and meet the development of market diversification. The study first analyzes the implementation principle of collaborative filtering algorithm, and then based on the demand characteristics of e-commerce platforms, it constructs different steps of the intelligent recommendation method, including data preprocessing, similarity calculation, recommendation generation and evaluation, and puts forward the conditions for the implementation of existing algorithms.*

Keywords: e-commerce; intelligent recommender systems; collaborative filtering; diversity; digitization.

1. COMBINING ARTIFICIAL INTELLIGENCE WITH E-COMMERCE FINANCIAL SERVICES

1.1 Development history of e-commerce financial services

The combination of artificial intelligence and e-commerce financial services is an important development trend in the current e-commerce field. With the increasing volume of e-commerce users, information and commodities, the recommendation system in e-commerce has put forward higher requirements. The intelligent recommendation method based on collaborative filtering technology can not only accurately carry out personalized recommendation by combining users' personal preferences and habits, but also discover and display long-tail commodities through the recommendation system, accelerate the utilization and transformation of commodities, and comply with the diversified development of the market. In the e-commerce platform, intelligent recommendation system plays an essential role, domestic and foreign enterprises and scholars for e-commerce in the use of intelligent recommendation problem carried out in-depth research, a number of personalized recommendation methods came into being, but also make Amazon, Ctrip, Alibaba and so on in the field of recommendation has achieved a lot of application results. However, compared with foreign countries, China's research on e-commerce intelligent recommendation technology is still in the follow mode, the research on new ideas, new methods and new technologies is still weak, the recommendation strategy is relatively simple, and most of them are used in customer-oriented push, and the relevant research on the recommendation algorithms for the enterprise products and product evaluation is relatively small.

1.2 Fundamentals of Artificial Intelligence and its Application in Financial Services

Artificial Intelligence, a technology that covers a wide range of subject areas, is profoundly changing our way of life. In the field of financial services, the application of artificial intelligence is particularly extensive, and its influence has been involved in risk management, fraud detection, portfolio optimization, customer service and many other aspects. The following are the specific applications and roles of AI in the financial services field.

First, the application of machine learning and deep learning in financial services has significant advantages. These technologies can help financial institutions predict stock market trends, perform credit scoring, assess loan default risk, and optimize transaction execution, among other aspects, through the analysis of massive amounts of data. Not only that, machine learning and deep learning technologies can also discover patterns and trends hidden behind data, enabling financial institutions to make more accurate and efficient decisions.

Secondly, the application of natural language processing technology in the financial field is also increasingly showing its importance. Through the use of natural language processing technology, financial institutions can

analyze and monitor the public opinion of a large amount of news, social media and market commentary, and extract information useful for investment decision-making and risk management. This not only helps financial institutions better grasp market dynamics, but also provides them with a more comprehensive perspective on risk assessment.

Further, expert systems play an important role in the customer service of financial institutions. The emergence of virtual assistants and intelligent customer service systems has enabled financial institutions to provide faster and more personalized services to their customers. They are able to solve some common problems and reduce the workload of customer service personnel, while also improving customer satisfaction.

In summary, the application of artificial intelligence in financial services, whether it is machine learning, deep learning, natural language processing or expert systems, is designed to provide more powerful and accurate tools for more efficient service, risk management and decision-making. The continuous development and improvement of artificial intelligence technology will further promote innovation and change in the field of financial services and provide better services for financial institutions and customers.

In China, the development of artificial intelligence has also received strong support and attention from the state. With the promotion of policies and the continuous innovation of technology, the application of artificial intelligence in the field of financial services in China will be more extensive, providing more intelligent and personalized services for financial institutions and customers. At the same time, we should also pay attention to the potential risks brought by AI in the field of financial services, such as data security, privacy protection and other issues, and strengthen the construction of relevant laws and regulations to ensure the healthy development of AI in the field of financial services.

2. THE TRANSFORMATIVE ROLE OF ARTIFICIAL INTELLIGENCE IN E-COMMERCE FINANCIAL SERVICES

2.1 Innovation in Personalized Financial Products and Services

2.1.1 Customized Financial Solutions

The innovation of personalized financial products and services involves customized financial solutions, an area driven by advances in fintech and artificial intelligence technology. Customized financial solutions refer to financial products and services that are tailored to individual customers based on their needs, capital status, risk preferences and other factors. This innovative financial model provides customers with a more targeted and personalized financial experience.

