Journal of Computer Science and Frontier Technologies
ISSN Print: 3104-4204
ISSN Online: 3104-4212
CD ISSN: 3104-4220
https://doi.org/10.63313/JCSFT.9095

The Applications and Challenges of AI in the Banking Sector

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How to cite this paper: Chen, K. (2026). The Applications and Challenges of AI in the Banking Sector. Journal of Computer Science and Frontier Technologies, 4(1), 82–96. ISSN Print: 3104-4204, ISSN Online: 3104-4212.
https://doi.org/10.63313/JCSFT.9095
Published: 2026-08-12

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Abstract

This study systematically explores the current state of artificial intelligence (AI) applications across three core scenarios in the banking industry: intelligent customer service, risk management, and wealth management. Based on empirical case studies, AI technology has significantly reduced labor costs in the banking sector, enhanced the efficiency of business processes such as credit approval, and enabled ordinary customers to access professional financial advice. However, AI also faces several limitations, including insufficient levels of intelligence, a lack of interpretability in model decision-making processes, risks of customer data leakage, and suboptimal system stability. In the banking industry—a sector where operational accuracy and security are paramount—the risks arising from these issues are particularly pronounced compared to those in other industries. In summary, the deep integration of AI in the banking sector has become an inevitable trend; the key challenge lies in how to achieve its deployment in a robust and controllable manner. Feasible approaches include: at the technical level, adopting methods that integrate multiple optimization algorithms to enhance the generalization capability and robustness of models; at the business process level, establishing a hybrid decision-making mechanism that integrates human and machine capabilities; and at the institutional and regulatory level, urgently formulating and refining specific regulations and standards tailored for AI-driven financial applications. Only through such multi-dimensional collaborative governance can the application value of AI in the banking sector be maximized, while its potential risks are confined within acceptable limits.

Keywords

Artificial Intelligence; Banking Sector; Application Scenarios; Risk Management; Regulatory Framework

1. Introduction

1.1. Research Background

Currently, artificial intelligence (AI) technology is profoundly reshaping the operational paradigms of numerous industries and injecting new momentum into

the digital transformation of commercial banks. As a core component of the modern economic system, the banking sector faces unprecedented transformation pressures: customer demands have become increasingly diversified; they are no longer satisfied with traditional counter-based services but now place greater emphasis on the convenience, intelligent capabilities, and responsiveness of financial services. In this context, commercial banks can leverage AI technology to address external challenges and consolidate and enhance their core competitiveness. AI not only enables the optimization of bank service quality but also provides more precise data analytics and decision support. However, opportunities often coexist with risks, and the deep integration of AI technology within the banking industry has also given rise to numerous complex issues. Consequently, how to fully unlock the value of AI while effectively managing and controlling its potential risks has become a critical issue that commercial banks must urgently address.

1.2. Research Significance

Against this backdrop, this paper aims to systematically explore the current state of artificial intelligence (AI) applications in commercial banks, their primary opportunities, and key challenges, while proposing corresponding development strategies. First, from the perspective of bank industry development, AI applications enable traditional banks to break through the constraints of their existing business models and accelerate their digital transformation process. For instance, the introduction of intelligent customer service systems can significantly reduce labor costs and enhance service efficiency; meanwhile, robo-advisory services can provide customers with more precise investment recommendations, thereby strengthening customer loyalty. Second, regarding financial stability, the application of AI in risk management can effectively identify potential risks, lower credit default rates, and reduce the probability of fraudulent activities, thereby safeguarding the stable operation of the financial system. Finally, from the perspective of customer service, AI enhances the customer experience through functions such as personalized recommendations and real-time responses, aligning perfectly with modern consumers' demand for efficient and convenient financial services. It is evident that a thorough examination of the applications and challenges of AI in the banking sector not only helps banks establish competitive advantages in a fiercely competitive market but also exerts a profound impact on the overall financial ecosystem.

1.3. Research Methods and Content

This study focuses on how artificial intelligence can help banks enhance customer satisfaction and operational efficiency, aiming to enrich the academic literature in the fields of fintech and banking digital transformation, and to provide a reference for commercial banks in their strategic planning and optimization of technology

applications, thereby driving the banking industry toward higher-quality development.

To achieve the aforementioned research objectives, this paper primarily employs the following research methods:

1. Literature Review Method: By systematically reviewing and summarizing both domestic and international academic research findings and industry reports on the application of artificial intelligence technologies in the financial sector, this method enables a comprehensive understanding of the research progress and development trends in this field.

