

Research on the Construction of a Smart Ecosystem in China's Cultural Tourism Industry Empowered by AI

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Abstract

This article takes the empowerment of artificial intelligence technology to build a smart ecosystem for the cultural and tourism industry as its core, and systematically explores the innovative applications and practical paths of AI in areas such as cultural experience, tourism services, operation management, and leisure and entertainment. The research adopts the case analysis method and literature review method, and combines practical cases of China's cultural and tourism industry for analysis, revealing the internal mechanism of AI technology driving the digital transformation of the cultural and tourism industry. Research has found that generative AI and multimodal interaction technologies have given rise to new forms of immersive entertainment. For instance, the narrative naturalness of the AI improvisational drama system has reached a professional level, transforming cultural and tourism resources into immersive image images, which can better facilitate cultural dissemination. Research indicates that AI technology promotes the evolution of the cultural and tourism industry towards intelligence, personalization, and sustainability through a trinity model of technology, scenarios, and services, providing policymakers with practical paradigms in three aspects: data-driven, experience upgrade, and value creation.

Keywords

Artificial intelligence; Cultural and tourism industry; Smart ecosystem; Digital transformation Immersive experience

1. AI Applications in the Digital Age and AI Empowerment of the Cultural and Tourism Industry

1.1. AI Technology Driving the Digital Transformation of the Cultural and Tourism Industry

In the era of rapid advancements in AIGC technology, digital technology has become the key to the green transformation and upgrading of the cultural and tourism industry. The widespread application of big data, generative artificial intelligence, cloud computing, and internet technology has made the presentation mode of the

cultural and tourism industry more diverse and dynamic. Digital technology has broken the time and space boundaries of emerging cultural formats such as digital reading, cloud concerts, and AR libraries, reducing energy consumption caused by personnel movement and related distribution, and optimizing space utilization. At the same time, the rapid rise of smart cultural and tourism has also promoted the transformation and upgrading of cultural and tourism consumption patterns.[1]

The construction of a smart cultural and tourism ecosystem requires systematic planning from three dimensions: technology, scenarios, and services. On the technology level, the integration of AI with emerging technologies such as the Internet of Things and cloud computing has laid a solid foundation for a smart ecosystem. On the scenario level, AI technology is deeply embedded in specific application scenarios such as scenic area guidance, cultural display, and safety monitoring, forming a three-party collaborative intelligent service system. On the service level, AI-driven personalized recommendation systems can provide customized travel routes and content recommendations based on tourists' preferences and behavior data, greatly enhancing the user experience. This three-in-one ecological model realizes the full-chain intelligence from content production to consumption, promoting efficient collaboration among all links of the cultural and tourism industry chain.

In all links of the cultural and tourism industry chain, AI technology not only optimizes traditional business processes but also creates new service scenarios and consumption experiences. This technological empowerment is not only reflected in the improvement of service efficiency but also in the construction of a new cultural and tourism industry ecosystem characterized by data-driven and intelligence. From the digital protection of cultural content to the personalized customization of tourism services, from the precise decision-making of operation management to the immersive innovation of entertainment experiences, AI technology is reshaping the value chain of the cultural and tourism industry in all aspects.

1.2. Construction Framework of the Smart Ecosystem in the Cultural and Tourism Industry

While promoting the development of the cultural and tourism industry, artificial intelligence is also deeply promoting the systematic construction of a smart ecosystem across the board. The smart cultural and tourism ecosystem takes technology, data, scenarios, and services as the core four-dimensional elements, achieving a full-chain smart transformation from resource management, tourist experience to industrial operation through the coordinated interaction and closed-loop operation of the four.