In the field of e-commerce financial services, artificial intelligence (AI) is driving innovation in personalized financial products and services, and is especially being used more and more widely in customized financial solutions. Here are a few key aspects of how AI is contributing to personalized financial solutions:

1) Customer data analysis

AI can provide a comprehensive understanding of customers' personal preferences and needs by analyzing their transaction data, consumption habits, search history and social media behavior. This in-depth analysis can help financial institutions design financial products that meet the needs of individual customers. In addition, AI can tap into potential customers and provide financial institutions with targeted marketing strategies.

2) Risk Assessment Customization

AI models are able to provide more accurate risk assessments based on sophisticated analysis of data such as a customer's credit history, transaction behavior, and even online behavior. With this information, financial service providers can provide tailored products for customers with different risk preferences, such as different financial products based on customers' risk tolerance.

3) Dynamic Pricing

AI enables a dynamic pricing strategy, adjusting loan interest rates, insurance rates, etc. according to customers' credit status, market conditions, supply and demand, and other factors. This flexibility can provide more attractive and personalized products and services, thus increasing customer satisfaction and loyalty.

4) Intelligent Recommendation System

Through AI algorithms, intelligent recommendation systems can be created to recommend the most appropriate financial products and services for customers. These systems perform real-time analysis based on the customer's financial situation, life events, purchasing power and other factors in order to provide customized recommendations. In addition, AI can adjust the recommendations based on the customer's behavior and preferences to improve the effectiveness of the recommendations.

5) Automated Customer Service

Through natural language processing (NLP) and machine learning, AI can provide automated customer service, answering customer inquiries and even providing financial advice in some cases. This kind of service can provide personalized solutions based on the customer's specific situation and needs, improving the customer experience.

6) Robo-Advisor

Robo-advisors use AI algorithms to provide personalized investment advice to clients. They are able to process large amounts of market data to help clients develop investment strategies based on their risk appetite, financial goals and investment horizon. In addition, robo-advisors are able to adjust their portfolios in real time to adapt to market changes and client needs.

7) Credit Scoring

AI can provide more refined credit scoring models by analyzing a large number of non-traditional data sources. For example, it can take into account data points such as an individual's online shopping habits, utility payment history, and other data points to provide credit scoring services to those who do not have sufficient credit history. Such innovations can help expand the reach of financial services to meet the needs of more people.

8) Anti-Fraud Detection

AI systems can monitor and analyze transaction patterns in real time to identify and prevent fraud. By learning patterns of normal and abnormal behavior, these systems can improve the accuracy of identifying fraud while providing a safer financial environment for customers. In addition, AI can assist financial institutions in developing anti-fraud strategies to reduce risk.

2.1.2 Intelligent Recommender System

Intelligent recommendation systems play a crucial role in personalized financial products and services. Through the use of artificial intelligence and big data analysis, the intelligent recommendation system can provide financial institutions with a more effective customized customer experience and promote customer loyalty and satisfaction. First, intelligent recommendation systems can provide customized financial products and services based on customers' behavioral patterns, consumption habits and preferences. This personalized service approach can meet the unique needs of different customers, thus increasing customer satisfaction and loyalty. At the same time, financial institutions are also able to more accurately assess risks and control them through intelligent systems, which helps to innovate financial products and services while ensuring that risks are controllable [1]. However, the implementation of intelligent recommendation systems needs to follow the general principles of AI governance and take into account the specificities of the financial sector. This includes ensuring the fairness, interpretability and robustness of algorithms, as well as the ability to fully utilize new technologies in the future development of financial services [1]. In addition, there is a need to confront the ethical and regulatory risks in the application of AI to the financial industry and to ensure the security of private personal data [2].

The application of intelligent recommender systems is not limited to large financial institutions, but is also of great significance to small and medium-sized enterprises (SMEs), especially e-commerce SMEs. Financial policies and financial institutions can use these systems to provide e-commerce SMEs with differentiated, scenario-based, and

intelligent financial service products, while realizing the effective integration and deep utilization of data resources [4].

In the field of financial services, intelligent recommender systems can be applied to a number of aspects, including:

1) product recommendation: according to customers' personalized needs and preferences, intelligent recommendation system can recommend the most suitable financial products for customers, such as credit cards, loan products, investment and wealth management products. This personalized recommendation can improve customer satisfaction, increase product sales, and enhance customer experience.

2) Precise marketing: Intelligent recommendation system can analyze customer's transaction behavior and consumption preference, so as to accurately customize marketing and promotion programs. Through personalized marketing recommendations, financial institutions can better interact with customers and improve marketing effectiveness, while reducing ineffective advertising.