2. Case Study Method: Select several representative commercial banks as case studies to conduct an in-depth analysis of their practical models and outcomes in AI applications, thereby providing peer institutions with actionable implementation pathways.

By integrating the aforementioned approaches, this study aims to avoid complex modeling and quantitative analysis, instead focusing on an in-depth exploration of application scenarios, potential challenges, and corresponding countermeasures. The main content of this paper will center around three key aspects: first, a detailed exposition of specific application scenarios for artificial intelligence technologies within the banking sector and their corresponding implementation mechanisms; second, a comprehensive analysis of the critical challenges encountered during their application, such as data privacy, technical reliability, and ethical considerations; and finally, the proposal of practical and feasible countermeasures addressing these challenges, with the aim of providing valuable insights for the digital transformation of the banking industry.

2. Literature Review

2.1. Relevant theories regarding the application of AI in the banking sector

Artificial Intelligence (AI), as an interdisciplinary field, encompasses core technologies such as machine learning, deep learning, natural language processing, and knowledge graphs, all of which possess a solid theoretical foundation for application in the banking sector. Machine learning enables banks to perform efficient risk assessment and customer behavior analysis by automatically extracting patterns from data for prediction or decision-making [6]. For instance, supervised learning algorithms can be employed to construct credit scoring models, while unsupervised learning can identify anomalous transactions to prevent fraud. Deep learning further expands the scope of machine learning applications, demonstrating particularly outstanding performance in areas such as speech recognition and image processing. Natural language processing technologies based on deep neural networks have been widely adopted in intelligent customer service systems, enabling automated responses to customer inquiries. Additionally, the

ability of reinforcement learning to optimize decisions within dynamic environments provides new solutions for banks' portfolio management and risk control. The integration of these technologies not only enhances the level of intelligence in banking operations but also lays a robust technical foundation for achieving refined management practices.

2.2. Current Status of the Banking Industry and Research on AI Applications

For a long time, traditional banking has centered its operations around deposit and loan services, with its operational model primarily relying on physical branches and manual processes. This model has revealed numerous pain points when facing digital transformation—such as low efficiency, high costs, and inadequate customer service experiences [1]. To address these challenges, banks both domestically and internationally have increasingly introduced AI technology across various business segments. Domestically, artificial intelligence has been widely applied in areas such as intelligent customer service, risk management, and investment and wealth management. For example, intelligent customer service systems have significantly enhanced customer service efficiency through speech recognition and natural language processing technologies, while simultaneously reducing labor costs [4]. In terms of risk management, machine learning algorithms can analyze vast amounts of customer data to assess credit risks more accurately and monitor abnormal transactions in real time, thereby effectively mitigating fraud-related losses [2]. Internationally, banks in developed countries such as the United States lead in AI applications, particularly in the implementation of robo-advisors and biometric identification technologies, where they have accumulated extensive experience. However, despite the remarkable achievements achieved in the application of AI technology within the banking sector, its widespread adoption still faces constraints such as insufficient technological maturity, uneven data quality, and incomplete regulatory policies [1].

2.3. Research Gaps and the Research Focus of This Paper

Although existing literature has conducted relatively comprehensive discussions on the application scenarios and technical principles of AI in the banking sector, research concerning application challenges and corresponding countermeasures remains insufficient. For instance, most studies focus on the advantages of AI technologies and their application effectiveness in specific domains, while their analysis of potential risks—such as data privacy breaches, algorithmic bias, and decision-making opacity—is rather superficial [3]. Furthermore, research addressing technical reliability and stability issues that may arise when AI systems are deployed in actual banking operations is also relatively scarce [5]. Building upon existing research, this paper will delve into the key challenges faced by AI

applications in the banking sector and propose targeted countermeasures. Specifically, this paper will examine these challenges from three dimensions—data privacy and security, technical reliability and stability, and ethics and morality—while drawing upon both domestic and international practical experiences to propose feasible solutions, with the aim of providing theoretical support and practical guidance for the intelligent transformation of the banking industry.