Among them, the technology layer includes two major systems: infrastructure support and intelligent application support. The infrastructure system takes 5G, the Internet of Things, cloud computing, and Beidou positioning as the core base,

providing hardware support for data collection and transmission; the intelligent application layer takes AI algorithms, digital twins, virtual reality, and big data analysis as the core engines, providing technical capabilities for scenario implementation and service optimization. The data layer is the core production material for the operation of the smart ecosystem, mainly covering dynamic information flows such as tourist behavior data, scenic area operation data, cultural and tourism resource data, online public opinion data, and consumption preference data, providing a basis for intelligent decision-making. The scenario layer focuses on real cultural and tourism scenarios such as cultural experience, tour services, scenic area management, and marketing promotion, achieving precise matching of AI technology and cultural and tourism demands. The service layer is centered on tourists, relying on AI to achieve personalized itinerary recommendations, intelligent guidance, intelligent customer service, emergency rescue, and seamless passage, providing convenient and immersive cultural and tourism services, enhancing the quality of experience and service efficiency. Scenic areas can achieve a paradigm shift from experience-based decision-making to data-driven through the dynamic optimization of machine learning algorithms. For example, Jiuzhaigou Scenic Area has adopted a neural network-based passenger flow prediction model, significantly improving the accuracy of tourist diversion during peak seasons, effectively alleviating congestion, optimizing the tour route, and significantly increasing the comprehensive economic benefits of the scenic area while enhancing tourist satisfaction. The breakthrough development of natural language processing technology has made multimodal interaction possible. The AI intelligent tour guide developed by the Dunhuang Academy can accurately recognize multimodal instructions such as voice and gestures, and dynamically adjust the explanation style and content depth based on the age and emotional state of tourists, achieving intelligent, emotional and personalized cultural dissemination, which verifies the practical feasibility and application value of the smart ecological model.

The construction of a smart ecosystem in the cultural tourism industry is an inevitable path for high-quality development in the AI era, and it is also the core support for industrial upgrading, service optimization and cultural revitalization. With the synergy of four elements - technology, data, scenarios and services as the framework, and policy guidance, market-driven and cultural soul-casting as the guarantee, the smart ecosystem has broken the limitations of traditional cultural tourism in resource allocation, operation management and experience supply, promoting the industry's deep transformation from passive service to proactive prediction, from single-point intelligence to all-domain collaboration, and from resource dependence to innovation-driven.

1.3. Policy Support and Industry Practice Cases

General Secretary Xi Jinping emphasized: "Strategic emerging industries are new

pillars and new tracks leading future development." [2]Policy support serves as a crucial guarantee for promoting the deep integration of AI and the culture and tourism industry. In recent years, centering on the strategy of Digital China and the goal of integrated development of culture and tourism, the state has successively issued guiding documents such as the Guiding Opinions on Promoting the Development of Smart Tourism and the Opinions on Further Implementing the "AI Plus" Initiative. These documents clarify the direction of technology empowerment from a top-level design perspective, encourage the application of artificial intelligence in scenarios including smart services, cultural revitalization, precision marketing, and business format innovation, provide a stable policy environment and development guidance for industrial transformation, and offer institutional support for the application of artificial intelligence technology in the culture and tourism sector.

At the practical level, numerous successful cases have emerged across the country, all demonstrating that the integration of AI and cultural tourism has a promising development path. For instance, the Yangtze River Delta region, leveraging its digital economy advantages, has established a smart tourism public service platform, breaking down data barriers in four areas: scenic spots, transportation, accommodation, and consumption. This has enabled cross-regional resource coordination, intelligent scheduling, and personalized recommendations, effectively achieving multi-faceted resource coordination and significantly reducing labor costs. Yan'an, on the other hand, focuses on its red cultural resources, using digital modeling and VR immersive technology to recreate historical revolutionary scenes, making red culture tangible and memorable, and enhancing its cultural dissemination power. These two models respectively represent technology-driven and culture-led integration paths, providing practical experience for regions with different resource endowments. These cases collectively indicate that the effectiveness of AI application not only depends on the advancement of the technology itself but also on its precise matching and deep integration with local cultural tourism resources, as well as the completeness of the supporting policy system. The introduction of AI technology not only optimizes traditional cultural tourism service models but also gives rise to new business forms and experience methods, injecting new impetus into industrial transformation and upgrading.[3]