3) Financial Planning Recommendations: For the financial situation of individual customers, the intelligent recommendation system can provide more accurate financial planning recommendations and investment portfolio recommendations. This helps customers to better develop personalized financial planning and improve the effectiveness of asset allocation.

In addition, the development of intelligent recommender systems needs to consider the challenges of privacy protection and data security. Ensuring the security and privacy of customer data, as well as compliant use and storage, are key considerations in the development of intelligent recommendation systems. In practice, some fintech companies and banks have already used smart recommendation systems to provide personalized financial product recommendations and services to customers with some success. These cases provide financial institutions with experiences that can be drawn upon and promote the personalized and intelligent development of financial services.

2.2 Optimization of Risk Management and Fraud Detection

2.2.1 Transaction Monitoring and Abnormal Behavior Detection

Risk management and fraud detection are crucial in the field of financial services, especially in transaction monitoring and abnormal behavior detection. By combining artificial intelligence technology, financial institutions can achieve real-time monitoring of transactions and timely detection of abnormal transaction behavior, so as to intervene early and prevent potential risks and fraud. The optimization of transaction monitoring and abnormal behavior detection mainly includes the following aspects.

First, by applying AI technology, financial institutions can achieve real-time monitoring of transaction data to identify and record potential abnormal transaction behavior. Such real-time monitoring helps to detect anomalies as soon as a transaction occurs so that timely action can be taken. Second, using big data analytics and machine learning technologies, financial institutions can conduct in-depth analysis of historical trading data to identify patterns and regularities that are inconsistent with normal trading behavior. Such data analysis can help financial institutions better understand the characteristics and changing trends of fraudulent activities. In addition, by building and optimizing intelligent models, financial institutions can identify abnormal transaction behaviors, such as abnormal transaction times, locations, and amounts. This helps financial institutions realize automated abnormal transaction detection, reducing manual intervention and improving detection efficiency. Finally, based on artificial intelligence technology, the transaction monitoring system can realize real-time alarm and processing of abnormal trading behavior. Once anomalies are detected, the system can immediately issue an alert and automatically or prompt staff to take appropriate action, as well as conduct further investigation and processing.

In practical application, some fintech companies and banks have successfully used AI technologies to optimize transaction monitoring and abnormal behavior detection with remarkable results. The optimization of these technologies can not only improve the ability of financial institutions to perceive risks, but also reduce the impact of fraudulent activities on the financial system, thus safeguarding the security and stability of the financial system.

2.2.2 Credit Risk Assessment and Management

In the field of financial services, credit risk assessment and management are crucial. Combined with artificial intelligence technology, financial institutions are able to achieve more accurate and efficient credit risk assessment and management, thereby reducing the risk of non-performing loans and improving loan efficiency as well as customer satisfaction. This optimization process covers a number of aspects.

By using machine learning algorithms to construct intelligent credit scoring models, such as logistic regression, random forest, gradient boosting tree, etc., financial institutions are able to more accurately predict the default risk of a borrower and take into account a variety of borrower characteristics and credit history data, thus providing financial institutions with a more objective and scientific means of credit assessment. Combined with big data technology for data analysis, by analyzing massive borrower data and market information, financial institutions can more comprehensively grasp the risk profile of the overall loan market and make timely adjustments to credit policies and risk management strategies.

In addition, the use of artificial intelligence technology for fraud detection, such as machine learning and natural language processing, helps to identify potential signs of fraud and effectively reduce the risk of fraud. What's more, real-time data processing technology is utilized to establish a real-time monitoring system from the application stage to the loan period to provide more timely and comprehensive monitoring of loan risks and reduce credit losses.

In recent years, many fintech companies and banks have successfully applied artificial intelligence technologies to improve credit risk assessment and management, such as predictive credit scoring models and real-time fraud detection systems. The application of these technologies has helped to improve the accuracy and efficiency of credit decision-making, bringing significant business value to financial institutions.

2.3 Customer Service and Interaction Improvements

2.3.1 Chatbots and Virtual Assistants

Chatbots and virtual assistants play an important role in customer service and interaction improvement. The application of these AI technologies provides financial institutions with a smarter and more efficient customer service and interaction experience.

Chatbots and virtual assistants are able to identify customer problems and provide instant, personalized solutions through natural language processing and machine learning technologies. This instant interaction enhances customer satisfaction, quickly resolves customer issues and improves service efficiency. These technologies can also be used for customer self-service and automated processes. Customers can interact with chatbots to inquire about account information, apply for products, or even perform simple problem solving on their own, thus reducing the pressure on human customer service and improving service efficiency.

