

Research on Smart Tourism Enabled by Artificial Intelligence in Digital Transformation

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Abstract

In the era of the digital economy, digital transformation has become the core path for the tourism industry to improve quality, increase efficiency and achieve high-quality development. As a core branch of digital technologies, artificial intelligence (AI) provides crucial technical support for the construction of smart tourism and industrial upgrading. Against the backdrop of the digital transformation of the tourism industry, this paper defines the core concepts of artificial intelligence, smart tourism and digital transformation. Based on industrial integration theory, experience economy theory and other relevant theoretical foundations, this paper analyzes the application status of artificial intelligence in four major scenarios of smart tourism, including tourism services, operation management, marketing and cultural inheritance. It identifies prominent problems in the current integrated development, such as data silos, superficial technology application, shortage of interdisciplinary talents, high transformation costs and imperfect supervision systems. Targeted optimization countermeasures are further proposed to promote the in-depth integration of artificial intelligence and the tourism industry, facilitate the steady development of smart tourism, and realize the digital and intelligent transformation of the tourism industry.

Keywords

Artificial Intelligence; Digital Transformation; Smart Tourism; Cultural and Tourism Industry; Technology Integration.

1. Introduction

1.1. Research Background

With the comprehensive penetration of digital technologies into the real economy, the digital transformation of various industries has been continuously accelerated. As a pillar service industry, the tourism industry must conform to the development trend of the digital economy and promote the construction of smart tourism to break through the bottlenecks of traditional development. In recent years, with the maturity of 5G, Internet of Things (IoT), cloud computing and other digital technologies, artificial intelligence has achieved rapid iterative updates. Technologies including machine learning, natural language processing, computer vision and generative artificial intelligence have been gradually commercialized, laying a solid technical foundation for the tourism industry to reconstruct service models, optimize management processes and innovate marketing approaches[1].

At the policy level, the Chinese government has successively issued policy documents such as the 14th Five-Year Plan for Tourism Development and the Action Plan for the Innovative Development of Smart Tourism (2023-2025), which clearly propose to promote the in-depth integration of digital technologies represented by artificial intelligence with the cultural and tourism industry, vigorously develop smart tourism, and advance the digital transformation of the tourism industry. At the market level, tourist consumption demands are constantly upgrading, with personalization, immersion and convenience emerging as new consumption

trends. Traditional standardized tourism services can no longer meet the needs of modern tourists, forcing the tourism industry to upgrade services through technical means. At the industrial level, the traditional tourism industry faces prevalent problems including homogeneous services, extensive management, supply-demand mismatch, high operating costs and low resource utilization efficiency. Artificial intelligence technologies are urgently required to solve industrial development dilemmas and realize industrial transformation and upgrading. In this context, exploring the paths for artificial intelligence to empower smart tourism amid digital transformation possesses important practical significance.

1.2. Research Significance

In terms of theoretical significance, this paper systematically sorts out the internal correlation between artificial intelligence, smart tourism and digital transformation, enriches theoretical research achievements in the field of smart tourism, fills the research gaps in the integration of technology and tourism industry, and provides theoretical references for subsequent relevant academic studies.

In terms of practical significance, combined with industrial realities, this paper analyzes existing problems in AI-enabled smart tourism development and puts forward targeted countermeasures. It can provide practical guidance for scenic spots, cultural and tourism enterprises, and industry competent authorities to promote digital transformation and implement smart tourism projects, helping the tourism industry reduce costs, improve efficiency, enhance tourist experience and strengthen core competitiveness.

1.3. Research Ideas and Methods

This paper follows the research framework of “theoretical foundation - application status - problem analysis - optimization countermeasures - conclusion and prospect”[2] for systematic elaboration. The main research methods are adopted as follows: First, the literature research method. By reviewing domestic and foreign academic papers, policy documents and industry reports, this paper collates existing research results and constructs the theoretical framework of the thesis. Second, the inductive analysis method. It integrates industrial development status and practical cases to summarize core problems and optimization paths of AI application in tourism. Third, the case analysis method. Combined with domestic AI application practices in smart scenic spots and cultural and tourism platforms, the practicality and credibility of the research are enhanced.