At the fundamental logic level of technology-driven industrial transformation, big data analysis technology, by mining tourist behavior data, builds precise user profiles, providing data support for personalized services; computer vision technology, through image recognition and processing, realizes functions such as scenic area passenger flow monitoring and digital protection of cultural relics; natural language processing technology empowers intelligent customer service systems, enhancing service response efficiency and quality. These three core technologies together form the technical foundation for the intelligent

transformation of the cultural tourism industry, promoting the shift from standardized services to personalized experiences. [4]

2. AI Empowerment in Cultural Experience and Transmission Levels

2.1. Digital Protection and Dynamic Transmission of Cultural Heritage

Cultural heritage is the spiritual carrier of Chinese civilization. Achieving its permanent preservation and innovative transmission is an important mission in the construction of a cultural power in the new era. In the context of rapid technological iteration in AI, the protection of cultural heritage has shifted from traditional physical restoration to a new stage of digitalization, intelligence, and interactivity. AI, with its high-precision collection, deep analysis, and dynamic regeneration capabilities, provides key technical support for "preserving, spreading, and using" cultural heritage, promoting the transition from passive preservation to active activation.

From the perspective of new productive forces development, AI technology has brought revolutionary breakthroughs to the digital protection of cultural heritage, completely breaking the limitations of traditional protection models and promoting the transformation of cultural heritage protection from "passive preservation" to "active activation". Relying on core technologies such as multispectral imaging, 3D modeling, and high-precision image processing, various cultural relics and documents can achieve non-destructive scanning, intelligent restoration, and permanent archiving. This not only effectively avoids possible losses, corrosion, and other problems during physical preservation but also lays a solid foundation for the subsequent research and dissemination of cultural heritage. Taking the development of Du Fu's cultural archives as an example, the research team used multispectral imaging technology to conduct high-precision scanning of ancient books and documents, accurately capturing invisible ink traces and damage details on the surface of the documents. On this basis, they used deep learning algorithms to analyze the scanned images automatically, identifying damaged areas of the text and restoring incomplete characters, successfully completing the digital restoration of multiple endangered ancient books. At the same time, based on the content of the restored documents, a Du Fu cultural knowledge graph containing 23,000 poetic image tags was constructed, achieving semantic correlation and visual presentation of Du Shi's text, imagery, and temporal and spatial background. [5] This digital protection not only completely preserves the physical form of cultural classics but also reveals the temporal narrative logic of Du Shi's poetry through semantic correlation technology, providing a new analytical dimension for literary research. In the field of intangible cultural heritage transmission, AI technology also plays an irreplaceable key role, effectively solving the problems of "transmission gap" and "form fixation" of endangered intangible cultural heritage projects. Taking the

digitalization project of Jiqi as an example, the research team used high-precision motion capture systems to accurately record the movement trajectories, body postures, and expression details of key skeletal points in the traditional performance of Jiqi, constructing an action database covering classic plays and performance techniques, and combining neural network technology to build an intelligent inheritance system that can generate new performance segments, enabling the digital regeneration of endangered local operas [6]. The addition of AI technology enables cultural resources to achieve high-precision, permanent digital preservation, and also gives them the ability for intelligent analysis and dynamic reconstruction, allowing cultural heritage to move from static protection to researchable, transmissible, and renewable sustainable development.

AI technology provides technical possibilities and innovative paths for the protection and transmission of cultural heritage, achieving both permanent digital preservation and dynamic transmission that can be disseminated, experienced, and innovated. In the future, the protection and development of cultural heritage should continue to use AI as a tool, with culture as the root, deepen scene applications on the basis of precise protection, and make the dormant heritage "come alive" and ancient culture "become trendy", truly achieving the unity of digital protection and creative transformation and innovative development.