In addition, the data analytics of chatbots and virtual assistants can help financial institutions better understand customer needs and behavioral patterns, so as to provide more personalized services and product recommendations. Virtual assistants can also be used for sales and marketing. Through personalized interaction with customers, virtual assistants can better understand customer needs and provide customers with thoughtful product recommendations and customized services, thereby increasing sales and enhancing customer loyalty.

In short, the application of chatbots and virtual assistants enables financial institutions to interact with customers in a more efficient and personalized way through intelligent means, improving customer service levels, while reducing operating costs and enhancing market competitiveness.

2.3.2 Intelligent Voice Interaction System

Intelligent voice interaction systems play an important role in financial services, providing customers with a more convenient and personalized service experience. These systems utilize artificial intelligence and natural language processing technologies to enable customers to interact with financial institutions and perform operations through voice commands. Intelligent voice interaction systems provide customers with 24/7, instantaneous service with no waiting time, greatly enhancing the customer experience. Customers can check account information, perform

transfers, pay bills, and other operations by simply using voice commands, providing a more efficient service. These systems are able to automatically provide personalized solutions based on customers' voice commands and questions. By recognizing and understanding the customer's voice, the system can provide appropriate services and suggestions based on the customer's needs and context, greatly enhancing the relevance and personalization of services. Intelligent voice interaction systems can also be integrated with other financial service systems, such as account management systems and customer relationship management systems, to achieve more comprehensive services and meet more diverse customer needs.

Finally, these systems can also provide intelligent problem solving and troubleshooting services. Through voice recognition and interaction, the systems can help customers identify and solve problems or perform initial troubleshooting, thus reducing the pressure on manual customer service and improving service efficiency.

2.4 Operational Efficiency Improvements

2.4.1 Automated Processes and Back Office Operations

The improvement of operational efficiency is of great significance in the financial sector, and the optimization of automated processes and back-office operations is the key to achieving this goal. Combined with AI technology, financial institutions can improve the automation of business processes and the efficiency of back-office operations, thereby realizing cost savings and service level enhancement. By automating processes, financial institutions are able to reduce repetitive tasks and human intervention, thereby improving operational efficiency. Automated processes can help reduce wasted human resources in areas such as customer account opening, loan applications, and compliance audits, while reducing the risk of operational errors.

Optimization of back-office operations can leverage AI technology to analyze and process large amounts of data to uncover potential improvements in operational efficiency. By mining and analyzing data, financial institutions are able to better understand the current state of business operations and guide operational decisions, thereby improving overall efficiency. Intelligent automated processes and optimization of back-office operations can greatly improve the operational efficiency and cost-effectiveness of financial institutions. The application of these technologies not only brings faster and more accurate business processes to financial institutions, but also frees up more time for employees to carry out more valuable work and provide more specialized services to customers. Under the current trend of rapid development of financial technology, many financial institutions have begun to apply automated processes and back-office operation optimization technologies to improve overall efficiency, reduce costs, and provide customers with more efficient and convenient services.

2.4.2 Data Analysis and Insight

Data analytics and insights play a key role in improving operational efficiency in the financial sector. By integrating AI technology, financial institutions are able to make better use of customer data, transaction information and market trends to achieve accurate decision-making and operational optimization.

Through data analytics, financial institutions are able to dig deeper into big data and discover potential business opportunities and risks from it. Combined with artificial intelligence technologies, methods such as machine learning, data mining and predictive analytics can help financial institutions more accurately identify and predict customer needs, market trends and risk signals to better formulate strategies and optimize operational processes. These technologies can also be used to gain insights into customer behavior and preferences, thereby providing financial institutions with more personalized products and services. By analyzing customer data, financial institutions can better understand customer needs, adjust product design and marketing strategies, and improve customer satisfaction.

In addition, data analytics can help financial institutions better manage risk and monitor compliance. Through real-time monitoring and analysis of transaction data, financial institutions can identify potential fraud and risk events in a timely manner and take appropriate measures to reduce business risks. Data analytics and insights also help financial institutions optimize marketing and promotional strategies. By analyzing customer data and market trends, financial institutions are able to carry out marketing activities in a more targeted manner, improve marketing efficiency and reduce promotion costs.

