

# Application Status and Development Trends of Artificial Intelligence in the Field of Digital Economy

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## ABSTRACT

As the core technology of the digital economy, artificial intelligence (AI) is profoundly changing the development model of the global economy. In the field of digital economy, AI has demonstrated enormous application potential in intelligent manufacturing, smart cities, fintech, and other aspects. By optimizing production processes, improving urban management efficiency, and innovating financial services, it has significantly promoted the quality and efficiency improvement of the digital economy. However, the widespread application of AI also faces challenges such as data security and privacy protection, technological barriers and unbalanced regional development, ethical risks, and regulatory lag. To address these challenges, it is necessary to establish a data governance system, promote technological inclusion and collaborative innovation, and improve ethical and dynamic regulatory mechanisms. In the future, AI will be deeply integrated with technologies such as the Internet of Things (IoT) and blockchain. Privacy computing and data governance technologies will be widely applied to drive cross-industry collaborative innovation and intelligent upgrading of the entire industrial chain. Meanwhile, technological inclusion and green and sustainable development will proceed in parallel, helping to narrow the "digital divide" and empower the "dual carbon goals".

## KEYWORDS

Artificial Intelligence; Digital Economy Field; Application; Development Trends.

## 1. INTRODUCTION

In today's era, the digital economy has become an important driving force for global economic development. It takes digitized knowledge and information as key production factors, and through the in-depth integration of digital technology with the real economy, promotes industrial upgrading and innovative development, exerting a profound impact on economic growth, job creation, and social progress. The vigorous development of the digital economy has not only changed people's production and lifestyle but also reshaped the global economic pattern. As one of the core technologies of the digital economy, AI plays a crucial role. It can intelligently analyze and process massive amounts of data, explore the potential value behind the data, and provide accurate support for enterprise decision-making. AI can also realize automated production and services, improve production efficiency and quality, and reduce costs. Through technologies such as machine learning and deep learning, AI can continuously optimize its own performance to adapt to the complex and changing market environment. This paper aims to deeply explore the application status and development trends of AI in the field of digital economy, analyze the challenges and opportunities it faces, and provide references for relevant enterprises and policymakers to promote the sustainable and healthy development of the digital economy.

## **2. BASIC CONCEPTS OF ARTIFICIAL INTELLIGENCE AND DIGITAL ECONOMY**

### **2.1. Definition and Development History of Artificial Intelligence**

Artificial intelligence refers to enabling machines to simulate human intelligence, endowing them with capabilities such as perception, learning, reasoning, and decision-making. It is an important branch of computer science, aiming to equip machines with human-like intelligent behaviors.

Development Period: With the continuous advancement of computer technology, AI has experienced rapid development. The emergence of expert systems enabled machines to demonstrate professional knowledge and decision-making capabilities in specific fields. In modern times, the rise of deep learning has pushed AI to new heights. By constructing multi-layer neural networks, deep learning allows machines to automatically learn features and patterns from large amounts of data, achieving tremendous success in fields such as image recognition and speech recognition.

Important development milestones include the 1956 Dartmouth Conference, which is regarded as the birthmark of AI; in 1997, IBM's Deep Blue computer defeated chess champion Garry Kasparov, demonstrating AI's strong capabilities in complex games; in 2016, AlphaGo defeated the human Go champion, triggering widespread global attention to AI.

### **2.2. Connotation and Characteristics of Digital Economy**

The digital economy refers to a series of economic activities that take digitized knowledge and information as key production factors, modern information networks as important carriers, and the effective use of information and communication technologies as important driving forces for efficiency improvement and economic structure optimization. In the digital economy, data is a key factor, which, like land and capital in the traditional economy, has important value. By collecting, storing, analyzing, and applying massive amounts of data, enterprises can better understand market demand, optimize production processes, and innovate products and services. Modern information networks, including the Internet and the Internet of Things, are important carriers of the digital economy. These networks break the constraints of time and space, enabling information to be transmitted quickly and accurately, and promoting the efficient allocation of resources. Information and communication technologies are important driving forces for the development of the digital economy. The continuous innovation and application of technologies such as big data, cloud computing, and AI have promoted the rapid development of the digital economy.

The digital economy has many characteristics: it is highly innovative, with new technologies and business models emerging continuously; it has strong permeability, capable of penetrating into various industries and fields to promote the transformation and upgrading of traditional industries; it also has wide coverage, able to cross regional and industry boundaries to achieve global resource sharing and collaborative development.