3. AI Application Scenarios in the Banking Sector

3.1. Intelligent Customer Service

3.1.1. Application Principle

Banks typically employ Natural Language Processing (NLP) technology to drive their AI-powered customer service systems. NLP enables computers to understand, parse, and even generate human language; the accurate interpretation of customer intent by intelligent customer service systems relies primarily on this technology. Specifically, banks utilize historical customer inquiry data—namely, vast databases—to train AI models, enabling these models to master response strategies for common inquiries. When a customer interacts with the AI customer service via messaging or telephone, the system first uses NLP to parse the semantic meaning of the statement, and then retrieves and returns the most appropriate response from the knowledge base.

3.1.2. Advantages and Effects

The core advantage of intelligent customer service lies in its ability to provide round-the-clock support. This means that even when customers encounter issues outside of business hours, they do not need to wait for a human agent to become available. Furthermore, for most customer inquiries, AI can typically provide solutions more efficiently, as answers to common questions can be rapidly retrieved from existing knowledge bases, thereby helping banks significantly reduce labor costs and achieve cost reduction alongside improved efficiency. Statistics show that the volume of inquiries handled by human customer service representatives in many banks has decreased by 30% to 40%, while the average waiting time for customer responses has been shortened from several minutes to just a few seconds—yielding remarkable results. Additionally, as younger customer segments increasingly favor online channels, the proportion of customers visiting physical branches to conduct business continues to decline, with mobile-based intelligent customer service having become their primary interface for interacting with banks.

3.2. Risk Management

3.2.1. Application Principle

Banking applications of artificial intelligence primarily focus on two areas: first,

assessing the credit risk of borrowers—namely, their repayment willingness and ability; and second, monitoring suspicious transactions to prevent fraud. Taking credit assessment as an example, AI is no longer limited to relying solely on the limited records contained in credit reports; instead, it conducts a comprehensive analysis of multi-dimensional data, such as consumption behavior, salary deposit patterns, and even the duration of mobile phone usage. This information is fed into a model for computation, ultimately producing a score that represents the individual's creditworthiness. Compared with manual review of financial statements, this approach is both faster and more accurate. For instance, common vending machines in daily life typically require users to verify their WeChat Pay Score or Sesame Credit Score to unlock the machine; otherwise, they cannot purchase goods. This measure aims to prevent unpaid transactions, and its underlying logic aligns closely with the core principles of bank loan approval processes.

3.2.2. Advantages and Effects

From an efficiency perspective, approving a loan manually by banks previously could take one to two days, whereas using AI models now allows the process to be completed in just a few minutes. More importantly, AI can identify correlation patterns that are difficult for humans to detect. For example, when a user performs small-value, high-frequency transfers across multiple accounts, traditional methods often fail to notice such anomalies, whereas AI can promptly flag them as suspicious activity. As the accuracy of anti-fraud models in some banks has improved, their false-positive rates have correspondingly decreased. Following the implementation of AI solutions, some banks have reduced their manual review workload for suspicious transactions by nearly 50%.

3.3. Investment and Wealth Management

3.3.1. Principles of Intelligent Investment Advisory

An robo-advisor system performs three primary backend functions: first, it asks customers to complete a risk assessment questionnaire to determine their risk tolerance; second, based on the results of this questionnaire, it automatically calculates the asset allocation ratios—such as the distribution between stocks, bonds, and cash; finally, it continuously monitors market dynamics; if the price fluctuations of any particular asset category exceed a predefined threshold, the system will automatically adjust the asset portfolio proportions. In essence, a robo-advisor serves as an automated wealth management assistant: the user only needs to input their investment amount, risk preference, and return target, after which the system uses algorithms to construct an investment portfolio comprising stocks, funds, bonds, and other assets, and adjusts it in real time according to market changes. The entire process requires no manual intervention. Previously, such services were exclusively available to high-net-worth individuals, but robo-advisors

have made these services accessible to ordinary investors.

3.3.2. Market Impact

The emergence of robo-advisors has lowered the entry barrier and reduced the costs associated with professional wealth management services. Traditional financial advisors typically charge high fees and serve only high-net-worth clients; today, ordinary investors can access customized investment portfolios for just a few hundred yuan. However, robo-advisors also have their limitations. For instance, during sharp market declines, algorithms may trigger mass selling, thereby exacerbating market volatility. Furthermore, compared with younger clients who are more receptive to new technologies, older clients tend to prefer communicating with human advisors. To address this, many banks are experimenting with integrating robo-advisors with human advisors—where machines efficiently generate investment strategies, and human advisors then provide explanations, communication, and emotional support; practice has shown that this hybrid model yields better results.