3. CHALLENGES AND FUTURE PROSPECTS

3.1 Ethical and Legal Challenges of Artificial Intelligence in Financial Services

3.1.1 Data Privacy and Security Issues

The widespread use of AI in financial services poses a number of ethical and legal challenges. Among them, data privacy and security issues are particularly prominent. Financial institutions must strictly comply with laws and regulations when handling customer data to protect customer privacy and data security. Collecting, storing and processing large amounts of customer data may involve the risk of privacy leakage. Artificial intelligence algorithms require a large amount of data for training and optimization, yet this data may contain sensitive information about individuals, such as ID numbers and financial status. Therefore, ensuring the privacy and security of customer data is critical. Misuse and leakage of data can lead to significant legal liabilities and reputational risks. Financial institutions need to establish strict data management and protection measures to ensure data security and confidentiality while complying with relevant laws and regulations, such as the Personal Information Protection Act.

In addition, with the continuous development of AI technology, the cross-analysis and use of personal data may also pose potential ethical challenges. Financial institutions need to ensure the legitimacy and compliance of data and provide customers with transparent instructions on data usage to ensure the legality and fairness of data usage.

3.1.2 Algorithmic Bias and Fairness Issues

Algorithmic bias and fairness issues are of great concern in financial services. The design and application of AI algorithms may be potentially biased, leading to unfair treatment of certain groups, particularly in areas such as credit, recruitment and pricing.

The data on which AI algorithms are trained may be socially biased, allowing the algorithms to produce unfair decisions in credit granting, employment opportunities, and market pricing. This can lead to discriminatory outcomes based on gender, race or other groups. Algorithms are less transparent and explanatory, making their decision-making processes difficult to explain and understand. This may further erode trust and acceptance of the fairness of algorithms. Financial institutions need to take steps to address this issue. This includes:

- 1) data review: review of training data to identify and correct possible biases and unfairness in it.
- 2) Algorithm review: reviewing and evaluating AI algorithms to ensure that their decisions do not introduce unfairness and to correct for possible bias.
- 3) Transparency and Interpretation: Increase the transparency of the algorithm's decision-making process so that its decisions can be explained and understood, reducing the potential for unfairness.
- 4) Diverse Participation: Encourage diverse teams to participate in algorithm design and review to reduce the potential for bias.

Financial institutions need to take proactive steps to ensure that the use of AI algorithms in financial services does not introduce bias and unfairness, thereby ensuring fair treatment of every customer and market participant.

3.2 Continued Advances in Artificial Intelligence Technology and Financial Innovation

3.2.1 Combination of Blockchain Technology and AI

The combination of blockchain technology and AI has great potential in financial innovation. The combination of blockchain's decentralization, security and traceability features with AI's intelligent analysis and decision-making capabilities opens up vast innovation possibilities for financial services.

When blockchain technology is combined with artificial intelligence, it can enhance the automated execution of financial transactions and contracts. The programming capabilities of smart contracts combined with the decentralized nature of blockchain enable more efficient and secure transaction execution and settlement. Risk

assessment models that combine blockchain technology and artificial intelligence can enable more accurate risk management. By using the data immutability and traceability of blockchain, combined with the data analysis and pattern recognition techniques of artificial intelligence, financial institutions can better identify and manage risks. Combining blockchain technology and artificial intelligence can also drive personalization of financial products and services. Through blockchain's data collection and protection, combined with AI's data analysis and personalized recommendation technology, financial institutions can better meet customers' individual needs.

3.2.2 Potential impact of quantum computing on financial services

The emergence of quantum computing has potentially significant implications for the financial services sector. The high-speed computing power and parallel processing advantages of quantum computing enable it to drive innovation and growth in the financial sector. Quantum computing can accelerate the development and optimization of financial models. Its efficient computing power can help financial institutions accelerate risk management models, transaction optimization, and pricing of complex financial instruments, thereby improving the speed and accuracy of financial decisions. The impact of quantum computing on encryption algorithms and secure communications will have a profound effect on financial services. Traditional encryption algorithms may be challenged by algorithmic cracking in quantum computing, so financial institutions will need to adapt to new encryption technologies to secure transactions and customer data. Quantum computing may also dramatically change risk management and portfolio optimization. By leveraging the parallelism and high-dimensional nature of quantum computing, financial institutions can more accurately assess and manage complex risk exposures while optimizing portfolios and accelerating the decision-making process. Quantum computing can also have a profound impact on derivatives pricing and financial engineering. Its efficient computational power and complexity-handling capabilities will facilitate the development of more sophisticated financial products and instruments, thus promoting financial innovation. The potential impact of quantum computing on financial services encompasses efficient computing power, secure communication, risk management and portfolio optimization, which are expected to drive innovation and development of financial services. However, as quantum computing technology evolves, financial institutions will need to continuously adapt and adjust to take full advantage of the potential benefits and address the challenges that may arise.

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