## **3. APPLICATION STATUS OF ARTIFICIAL INTELLIGENCE IN THE DIGITAL ECONOMY**

### **3.1. Application in the Field of Intelligent Manufacturing**

In the field of intelligent manufacturing, AI plays a vital role.

In terms of automated production processes: AI-driven robots and automated equipment can achieve highly precise operations. Through computer vision and machine learning algorithms, robots can identify and grasp objects of different shapes and sizes, completing complex assembly tasks. In

automobile manufacturing, robots can install parts quickly and accurately, greatly improving production efficiency and product quality.

[1] In terms of industrial big data analysis: Enterprises can collect various data during the production process, such as equipment operating status and production quality data. Using AI algorithms to conduct in-depth mining and analysis of these data, enterprises can timely identify potential problems in the production process, carry out equipment maintenance in advance, and avoid production interruptions caused by equipment failures. Through the analysis of production data, enterprises can also optimize production processes and improve production efficiency. [1]

### **3.2. Application in the Field of Smart City Construction**

In terms of intelligent traffic management: By real-time analyzing and processing traffic data, AI has realized the precise regulation of traffic flow. With the help of cameras and sensors deployed throughout the city, the system can real-time monitor road congestion and automatically adjust the duration of traffic signals to optimize vehicle traffic efficiency. During peak hours, the intelligent traffic system can dynamically adjust traffic lights according to traffic flow, reducing vehicle waiting time and alleviating traffic congestion. AI can also be used for intelligent parking management, guiding drivers to quickly find available parking spaces through sensors and data analysis, and improving the utilization rate of parking resources.

In terms of intelligent security monitoring: AI technology has greatly enhanced the city's security capabilities. Intelligent cameras can use image recognition and behavior analysis technologies to real-time monitor abnormal behaviors and events. For example, it can identify the behavioral patterns of suspicious persons, such as loitering and theft, and issue alarms in a timely manner. The application of facial recognition technology enables security systems to quickly and accurately identify personnel identities, strengthening the control of key areas.

In terms of intelligent energy management: AI can real-time monitor and optimize urban energy consumption. By analyzing energy usage data, the system can predict energy demand and rationally allocate energy supply. For example, during peak electricity consumption periods, the intelligent energy management system can automatically adjust the electricity load of large enterprises to ensure the electricity demand of residents. At the same time, it can optimize the utilization of renewable energy, improve energy efficiency, and reduce urban energy consumption and carbon emissions. [2]

### **3.3. Application in the Field of Fintech**

In terms of risk management and compliance: AI plays a key role. Financial institutions face massive transaction data every day. Through machine learning algorithms, they can real-time analyze these data to identify potential risk factors, such as fraudulent transactions and credit risks. For example, deep learning models can accurately assess customers' credit status, predict default probabilities, and help financial institutions take preventive measures in advance. AI can also automatically monitor whether financial transactions comply with regulatory requirements, ensuring the compliant operation of financial institutions and reducing compliance costs.

In terms of intelligent payment and settlement: AI has made the payment process more convenient and secure. Through biometric technologies such as fingerprint recognition and facial recognition, rapid identity verification is achieved, improving payment security and efficiency. AI algorithms can real-time monitor payment transactions, timely detect and intercept abnormal transactions, and protect users' fund security. In cross-border payments, AI can optimize settlement processes, reduce settlement costs, and improve fund arrival speed.

Intelligent investment advisory is another important application of AI in the financial field. Based on factors such as customers' risk preferences and investment goals, it uses algorithms to provide customers with personalized investment advice and asset allocation plans. Intelligent investment

advisory can real-time track market dynamics, automatically adjust investment portfolios, and provide investors with more professional and efficient investment services.

### **3.4. Applications in Other Fields**

In the field of intelligent education: AI has realized personalized learning. Intelligent teaching systems can customize exclusive learning plans and content for students based on their learning progress, knowledge mastery, and learning habits. Intelligent tutoring systems can answer students' questions in real-time and provide targeted guidance. Virtual learning environments, with the help of AI technology, simulate real scenarios, allowing students to obtain an immersive learning experience and improving the interest and effect of learning. With the development of technology, intelligent education is expected to break the regional limitations of educational resources, enabling more people to enjoy high-quality educational services. [3]

In the field of intelligent agriculture: AI helps realize precision in agricultural production. By collecting data such as soil, meteorology, and crop growth through sensors and drones, AI systems can analyze these data to provide farmers with scientific planting advice, such as precise fertilization, irrigation, and pest control. Intelligent agricultural robots can complete tasks such as sowing, weeding, and harvesting, improving agricultural production efficiency and reducing labor costs. In the future, intelligent agriculture is expected to realize the automation and intelligence of agricultural production, ensuring food security.