2. Relevant Concepts and Theoretical Foundations

2.1. Definition of Core Concepts

2.1.1. Artificial Intelligence

Artificial intelligence is a technical science that simulates human intelligent activities. Relying on algorithms, data and computer technologies, it realizes functions including data processing, autonomous learning, logical judgment and interactive decision-making. Covering machine learning, speech recognition, machine vision, natural language processing, intelligent robots, generative AI and other technical categories, artificial intelligence features automation, intelligence, personalization and high efficiency.[3] Widely applicable to the entire industrial chain of tourism, it serves as a core technical driving force for the digital transformation of the tourism industry.

2.1.2. Digital Transformation

The digital transformation of the tourism industry refers to a process that takes data as the core production factor and digital technologies as the core means to comprehensively reconstruct the business processes, operation modes, management systems and value

creation modes of the tourism industry. It breaks the development limitations of traditional tourism, realizes optimal resource allocation, accurate service supply and refined and efficient management, and promotes the transformation of the tourism industry from resource-driven development to digital innovation-driven development.

2.1.3. Smart Tourism

Smart tourism is a new tourism model relying on new-generation information technologies such as artificial intelligence, big data and IoT. Centering on tourist experience, it covers all links of tourism including catering, accommodation, transportation, sightseeing, shopping and entertainment, and realizes intelligent services, smart management, precise marketing and cultural activation. As the core carrier of the digital transformation of the tourism industry, smart tourism aims to improve tourist satisfaction, industrial operation efficiency and the utilization value of cultural and tourism resources.

2.2. Theoretical Foundations

2.2.1. Industrial Integration Theory

The industrial integration theory holds that different industries can break industrial boundaries through technology penetration and business crossover, generating new industrial formats and development models. Artificial intelligence facilitates the in-depth integration of the information technology industry and the tourism industry, breaks the industrial barriers between the two sectors, reconstructs the tourism industrial chain and value chain, and provides core theoretical support for the development of smart tourism.

2.2.2. Experience Economy Theory

The experience economy theory takes consumer demand as the core and focuses on creating personalized and immersive consumption experiences. Relying on artificial intelligence technologies, smart tourism accurately perceives tourist demands, customizes exclusive tourism services and optimizes the whole-process tourism experience[4]. It conforms to the core connotation of the experience economy and guides the upgrading of tourism services empowered by AI technologies.

2.2.3. Data Factor Theory

The data factor theory points out that data is a key production factor in the digital economy era. The collection, analysis and utilization of data can realize optimal resource allocation and scientific decision-making. Through mining and analyzing tourism data, artificial intelligence enables precise services, intelligent management and efficient marketing, highlighting the core value of data factors in the development of smart tourism.

3. Application Status of Artificial Intelligence in the Digital Transformation of Smart Tourism

3.1. Empowering Tourism Services to Optimize Tourists' Whole-process Experience

Artificial intelligence comprehensively upgrades tourism service processes to realize convenient and personalized tourism services. Before travel, AI travel planning tools quickly generate personalized tourism schemes based on tourists' travel time, budget, preferences and other information, integrate transportation, accommodation, scenic spot and catering resources, and support one-stop reservation, solving the problems of cumbersome manual strategy planning and information asymmetry in traditional tourism. During travel, intelligent audio guides, real-time multi-language translation, face recognition admission, non-inductive payment and other technologies are widely applied to simplify tourism procedures and improve sightseeing efficiency[5]. Some scenic spots combine AR, VR and AI technologies to

build immersive cultural experience projects for tourists to deeply perceive cultural connotations. 7×24-hour AI intelligent customer service responds to tourist consultations and requests in a timely manner to improve service response efficiency. After travel, AI automatically generates travel notes and short videos to help tourists preserve travel memories, collects tourist feedback continuously, and supports iterative optimization of tourism services.

3.2. Assisting Operation Management to Improve Industrial Operation Efficiency

Artificial intelligence transforms tourism operation management from experience-driven mode to data-driven mode, realizing refined and intelligent management and control. Scenic spots adopt AI passenger flow monitoring systems to collect real-time passenger flow data, accurately predict passenger flow peaks, release congestion warnings and guide tourist diversion, so as to ensure tourism safety and optimize the allocation of human and material resources. Intelligent facility operation and maintenance systems monitor the operating status of scenic spot and hotel facilities in real time and warn of potential faults in advance, reducing operation and maintenance costs. Cultural and tourism competent authorities rely on AI big data supervision platforms to integrate tourism market data, realize precise supervision over scenic spots, enterprises and practitioners, standardize market order and safeguard tourists' legitimate rights and interests[6].