4. Facing Challenges (Identifying Problems)

4.1. Insufficient intelligence level of the intelligent customer service system

When customers consult the bank's AI-powered customer service system, the system typically can only provide responses pre-stored in its database that already contain solutions. When faced with complex queries, the system often repeatedly states that it cannot understand the query and suggests that the user adjust their phrasing. In certain cases, the AI may even generate fabricated data to force a response. Furthermore, when customers request a transfer to a human agent because the AI customer service system is unable to resolve their issue, the AI system sometimes struggles to successfully fulfill this request. Additionally, the application of AI algorithms in financial scenarios such as credit approval and customer service may give rise to algorithmic discrimination—a topic that has become a shared focus of research and industry alike. Algorithmic discrimination typically stems from biases present in the training data or inherent flaws in the model's design, leading the system to produce discriminatory outputs when processing requests from different demographic groups. In credit scoring models, if the training data contains historical records of discriminatory decisions, the model may perpetuate such biases and reflect them in its scoring results. Such discrimination not only violates the principles of social equity but may also lead banks to lose the trust of certain customer segments. In the realm of customer service, if the algorithmic design of an AI customer service system fails to adequately account for the differentiated needs of various users, it may similarly result in unequal service experiences. Therefore, determining how to eliminate

potential discrimination through algorithmic review and optimization mechanisms is a critical issue that banks urgently need to address during the deployment of artificial intelligence technologies.

4.2. The Artificial Intelligence Decision-Making Process Lacks Transparency

For service recipients, artificial intelligence models operate as black boxes. Taking loan applications as an example, an AI system automatically integrates and processes the collected personal data to perform model computations, but only outputs the final decision; it cannot explain the reasoning behind this decision to the customer. When banks are approving loans, if they rely solely on the negative conclusions provided by the AI without offering any explanation, it can easily lead to customer dissatisfaction.

The "black-box" nature of artificial intelligence's decision-making process represents one of the primary obstacles hindering customers' ability to understand and trust bank business decisions. Because of the operational mechanisms of complex algorithms, such as deep learning, which are often difficult to interpret intuitively, customers frequently struggle to comprehend why a specific decision was made by the system. In credit approval and risk management processes, the rationale behind AI models' decisions is typically concealed within multi-layered neural networks, making it challenging even for internal personnel to provide a clear explanation. This opacity not only undermines customer trust in banking services but may also give rise to legal disputes when conflicts arise. Furthermore, such lack of transparency complicates for regulatory authorities their ability to effectively supervise banking operations, thereby increasing potential compliance risks. Consequently, developing highly interpretable AI models and establishing corresponding decision-explanation mechanisms are of great significance for enhancing customer trust and maintaining financial market stability.

4.3. Data Privacy and Security Risks

4.3.1. Data Leakage Risk

The training of artificial intelligence systems relies on vast amounts of data inputs to enable continuous learning; this data includes sensitive personal information such as customers' names, ID numbers, consumption records, and bank card numbers. Should such data be leaked, it would have severe consequences for both customers and banks. Meanwhile, bank operations must comply with the *Personal Information Protection Law* and are prohibited from using customer data indiscriminately to train artificial intelligence. This creates a paradox: improving the performance of AI requires more data, yet increasing the use of such data may exacerbate associated risks.

4.3.2. Compliance Issues

Banking applications of AI technology also face challenges in complying with data protection regulations. Global attention to data privacy has grown significantly, with various countries introducing stringent regulations such as the GDPR and CCPA, which require enterprises to handle personal data in accordance with compliance standards. However, the complexity and automated nature of AI systems make it difficult for them to fully meet these requirements when utilizing data. Reference points out that when banks employ large-scale AI models for customer behavior analysis and transaction monitoring, they must ensure that data collection and usage are authorized by users and conducted legally. In practice, due to the diversity of data sources and the complexity of processing workflows, banks often struggle to achieve full transparency throughout the process, which can easily give rise to compliance issues, potentially leading to fines and undermining customer trust.