2.2. AI Empowers the Innovative Development of Cultural IPs

In the dimension of cultural IP development, AIGC technology is profoundly driving the paradigm shift in content production and creative expression, opening up new paths for the activation and dissemination of traditional cultural resources. Under the empowerment of AI, traditional regional cultures and intangible cultural heritage symbols, which were originally static cultural resources, gradually transform into dynamic, immersive, and interactive experiences, breaking the limitations of traditional cultural dissemination. For a long time, the dissemination of traditional cultural IPs has relied on traditional forms such as books, museum exhibitions, and static posters, which often have problems such as limited dissemination scenarios, insufficient interactivity, and the lack of youthful expression, resulting in many excellent regional cultures and intangible cultural heritages being difficult for contemporary audiences, especially the Z-generation, to know and recognize. Some traditional cultural resources even fall into the predicament of "hidden from view and unknown", making it difficult to achieve dynamic inheritance and the dual empowerment of commercial value.

Specifically, in the aspect of dynamic transformation, AIGC technology can convert static cultural symbols and historical figures into dynamic visual content. Whether it is short videos, animated short films, or dynamic emojis, digital scenes, they can all present traditional culture in a more vivid and lively form. For example, cultural symbols that existed only in ancient books and paintings can be endowed with

coherent actions, vivid expressions, and matching contemporary sound effects and explanations through AI animation generation technology, making the abstract cultural connotations intuitive and tangible, greatly reducing the threshold for contemporary audiences to understand traditional culture. In the creation of immersive experiences, AIGC combined with VR and AR technologies can build virtual cultural scenes, allowing audiences to "enter" historical contexts and intangible cultural workshops, achieving close interaction with traditional culture. For instance, with the help of AI-generated virtual intangible cultural heritage experience halls, audiences can simulate the production process of traditional skills online, touch virtual intangible cultural heritage exhibits, and listen to AI digital voices explaining the historical origin and inheritance story of the skills, which is far more compelling than traditional static displays and can effectively stimulate the interest and identification of audiences with traditional culture. The construction of the Sanyishan cultural representative figure Wang Shuanshan digital IP image breaks the limitations of traditional IP static displays and realizes the intelligent and personalized rebirth of historical culture in the digital age [7]; Longnan Wenxian Bai Mountain culture uses the AI image generation tool Midjourney to deeply extract intangible cultural heritage elements and successfully creates a distinctive tourism IP image [8]. These two cases fully demonstrate that AI can efficiently activate traditional cultural resources and demonstrate great application potential in the field of cultural creativity and cultural tourism integration.

AI technology provides powerful impetus and possibilities for the innovative development of cultural IPs, but in the application process, it must adhere to the core bottom line - with cultural authenticity and deep inheritance as the foundation, rather than simply the accumulation and display of technology. In the future, we should further promote the deep integration of art design, AI technology, and cultural research to optimize the IP development process and adhere to the cultural root while innovating the expression, avoiding the application of technology deviating from the cultural core. Only by maintaining a balance between innovation and orthodoxy can AI truly become the "innovation engine" for the activation of cultural IPs, promoting the creative transformation and innovative development of excellent traditional culture in the digital era.

2.3. Intelligent Technology Reconstructs the Cultural Communication Ecology

In the dimension of cultural communication, the addition of AI technology is also reshaping the communication logic and experience paradigm of cultural tourism, becoming a key link in promoting the construction of a smart ecosystem for the cultural tourism industry. The intelligent technology system represented by AIGC, big data recommendation, VR/AR, and cross-media narrative has driven the cultural dissemination to undergo three major transformations - from one-way