3.3. Innovating Marketing Modes to Realize Precise Customer Conversion

Artificial intelligence eliminates the extensive marketing mode of traditional tourism and enables precise and efficient marketing. By analyzing tourists' travel behaviors and consumption habits to build user portraits, cultural and tourism enterprises can push personalized tourism products and preferential activities in a targeted manner and improve marketing conversion rates. Generative AI can rapidly produce marketing materials including promotional copies, short videos and posters, reducing content production costs and improving marketing update efficiency[6]. AI public opinion monitoring systems capture real-time tourism market trends and tourist evaluations, helping enterprises adjust marketing strategies timely, avoid public opinion risks and enhance brand influence.

3.4. Activating Cultural and Tourism Resources to Promote Cultural Inheritance and Innovation

Artificial intelligence provides technical support for the protection and dissemination of cultural and tourism resources. Through 3D modeling and image restoration technologies, it realizes digital collection and preservation of cultural relics, historic sites and intangible cultural heritage, builds a digital cultural and tourism resource library, and solves the problems of fragility and difficult inheritance of traditional cultural resources. AI digital humans and virtual commentators display history, culture and folk customs in an interesting way and revitalize static cultural and tourism resources. In addition, AI technologies are applied to explore cultural connotations, develop personalized cultural and creative products, increase the cultural added value of tourism products, and promote the in-depth integration of culture and tourism.

4. Existing Problems in the Development of AI-enabled Smart Tourism

4.1. Prominent Data Barriers and Difficult Resource Integration

Tourism data is scattered across multiple parties including scenic spots, hotels, transportation departments, online travel agency (OTA) platforms and government authorities. Each party adopts inconsistent data collection standards and storage formats[7]. Meanwhile, limited by

commercial interests and privacy protection demands, stakeholders are reluctant to share data, resulting in severe data silos and blocked data interconnection. In addition, most small and medium-sized cultural and tourism institutions have non-standard data collection, delayed data updates and massive invalid data, leading to uneven data quality. This reduces the accuracy of AI algorithm analysis and restricts the full play of technology empowerment.

4.2. Superficial Technology Application and Insufficient Integration Depth

Most cultural and tourism enterprises only apply artificial intelligence to basic scenarios such as intelligent guiding, face recognition and basic customer service, lacking technological innovation and in-depth development. Advanced technologies including generative AI, intelligent decision-making and affective computing are rarely implemented. Some enterprises introduce AI technologies blindly without combining their own cultural and tourism characteristics and actual tourist demands, resulting in disconnection between technologies, business and cultural connotations. Superficial intelligent application fails to realize the in-depth integration of technologies and tourism industry.

4.3. Shortage of Interdisciplinary Professional Talents

The integrated development of artificial intelligence and smart tourism requires interdisciplinary talents proficient in both AI technologies and tourism management. However, the industry currently faces a severe talent shortage. Most tourism practitioners lack digital technology application and data analysis capabilities, while technical professionals are unfamiliar with tourism operation rules and tourist demands. Moreover, talent training programs in universities lag behind industrial development, with insufficient interdisciplinary curriculum design, failing to meet the talent demand of industrial digital transformation.

4.4. High Transformation Costs for Small and Medium-sized Tourism Institutions

The deployment, operation, maintenance and upgrading of artificial intelligence technologies require substantial capital investment. Large scenic spots and leading cultural and tourism enterprises have sufficient funds to promote digital transformation, while small and medium-sized institutions face capital constraints and cannot afford high technical costs, resulting in slow intelligent transformation. The polarized transformation development restricts the balanced and overall progress of the smart tourism industry.

4.5. Imperfect Data Security and Supervision System

The application of artificial intelligence in tourism requires the collection of massive tourists' personal information. Most cultural and tourism enterprises have weak data security protection capabilities, leading to risks of tourist privacy leakage and information abuse. Meanwhile, relevant systems regulating AI application standards, algorithm supervision, data right confirmation and ethical constraints in the cultural and tourism industry are incomplete. Problems such as algorithm bias, big data price discrimination and excessive marketing cannot be effectively regulated, hindering the healthy and standardized development of the industry.