4.4. Technical Reliability and Stability

4.4.1. Model Risk

Although the application of artificial intelligence models in banking operations has brought numerous advantages, issues such as model inaccuracies and overfitting also pose potential risks to business decision-making. Specifically, machine learning algorithms may produce distorted output results during the training process due to dataset bias or improper feature selection. For example, Reference [8] points out that in credit assessment models, if the training data fails to adequately cover the behavioral patterns of different customer segments, it may lead the model to make systematic misjudgments regarding certain specific groups, thereby compromising the fairness and accuracy of credit approvals. Furthermore, overfitting can cause a model to perform exceptionally well on the training set but exhibit poor generalization capabilities when applied to new data; this phenomenon may result in erroneous decision recommendations in actual business scenarios. Consequently, optimizing model design and enhancing their robustness have become critical challenges that banks must address when implementing artificial intelligence technologies.

4.4.2. Errors in Artificial Intelligence Systems

The knowledge underlying artificial intelligence primarily derives from the Internet, where only a small portion of the information is authentic and reliable; consequently, hallucination phenomena may occur. During the training process, developers often prioritize linguistic fluency and formatting accuracy, while paying less attention to verifying the authenticity of the content. For example, when a client queries the price-to-earnings (P/E) ratio of a specific stock, the AI may generate fabricated numerical values. In critical scenarios such as investment recommendations or risk control decisions, such errors can lead to actual financial losses.

4.4.3. System Stability

The operational stability of AI systems is critical to the continuity of banking services, yet failures and performance bottlenecks remain prevalent in practical deployments. The computational complexity of AI models imposes stringent hardware requirements, and under conditions of surging concurrent requests, these systems may experience response delays or even crash. Additionally, certain AI technologies are not yet fully mature, which could lead to system anomalies under specific circumstances. For instance, as mentioned in Reference, some banks introduced facial recognition payment and voice recognition features, only to have their systems compromised by hackers exploiting technical vulnerabilities, thereby threatening information security. Consequently, enhancing the stability and risk resilience of AI systems constitutes a vital safeguard for banks' digital transformation.

5. Strategies for Addressing Challenges in the Application of AI in the Banking Sector

5.1. Solutions to Intelligent Customer Service's Technical Defects & Algorithmic Bias

Countermeasures for addressing the insufficient level of intelligence in intelligent customer service systems and algorithmic bias (related to technical reliability and stability). Companies providing artificial intelligence software for banks should be responsible for conducting model optimization training to enhance the model's generalization capability and stability. For instance, instead of merely increasing the volume of data, they should input higher-quality data into the model to elevate its intelligence level. Additionally, cross-validation methods can be employed by randomly shuffling historical data before using it for model training, thereby reducing the model's reliance on historical data and enabling it to perform knowledge transfer when addressing new problems, thus enhancing its risk resilience. When high-quality data is scarce, the Bootstrap sampling method can be applied to generate new data by repeatedly sampling from the original dataset. During the training process, regularization techniques or deep ensemble learning methods can be utilized to handle complex nonlinear relationships, allowing the model to capture underlying patterns rather than over-relying on the original data, thereby improving the accuracy of credit assessment and anti-fraud monitoring.

5.2. Strategies for Transparent and Explainable AI Decision-Making

Artificial intelligence systems should demonstrate their reasoning and computation processes to customers, helping them understand the basis for their decisions and thereby enhancing customer trust. Decision explanation tools can generate easy-to-understand explanations using either local approximation methods (such as LIME) or global explanation methods (such as SHAP values), enabling customers to

gain an intuitive understanding of how the AI system arrives at its final decision based on the input data. Local approximation methods (LIME) can quickly provide intuitive explanations—for example, clearly identifying specific credit reporting issues that led to a loan application being rejected; whereas SHAP values offer more detailed contribution analyses, quantifying the influence of each decision factor, which also helps demonstrate the openness and transparency of the decision-making process during regulatory reviews.

5.3.1. Data Privacy and Security Policy

a. Encryption technology is a critical means of ensuring data security; it can efficiently protect customer-sensitive information using symmetric and asymmetric encryption algorithms, thereby reducing the risk of data leakage. Symmetric encryption can process large volumes of data rapidly, but may involve security risks during the key transmission process. In contrast, asymmetric encryption addresses this limitation: banks use public-key encryption to encrypt data and decrypt it using the private key stored within the server, thus preventing the exposure of the decryption method.

b. The introduction of access control technologies can further enhance data security. Internal core systems strictly employ Mandatory Access Control (MAC) or Label-Based Access Control (LBAC) to ensure that only personnel with specific privilege levels can access core data. For routine business operations, such as credit approval and customer service, Role-Based Access Control (RBAC) is adopted, assigning permissions based on employee roles (e.g., "Customer Manager," "Risk Control Specialist"). For remote or mobile work scenarios, Attribute-Based Access Control (ABAC) is introduced to incorporate environmental constraints, such as "Access permitted only during working hours on the company intranet."