indoctrination-style propaganda to two-way interactive communication, from static display and presentation to immersive scene experience, and from broad-based mass coverage to refined and precise targeting. This has made cultural and tourism dissemination more efficient, closer to the audience, and more penetrating and infectious. Digital tour guides based on generative artificial intelligence large language models can break through time, location, and language boundaries, providing real-time guided tours based on individual tourists' interests, in the form of customized virtual tour guide images. This is a special application of social robots. "Robots that participate in our daily lives, if they are to become equal partners to us, not only need to exhibit credible social cues, but also must be able to recognize these cues and respond appropriately. This is not limited to all aspects of communication and emotions; it also includes a large number of situational, personal, cultural, and historical contexts." [9] The Dunhuang Academy has launched special interactive experience projects such as "Digital Donor", effectively improving the production efficiency and presentation quality of cultural content, and rejuvenating the thousand-year-old Dunhuang culture. The collaborative filtering algorithm and intelligent recommendation system based on user profiling can precisely match tourists' interest preferences, achieving targeted and personalized dissemination of cultural content, and significantly enhancing the accuracy and effectiveness of cultural reach. At the same time, VR/AR immersive technology breaks the constraints of time and space, constructing "presentational" experience scenarios, making immovable cultural heritage tangible, accessible, and interactive; cross-media narrative further breaks down the barriers between text, images, interactive installations, and offline scenarios, forming a multi-form, multi-point, and all-round communication matrix, significantly enhancing the appeal and dissemination power of cultural heritage. However, it is necessary to be vigilant that the empowerment of technology also brings many hidden concerns. Problems such as content homogenization, shallow experience, and ambiguous dissemination subjects have become increasingly prominent, posing potential impacts on the deep connotation and humanistic value of cultural tourism.

In the field of the dissemination of intangible heritage and cultural heritage, intelligent technology not only brings new opportunities for dynamic inheritance but also poses new governance challenges. On one hand, AI helps niche cultures and intangible cultural heritage skills break through the barriers of circles and expand dissemination channels, improving visibility and influence; on the other hand, algorithm preferences can lead to fragmentation and entertainment of content, weakening cultural connotation and ideological depth, and cross-border data flow and platform algorithm manipulation may trigger risks such as cultural discourse imbalance and value implantation.

Therefore, to build a healthy and sustainable intelligent cultural dissemination ecosystem, it is necessary to adhere to the collaborative governance of technology,

institutions, and humanities: strengthen human-machine collaboration, safeguard the humanistic essence and cultural authenticity; improve platform governance and legal norms, prevent algorithm black boxes and data monopolies; strengthen global collaboration to promote cultural exchanges and mutual learning, and maintain cultural diversity. Only by seeking balance between efficiency and value, innovation and orthodoxy can intelligent technology truly become a positive driving force for cultural tourism dissemination, injecting lasting and warm cultural power into the intelligent ecosystem of the cultural tourism industry.

3. AI Empowerment at the Tourism Service and Operation Level

3.1. AI Enhances the Intelligence Level of Tourism Services

The rapid iteration of artificial intelligence technology is breaking the boundaries of traditional tourism services, reconfiguring the service architecture and operation logic of the cultural and tourism industry, promoting the transformation of tourism services from "passive response" to "active precision", comprehensively enhancing the intelligence level of tourism services, and injecting strong momentum into the high-quality development of the industry. In my opinion, the empowerment of AI in tourism services is not merely a simple technological addition, but rather through deep penetration in the entire process and multiple scenarios, it solves industry pain points, optimizes service experiences, and improves the industrial ecosystem, achieving multi-party win-win for tourists, merchants, and regulatory authorities.

The application of AI in front-end service scenarios has achieved a breakthrough in both service efficiency and accuracy. The algorithm innovation of the personalized recommendation system is reflected in the deep optimization of feature engineering. Meituan has effectively improved the accuracy of restaurant recommendations by building a three-dimensional relationship graph of users, merchants, and locations. This system can dynamically capture the spatiotemporal evolution patterns of users, for example, when it detects that tourists are in the surrounding area of the scenic spot, it automatically enhances the weight of "local specialty dishes", increasing the click-through rate of related merchants by 42.3% [10]. This effectively solves the core pain points of traditional tourism scenarios, such as "difficulty in finding food and choosing food", and breaks the information asymmetry between tourists and local characteristic catering resources. Previously, tourists in the scenic area often faced the problems of "not knowing what to eat, worrying about getting into trouble, and difficulty in finding authentic local cuisine", especially for tourists from other places who are not familiar with the local food culture, they are prone to fall into the trap of homogeneous catering recommendations, which not only affects the tourism experience but also hinders the traffic conversion of local characteristic merchants. The personalized recommendation system of AI can precisely capture tourists' spatiotemporal preferences, enabling tourists to quickly access the characteristic catering that meets expectations. In the operation management of scenic spots, the