5. Optimization Countermeasures for AI-driven Digital Transformation of Smart Tourism

5.1. Building Data Sharing Platforms to Break Industrial Data Barriers

Led by cultural and tourism administrative departments, a global tourism big data sharing platform should be built in cooperation with transportation and market supervision authorities. Unified standards for data collection, storage and transmission need to be

formulated, and a hierarchical and classified data sharing mechanism should be established to clarify the rights and obligations of all stakeholders. On the premise of ensuring data security and personal privacy, cross-industry and cross-department tourism data interconnection can be realized. In addition, data governance should be strengthened, and standardized data cleaning and updating mechanisms should be established to improve overall data quality and provide high-quality data support for AI application.

5.2. Deepening Scenario-based Technology Integration to Promote Application Innovation

Cultural and tourism institutions should combine their resource endowments and tourist demands to explore diversified AI application scenarios, focusing on innovative applications such as immersive cultural and tourism experience, intelligent operation decision-making and personalized customized services, so as to avoid homogeneous and formalistic technological construction. The coordinated integration of artificial intelligence with 5G, IoT, VR and AR technologies should be promoted to build an integrated smart tourism system, realize the in-depth combination of technologies, tourism business and cultural connotations, and maximize the value of technological empowerment.

5.3. Cultivating Interdisciplinary Talents to Improve Talent Supply

Universities should optimize the curriculum of tourism management, artificial intelligence and other majors, add interdisciplinary courses to cultivate compound talents with dual professional capabilities in digital technology and cultural tourism. Governments and enterprises should jointly carry out professional training to improve the digital literacy and technical application capabilities of existing tourism practitioners. Relevant talent introduction policies should be optimized to attract high-end technical and management talents[8]. Industry-university-research cooperation platforms need to be built to realize targeted talent training and make up for the industrial talent shortage.

5.4. Lowering Transformation Thresholds to Support Small and Medium-sized Institutions

Governments should introduce special subsidies and preferential tax policies to reduce the capital pressure of small and medium-sized cultural and tourism enterprises in digital transformation. Technology enterprises are encouraged to develop lightweight, low-cost and user-friendly standardized AI solutions and SaaS service models, reducing the cost of technology deployment and operation and maintenance. This provides affordable transformation paths for small and medium-sized institutions and promotes balanced digital transformation across the entire tourism industry.

5.5. Improving Supervision Systems to Consolidate the Bottom Line of Safe Development

Relevant policies and regulations for the integration of artificial intelligence and cultural tourism should be improved to standardize data collection, utilization and supervision, and strengthen the protection of tourists' personal information. An AI algorithm review mechanism should be established to standardize algorithm application and avoid algorithm bias and ethical risks. Industry supervision and enterprise self-discipline should be strengthened, with stricter penalties for data leakage, illegal marketing and other irregular behaviors, so as to build a safe, standardized and orderly development environment for smart tourism.

6. Conclusion and Prospect

6.1. Research Conclusion

As a core technical support for the digital transformation of the tourism industry and the construction of smart tourism, artificial intelligence effectively solves the development dilemmas of traditional tourism through extensive application in tourism services, operation management, marketing and cultural inheritance, and promotes the intelligent, personalized and high-quality development of the tourism industry. However, the integrated development of artificial intelligence and smart tourism is restricted by multiple bottlenecks, including data barriers, superficial technology application, insufficient interdisciplinary talents, high transformation costs and imperfect supervision systems, which hinder the full release of technological empowerment value. In the future, multi-dimensional measures including data integration, technological innovation, talent cultivation, policy support and supervision improvement should be adopted to break development constraints, facilitate the in-depth integration of artificial intelligence and tourism industry, and boost the high-quality development of smart tourism.

6.2. Future Prospect

With the continuous iteration of artificial intelligence technologies, the integration of AI and smart tourism will be further deepened. Personalized, immersive and intelligent tourism services will be fully popularized, and new industrial formats such as virtual tourism and intelligent cultural and tourism experience will continue to emerge. The digital protection and cultural communication capabilities of cultural and tourism resources will be steadily improved. Meanwhile, with the continuous optimization of data governance systems and industry supervision mechanisms, artificial intelligence will continuously release technological dividends under standardized and safe conditions, further advance the in-depth digital transformation of the tourism industry, and support the sustainable and high-quality development of the cultural and tourism industry.

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