5.3.2. Corresponding strategies for compliance issues

Banks should establish comprehensive data management systems and privacy protection policies, appoint a dedicated compliance team, formulate guidelines for the development and use of artificial intelligence, conduct regular self-assessments and audits, and disclose information regarding model usage to the public. Additionally, banks may engage third-party auditing firms to conduct independent evaluations of their AI models to ensure that internal assessments are free from bias. Similarly, software companies must clarify the specifications governing data collection, storage, use, and sharing during the model training process to ensure that all activities comply with legal boundaries.

6. Future Development Trends of AI in the Banking Sector

6.1. Integration with Emerging Technologies

The deep integration of artificial intelligence (AI) with emerging technologies such

as blockchain and the Internet of Things (IoT) is creating unprecedented innovation opportunities for the banking industry. Leveraging its decentralized, immutable, and transparent characteristics, blockchain technology provides banks with secure and efficient data management solutions. For example, in the application of smart contracts, AI can automate the parsing and execution of complex contractual terms, enabling efficient operations in scenarios such as cross-border payments and trade financing. Meanwhile, the widespread adoption of IoT technology allows banks to collect real-time data from vast numbers of devices, thereby enhancing the precision of risk management and customer service. The combination of AI and IoT not only enables the automation of loan approval processes for smart homes but also provides more comprehensive data support for supply chain finance and optimizes the coordinated management of capital flows and logistics. Furthermore, with the advancement of 5G/6G communication technologies, the synergistic effects between AI and other emerging technologies will be further amplified, unlocking additional innovative application scenarios for the banking sector.

6.2. Business Model Transformation

Driven by artificial intelligence (AI) technologies, banking business models are gradually transitioning from traditional approaches toward intelligent, personalized, and open frameworks. First, the application of intelligent technologies enables banks to respond in real time to customer needs and make precise predictions. For instance, utilizing AI-powered data analytics tools, banks can deeply analyze customer behavior patterns to offer customized financial products and services, thereby significantly enhancing the customer experience. Second, the widespread adoption of personalized services is facilitated by AI's deep learning capabilities in areas such as risk assessment and investment advisory. The extensive use of robo-advisors serves as a prime example of this trend; these systems can generate personalized investment portfolios based on a customer's risk preferences and financial objectives, thereby meeting diverse needs. Finally, the rise of the "open banking" model highlights the pivotal role of AI technology in fostering cross-industry collaboration. Through API interfaces and the development of ecosystems, banks can integrate their services into third-party platforms, thereby expanding their service boundaries and strengthening their market competitiveness. This transformation has not only altered the operational paradigms of traditional banks but has also injected new vitality into the entire financial industry.

6.3. Changes in the competitive landscape

The widespread adoption of artificial intelligence (AI) technologies is profoundly transforming the competitive landscape of the banking industry. On one hand, emerging fintech companies, leveraging their first-mover advantage and technological innovation capabilities in AI, are posing significant challenges to

traditional banks. These firms typically capture market share rapidly through agile development processes and flexible marketing strategies, particularly excelling in areas such as online lending and mobile payments. On the other hand, traditional banks are actively pursuing digital transformation to mitigate competitive pressures. For instance, many large commercial banks are increasing their investments in AI R&D, attempting to reshape their competitive advantages through intelligent upgrades. However, due to constraints in funding and technological resources, small and medium-sized banks are progressing more slowly through their digital transformation journeys, leading to increasingly pronounced polarization in market competition. Furthermore, the application of AI technology has given rise to new forms of competition, such as algorithm-driven automated trading and intelligent risk management systems; these innovative tools not only enhance market efficiency but also heighten the technical barriers within the industry. Consequently, future competition in the banking sector will increasingly manifest as technology-driven differentiated competition, where proficiency in AI technology will become one of the key determinants of an enterprise's success or failure.