application of AI models has achieved the optimization and upgrading of resource utilization efficiency. The dynamic scheduling system for tourist flow management in Huangshan scenic area, relying on non-radial and non-angular efficiency calculation methods, not only improves the tourist carrying capacity during peak hours but also reduces energy consumption, achieving the coordinated development of ecological protection and tourism experience, which is a vivid manifestation of AI empowering sustainable tourism. These intelligent applications not only optimize the tourist experience but also build a digital foundation for the sustainable development of the cultural and tourism industry. In the future, with the deep integration of AI technology and tourism scenarios, it is necessary to balance technological innovation and humanistic warmth, solve bottlenecks such as data security and talent shortage, and make AI truly become the core engine for the upgrade of tourism services, promoting the tourism industry to develop in a higher quality and more dynamic direction.

3.2. Data-driven Tourism Operation Management

In the field of tourism operation management, data-driven decision-making is achieving a qualitative leap by leveraging machine learning technology, completely breaking the limitations of traditional experience-based operations, and promoting the transformation of tourism operations from being precise, efficient, to intelligent. The specific AI plays a role in data collection and algorithm monitoring, and works in synergy with digital twin technology, jointly improving the digital governance level of the cultural and tourism industry. Generative AI can comprehensively monitor real-time data such as tourist density and tourist behavior patterns, promptly identify situations of excessive crowd concentration and trigger tourist diversion plans, and at the same time provide scientific suggestions for adjusting opening hours and optimizing the allocation of human resources, helping scenic spots flexibly respond to the fluctuations in tourist flow during peak and off-peak seasons [11]. Among them, the breakthrough progress in tourist flow control in scenic areas has been achieved first. By integrating historical operation data, real-time weather changes, surrounding traffic flow, and peak patterns during holidays, the intelligent model can accurately predict the tourist flow trends in different periods and areas, replacing the traditional extensive experience-based management model. As a typical example, the Huangshan Scenic Area relies on an accurate tourist flow prediction system, breaking away from the previous blindness of tourist flow regulation. Through dynamic adjustment of ticket allocation, implementation of time-based reservations, and optimization of tour routes, it effectively balances the distribution of tourist flows in different areas, resolving problems such as overcrowding at popular attractions and long waiting times, and simultaneously improving the order and experience of tourism, laying a solid foundation for the regular and efficient operation of the scenic area.

The in-depth application of deep learning algorithms has demonstrated unique advantages in optimizing the scheduling of tourism resources, promoting the comprehensive upgrade of emergency response and resource allocation capabilities in tourism operations. The combination of multi-technology integration and deep learning has established a global intelligent monitoring system. Through IoT sensing devices, video visual analysis, and intelligent terminal collection technologies, it can capture key information such as the density of tourist flows, the operating status of facilities, and potential safety hazards in the scenic area in real time. Once the safety warning threshold is triggered, the system can quickly activate emergency response plans, significantly reducing the response and handling time, and ensuring the safety of tourists. At the same time, deep learning and reinforcement learning algorithms precisely solve the problem of unbalanced resource allocation by continuously analyzing data such as tourist movement trajectories, consumption habits, and service demands, achieving dynamic optimization of catering supplies, facility maintenance, and personnel allocation. From the preventive maintenance of special equipment in scenic areas, early detection of faults to the on-demand allocation of catering supplies and staggered shift scheduling of human resources, it reduces resource waste and operational costs, making resource scheduling more in line with actual operational needs, significantly improving the overall efficiency of tourism operations.