In the field of intelligent medical care: AI has brought innovations to the medical industry. In medical image diagnosis, AI algorithms can quickly and accurately identify lesions, assisting doctors in making diagnoses. Intelligent health monitoring equipment can real-time collect patients' physiological data for health assessment and early warning. In drug research and development, AI can accelerate the drug screening and research and development process. With the continuous progress of AI technology, intelligent medical care will improve the quality and accessibility of medical services, safeguarding people's health.

## **4. CHALLENGES AND COUNTERMEASURES FOR AI ACCELERATING DIGITAL ECONOMY DEVELOPMENT**

### **4.1. Problems Existing in AI Accelerating Digital Economy Development**

**Data Security and Privacy Protection Issues**The application of AI technology highly relies on the collection, storage, and analysis of massive data, but there is a contradiction between the open sharing of data and privacy protection. In the construction of smart cities, intelligent traffic management systems need to real-time collect sensitive information such as vehicle trajectories and residents' travel habits. Once data is leaked or abused, it may lead to personal privacy violations and even social security issues. Some enterprises have vague boundaries and lack transparency in data use, resulting in a decline in public trust in data security. Currently, data anonymization and encryption technologies are not yet fully mature, and the compliance of cross-border data flow also faces the problem of inconsistent international standards. These issues restrict the large-scale application of AI in the digital economy. [1, 2]

**Technological Barriers and Unbalanced Regional Development**The research and development and application of AI technology require high-investment computing resources, algorithm optimization capabilities, and cross-field technology integration. However, the global distribution of technical resources is uneven. Leading enterprises in developed countries monopolize core technologies, while developing countries have obvious shortcomings in fields such as algorithm models and chip manufacturing. The core algorithms of industrial robots and high-end sensor technologies relied on in the field of intelligent manufacturing are still dominated by a few countries. Such technological

barriers lead to an expanding gap in digital economy development between regions. Small and medium-sized enterprises (SMEs) find it difficult to integrate into intelligent transformation due to high technical costs. Some traditional industries struggle to achieve rapid intelligent upgrading due to insufficient technical adaptability, exacerbating the "digital divide" between industries.

**Ethical Risks and Regulatory Lag**The autonomous decision-making characteristics of AI may trigger ethical disputes. [3] For example, if the algorithms of intelligent investment advisory in the fintech field have implicit biases, it may lead to unfair investment advice; the attribution of liability for misdiagnosis by medical AI has not been clarified, which may trigger legal disputes. The "black box" nature of algorithms makes the decision-making process lack transparency, limiting public trust in algorithms. Currently, the global regulatory framework for AI is still imperfect, and existing laws are difficult to cover emerging issues such as algorithm audits and data sovereignty. Regulatory lag may not only amplify technical risks but also inhibit enterprises' innovation motivation, forming a situation where "regulatory vacuum" and "innovation bottlenecks" coexist.

## **4.2. Countermeasures to Accelerate AI-Driven Digital Economy Development**

**Establish a Data Governance and Security Assurance System**Governments should take the lead in establishing a hierarchical and classified data management mechanism, clarifying the rules for data ownership, usage rights, and benefit distribution. Legislation can be used to force enterprises to implement data anonymization, and third-party data security certification agencies can be established to conduct dynamic supervision over data use in sensitive fields such as finance and medical care. Technically, promote privacy computing technologies such as federated learning and blockchain to realize "data available but not visible". Promote the formulation of international data circulation standards, and promote cross-border data cooperation under the premise of safeguarding national security. For example, the European Union's General Data Protection Regulation (GDPR) provides a reference for global data governance, and countries can refine data security clauses in combination with their national conditions.