7. Summary and Outlook

The application of artificial intelligence (AI) technology in the banking sector has demonstrated significant innovative potential and practical value, with its core application scenarios spanning areas such as intelligent customer service, risk management, and wealth management. In the realm of intelligent customer service, the integration of natural language processing and speech recognition technologies has significantly enhanced customer service efficiency while effectively reducing labor costs; in risk management, machine learning algorithms leverage precise analysis of customer data to optimize credit assessment models and strengthen anti-fraud monitoring capabilities; in investment and wealth management, robo-advisors utilize AI algorithms to provide customers with personalized investment recommendations, thereby transforming traditional wealth management service models.

However, the application of AI in the banking sector still faces a series of critical challenges, encompassing data privacy and security, technical reliability and stability, as well as ethics and morality. The risk of data breaches and compliance requirements impose higher standards on banks' data management capabilities, while the inaccuracies of AI models and performance bottlenecks during system operation may undermine the continuity and reliability of business decision-making. Additionally, issues such as algorithmic bias and lack of decision transparency may erode customers' trust in bank services.

To address the aforementioned challenges, this study proposes a multi-dimensional strategy. At the data privacy and security level, techniques such as encryption and access control can safeguard data security at the technical level, while

comprehensive data management systems and privacy protection policies provide support at the institutional level. Regarding technical reliability and stability, model verification and algorithm optimization can enhance the accuracy of AI models, whereas strengthening system infrastructure and implementing real-time monitoring can help ensure the stable operation of the system. Concerning ethical and moral issues, establishing an algorithm review mechanism and developing decision-explanation tools can effectively mitigate algorithmic bias and decision opacity, thereby enhancing customer trust in AI-driven decisions. In summary, through a comprehensive analysis of AI applications in the banking sector, this study reveals its potential value and major obstacles, proposes targeted solutions, and provides both theoretical references and practical guidance for the intelligent transformation of the banking industry.

Although this study provides a relatively systematic analysis of AI application scenarios, challenges, and corresponding strategies within the banking sector, several limitations remain. First, given the rapid evolution of AI technologies, relevant literature and case studies may lack up-to-date relevance and fail to fully capture the latest technological advancements and practical applications. Second, this study primarily relies on a literature review and case analyses, lacking empirical research supported by large-scale data from real-world business scenarios; this limitation somewhat constrains the generalizability and precision of the study's conclusions. Furthermore, regarding the potential impacts of the integration of AI with emerging technologies—such as the synergistic effects between blockchain and the Internet of Things—this study has only conducted preliminary explorations and has not yet provided an in-depth analysis of their specific implementation pathways or long-term implications.

Future research can focus on the following directions: First, strengthening follow-up studies on the latest applications of AI technology in the banking sector by integrating real-time data with dynamic case analyses to further validate the applicability of existing findings and propose forward-looking recommendations. Second, exploring interdisciplinary research approaches that integrate knowledge from multiple disciplines—such as computer science, economics, and law—to conduct a more comprehensive assessment of the overall impact of AI technology applications. Third, concentrating on in-depth research into the convergence of AI with emerging technologies, particularly regarding innovative applications in fields such as smart contracts and supply chain finance, thereby providing the banking industry with more actionable technical integration solutions. Finally, given the evolving global financial regulatory landscape, future research should pay close attention to the compliance challenges arising from AI applications in cross-border business operations and develop corresponding response strategies to foster the healthy development of international financial markets.

References

[1] Fang Liang; Liu Dianbing; Hou Tianshu; Pan Yanyang. Application and Analysis of Artificial Intelligence in Banking [J]. Information Security Research, 2017,3(12):1125–1128.

[2] Feng Cai; Summer; Zhao Wenbing. The Opportunities and Challenges Posed by Artificial Intelligence for the Development of the Silver Industry [J]. Financial Perspectives, 2023, (6):62–65.

[3] Lu Minfeng; Wang Zugang. Current Status, Challenges, and Countermeasures for Artificial Intelligence Applications in the Financial Sector—A Sample-Based Analysis of the Implementation of Digital Robots in Commercial Banks [J]. Financial Technology Era, 2021,29(1):14–22.

[4] Jiang Shiji. Exploration, Practice, and Development Strategies for Artificial Intelligence Applications in China's Banking Sector [J]. Southwest Finance, 2018, (2):44–49.

[5] Wang Xuelian. Analysis of Risks and Countermeasures Facing the Transformation and Upgrading of Banking Services Driven by Artificial Intelligence [J]. Information & Computer, 2021,33(6):159–161.

[6] Zhang Lan. The Impact of Digital Transformation on Bank Credit Risk Management [J]. Contemporary Accounting, 2023, (17):154–156.