The innovative application of blockchain and federated learning technologies has effectively broken through the trust and security barriers in data sharing in the cultural tourism industry, providing a new path for cross-regional collaborative development. In traditional cultural tourism operations, data from various scenic areas and tourism departments are independent, forming "data islands", making it difficult to achieve data interoperability and value extraction. The decentralized and immutable characteristics of blockchain technology, combined with the "data available but not visible" advantage of federated learning, enable scenic areas across different regions to achieve data value interoperability and sharing without disclosing core data privacy. The all-region cultural tourism data collaboration platform established by Yunnan Province is a successful practice of this technology integration application. Through a distributed learning framework, it integrates data from various domains such as scenic areas, transportation, and hotels, achieving precise prediction of cross-regional tourist flows, collaborative control, and resource scheduling, ensuring data security while significantly enhancing the overall management capabilities of the cultural tourism industry across the region. This innovative model breaks industry data barriers, providing a replicable and scalable path for cross-regional cultural tourism collaborative development, and is gradually being promoted nationwide, helping the cultural tourism industry move from single-point intelligent construction to all-region integrated development, and promoting tourism operation management towards a more intelligent, more

efficient, and more collaborative high-quality direction.

3.3. Innovative Integration of AI and Tourism Marketing

In the field of tourism marketing, the deep integration of AI technology is breaking the limitations of traditional marketing models and driving tourism marketing to transform from a broad-based promotion approach to a more precise, personalized, and contextualized one, becoming the core driving force for activating cultural and tourism consumption and enhancing brand influence. Through intelligent analysis and application of multi-dimensional data, AI technology accurately captures tourists' needs, optimizes marketing scenarios, making tourism marketing more targeted and compelling, and achieving a qualitative leap in marketing effectiveness. Taking the prediction of tourist flow and marketing regulation in scenic spots as an example, by integrating and analyzing various related data through AI algorithm models, it can accurately predict changes in tourist flow trends, providing scientific support for marketing decisions. The Huangshan Scenic Area, relying on the AI prediction model, precisely controls the flow rhythm, through dynamic adjustment of ticket promotion strategies and optimization of time-based reservation marketing plans, effectively balances the distribution of tourist flow, avoiding the impact of overloading on the experience and enhancing the tourist flow and reputation of the scenic area through reasonable marketing guidance, achieving a two-way improvement in marketing effects and tourism experiences.

The application of multimodal data fusion technology further enriches the contextualized expression of tourism marketing, while strengthening risk prevention and experience optimization in the marketing process, laying a solid foundation for the smooth implementation of marketing activities. Jiuzhaigou Scenic Area, with the help of the intelligent monitoring and marketing linkage system built by AI, integrates various perception data and visual analysis technologies, can grasp the dynamic changes of the scenic area in real time, timely resolve operational risks, and through analyzing tourists' behavioral preferences, precisely push marketing content and tour suggestions that meet their needs. This "prevention + marketing" integration model not only enhances tourists' sense of security and satisfaction in the tour, but also through precise contextualized marketing, strengthens the attractiveness of the scenic area, promotes word-of-mouth marketing and secondary consumption. In terms of facility maintenance, the application of AI predictive maintenance models can avoid facility failures affecting the implementation of marketing activities, ensuring the normal operation of the scenic area, and providing stable support for the continuous progress of tourism marketing.

Deep learning algorithms demonstrate unique value in the resource scheduling and precise targeting of tourism marketing, making marketing resource allocation more efficient and marketing content push more precise. AI technology, through analyzing

tourists' movement trajectories, consumption habits, and other preference data, can achieve dynamic optimization of marketing resources and personalized push. Shanghai Disneyland, with the help of the AI intelligent system, precisely analyzes tourists' needs, optimizes the marketing and supply layout of related products such as dining and surrounding areas, reducing resource waste and improving the conversion rate through precise product marketing; Wuzhen Scenic Area uses AI algorithms to optimize human resource allocation, ensuring the quality of marketing services, and through a high-quality service experience, strengthening the brand image, promoting the implementation of word-of-mouth marketing. In addition, the combination of blockchain technology and federated learning solves the trust problem of data sharing in tourism marketing, achieving cross-regional and cross-platform marketing data collaboration. The cultural tourism data platform established by Yunnan Province realizes cross-regional data collaboration and precise marketing through AI technology, ensuring data security and integrating marketing resources from various regions, forming a regional marketing synergy, providing a promotable model for cross-regional cultural tourism marketing cooperation, promoting tourism marketing towards a more comprehensive and collaborative direction, and facilitating the high-quality development of the cultural tourism industry.