**Promote Technological Inclusion and Collaborative Innovation**Through policy guidance and financial support, encourage the open-source sharing of core technologies and industry-university-research cooperation. Governments can set up special funds to support the research and development of domestic AI chips, and promote the establishment of joint laboratories by universities and enterprises to accelerate the iterative optimization of algorithm models. For SMEs, provide low-code AI development platforms and computing power rental services to reduce the threshold for technology application. In terms of regional collaboration, cross-regional digital economy demonstration zones can be established to narrow the development gap through technology transfer and talent exchange. China's "East Data West Computing" project has injected digital development momentum into underdeveloped regions by optimizing the layout of computing power resources.

**Improve Ethical Norms and Dynamic Regulatory Mechanisms**Formulate AI ethical guidelines, clarify that algorithm design must follow the principles of fairness, transparency, and traceability, and establish an interdisciplinary ethical review committee to conduct pre-assessments on AI applications in high-risk fields such as medical care and justice. Technically, promote explainable AI (XAI) technology to enhance the visualization and auditability of algorithmic decisions. [5] At the regulatory level, establish a "regulatory sandbox" model, allowing enterprises to test innovative products in a controlled environment while dynamically updating regulatory rules. The Monetary Authority of Singapore (MAS) has encouraged fintech experiments through the "regulatory sandbox", balancing innovation and risk prevention. Strengthen international regulatory cooperation to jointly address transnational challenges such as algorithmic bias and deepfakes.

## **5. DEVELOPMENT TRENDS OF ARTIFICIAL INTELLIGENCE IN THE FIELD OF DIGITAL ECONOMY**

### **5.1. In-depth Technological Integration and Cross-Industry Collaborative Innovation**

In the future, AI will be deeply integrated with new-generation digital technologies such as the Internet of Things (IoT) and blockchain, forming a more efficient technological ecosystem. In the industrial Internet, the combination of AI and IoT can realize the full life cycle management of equipment and optimize production processes; blockchain technology provides a credible data traceability and sharing mechanism for AI, solving the problem of data silos. Cross-industry collaborative innovation will accelerate, such as the combination of agriculture and AI to promote precision planting, and the integration of medical care and AI to realize personalized diagnosis and treatment. Technological integration will break the limitations of single scenarios, driving the intelligent upgrading of the entire industrial chain in the digital economy.

### **5.2. Wide Application of Data Governance and Privacy Computing Technologies**

With the increasing demand for data security and privacy protection, privacy-preserving technologies such as federated learning and secure multi-party computation will become mainstream. In the financial field, federated learning is used to realize cross-institutional risk control model training; in the medical field, privacy computing technologies are used to realize the compliant sharing of patient data. The process of data sovereignty legislation and technical standardization will accelerate. Countries will establish more comprehensive hierarchical and classified data management systems, promoting the free flow of data elements under the premise of safety and controllability, and providing support for the large-scale implementation of AI applications.

### **5.3. Parallel Development of Inclusion and Green Sustainability**

The reduction of AI technology thresholds will accelerate its inclusive process. SMEs and underdeveloped regions can access intelligent tools at low cost, narrowing the "digital divide". At the same time, AI technology will deeply empower the green economy, such as optimizing energy distribution through smart grids and improving the utilization rate of renewable energy with AI algorithms, helping to achieve the "dual carbon goals". At the policy level, the orientation of AI ethics and sustainable development will be strengthened, promoting the balanced development of technological applications with social and environmental benefits. [4]

## **6. CONCLUSION**

As the core technology of the digital economy, artificial intelligence is profoundly changing the development model of the global economy. It has demonstrated enormous application potential in various fields such as intelligent manufacturing, smart cities, and fintech, significantly promoting the quality and efficiency improvement of the digital economy. However, the widespread application of AI also faces challenges such as data security and privacy protection, technological barriers and unbalanced regional development, ethical risks, and regulatory lag. To address these challenges, it is necessary to establish a data governance and security assurance system, promote technological inclusion and collaborative innovation, and improve ethical norms and dynamic regulatory mechanisms. In the future, AI will be deeply integrated with technologies such as the Internet of Things and blockchain to form a more efficient technological ecosystem. Data governance and privacy computing technologies will be widely applied, and technological inclusion and green and sustainable development will proceed in parallel, driving cross-industry collaborative innovation and intelligent upgrading of the entire industrial chain. These trends will help narrow the "digital divide", empower the "dual carbon goals", and realize the sustainable and healthy development of the digital

economy. Countries should strengthen cooperation to jointly address the challenges brought by AI, seize development opportunities, and promote the global digital economy towards a more prosperous new stage.

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