4. AI Empowerment in the Fields of Leisure, Vacation and Entertainment

4.1. AI Reshaping Immersive Entertainment Experiences

Immersive experiences form a core part of tourism, bringing pleasure and engagement to tourists. Combined with virtual and augmented reality, generative AI creates vivid, interactive virtual scenes that reconstruct history, culture and landscapes, enabling deeply immersive exploration. It responds to tourists' feedback to enhance realism and participation.

New technologies including big data and AI enrich tourism products and services, supporting intelligent guidance and personalized strategies. Computer vision and emotion capture track tourists' expressions and movements, dynamically adjusting virtual scenes to strengthen immersion. Tokyo Disneyland's holographic system adapts performances in real time, while brain-computer interfaces further upgrade experience design.

AI demand forecasting supports tailored leisure services. Sanya Atlantis' smart rooms automatically adjust environments and recommend activities based on guest needs. In cruise tourism, AI optimizes facility scheduling and reduces waiting time, improving efficiency and satisfaction.

Generative AI drives content innovation in immersive entertainment. Zhangjiajie's AIGC system creates customized marketing materials. Xi'an Daming Night City uses large language models to capture public opinion and feedback, iterating

content in real time. AI thus becomes central to upgrading immersive entertainment, boosting personalization and high-quality development in cultural tourism.

4.2. AI Implementation of Personalized Leisure Services

In the leisure and vacation sector, AI restructures personalized service supply through dynamic needs perception and scenario adaptation, delivering refined, human-centric experiences. Multi-modal perception and emotional computing capture tourist preferences, creating tailored plans that transcend standardized services. Sanya Atlantis Hotel uses intelligent algorithms to adjust services, enhancing experience and loyalty. Hangzhou's night economy and Zhuhai Chimelong deploy AI interaction and passenger flow optimization to enrich personalized experiences across the entire journey.

In high-end vacations, AI integration redefines premium services. Aman Hotels employs biometric recognition and deep learning to enable seamless, customized services throughout guests' stays, boosting loyalty. In cruise tourism, AI optimizes schedules and reduces waiting time, improving comfort and efficiency. Generative AI enables cross-modal content creation, turning text, images and videos into personalized travel materials.

Douyin's AI Travel Assistant generates customized guides based on user behavior, supporting ticket and hotel partnerships for commercial success. Baidu's Metaverse Travel uses AI and AR to build virtual scenic spots and immersive experiences, driving consumption. Zhangjiajie's AIGC system creates targeted marketing content, while large language models enable real-time content iteration. AI thus empowers smarter, more diversified cultural tourism marketing and services.

5. Conclusion

In the context of cultural tourism integration, new quality productive forces have become a key driver for the transformation and upgrading of the cultural tourism industry. Accelerating their development is critical to promoting high-quality growth and the modernization of China's cultural tourism integration. Supported by innovation, technology and cultural exploration, new quality productive forces improve industrial quality and efficiency, optimize resource allocation, advance green development, and deliver more personalized and digital cultural experiences to tourists. Driven by technological innovation, the cultural tourism sector will move toward greater digitalization and green development. This paper highlights three priorities: advanced technologies including AI, big data and cloud computing provide essential support for smart, personalized services. Industrial integration with technology, education, sports and health deepens product connotation and fosters new business forms. Innovative configuration of resources, products and industrial chains enhances system competitiveness and overall efficiency.

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