Application Research of Artificial Intelligence Technology in Enhancing the Quality of Cultural Tourism Experiences

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Abstract: *The digital era has imposed urgent demands for the personalization, deepening, and emotionalization of cultural tourism experiences. This study systematically explores the intrinsic logic of how artificial intelligence technology enhances experience quality. It constructs a multi-dimensional evaluation framework for experience quality encompassing cognition, emotion, and behavior, and analyzes the internal mechanisms by which perceptual, cognitive, and generative intelligent technology clusters empower the reconstruction of experiences. By dissecting three key technological dimensions-intelligent information interaction, immersive environment generation, and personalized services-the research reveals the mechanism through which artificial intelligence systematically improves experience quality via three pathways: optimizing processes and cognitive depth, enhancing emotional resonance and meaning construction, and extending the lasting impact of experiences. This provides a theoretical framework for understanding the intelligent transformation of cultural tourism experiences.*

Keywords: *Artificial Intelligence; Cultural Tourism; Experience Quality; Intelligent Interaction; Immersive Environment; Personalized Service; Cognitive Depth; Emotional Resonance*

Introduction

Currently, the supply model of cultural tourism experiences is undergoing profound changes. Traditional, homogenized information services and static displays can no longer meet the growing demands of tourists for in-depth understanding, emotional connection, and personalized participation. The core of experience quality increasingly emphasizes tourists' cognitive gains, emotional resonance, and the generation of personal meaning, which requires tourism services to shift from one-way transmission to two-way interaction and from fixed programs to dynamic generation. In this context, artificial intelligence (AI) technology, with its powerful capabilities in intelligent data processing, context awareness, and content generation, demonstrates significant potential to reshape the interactive relationships among tourists, culture, and the environment. However, existing research mostly focuses on case descriptions of specific technological applications, lacking an integrated theoretical discussion on the internal mechanisms of technological empowerment, the composition of systematic technological dimensions, and comprehensive enhancement pathways, all approached from the intrinsic dimensions of experience quality. Therefore, this study holds significant theoretical necessity. It aims to bridge this research gap by systematically constructing an analytical framework covering "theoretical mechanisms, technological dimensions, and enhancement effects," and by deeply analyzing how and in what ways AI technology systematically improves the quality of cultural tourism experiences, thereby providing solid theoretical support and directional guidance for the intelligent development of the cultural tourism field.

1. Theoretical Foundations of Artificial Intelligence and Cultural Tourism Experience Quality

1.1 Core Dimensions and Evaluation Criteria of Cultural Tourism Experience Quality

Cultural tourism experience quality is a multi-dimensional composite construct whose core dimensions extend beyond simple functional satisfaction of services, delving deeply into tourists' cognitive, emotional, and meaning-making processes. Examined from the cognitive dimension,

experience quality is associated with the depth and accuracy of tourists' understanding of cultural symbols, historical narratives, and local knowledge. The emotional dimension involves subjective psychological states such as resonance, immersion, and aesthetic pleasure elicited during the tour. The behavioral dimension manifests as tourists' willingness and patterns of exploration, interaction, and deep participation generated based on the experience. Together, these dimensions constitute a dynamic, tourist-centric quality evaluation system.

A systematic evaluation of this quality requires the establishment of a framework that integrates subjective perceptions and objective attributes. Subjective evaluation criteria focus on the individual psychological gains and satisfaction of tourists, typically captured through self-report measurements. Objective evaluation criteria, on the other hand, focus on technical indicators such as the smoothness of the experience process, the fidelity of information transmission, and the responsiveness of interactive links. A comprehensive evaluation model aims to integrate these two types of criteria, revealing the interactive relationship between tourists' internal psychological states and the external technological environment, thereby providing a precise measurement benchmark and theoretical anchor point for subsequent technological application analysis[1].

1.2 Analysis of the Artificial Intelligence Technology System and Its Adaptive Characteristics

The artificial intelligence technology system applied in the cultural tourism field is mainly composed of three core technology clusters: perceptual intelligence, cognitive intelligence, and generative intelligence. Perceptual intelligence achieves real-time recognition and understanding of the physical environment, tourist behaviors, and unstructured data (such as historical texts and images) through computer vision, natural language processing, and Internet of Things sensing technologies. Cognitive intelligence, relying on machine learning and knowledge graphs, engages in in-depth data analysis, pattern mining, and personalized reasoning, aiming to construct a dynamic knowledge model of cultural resources and tourist demands. Generative intelligence encompasses natural language generation, content synthesis, and immersive environment construction, and its function lies in creating novel interactive content and experiential scenarios.

The adaptability of this technological system to the cultural tourism field stems from a series of its intrinsic characteristics. Its data-driven nature makes it possible to process and extract value from massive, diverse cultural tourism data in real time, thereby overcoming the static and one-sided nature of traditional information interpretation. The technology's interactivity and scalability allow the system to dynamically adjust based on real-time feedback, creating a highly personalized experience flow. This full-chain capability-from perception and understanding to generation-provides the technical feasibility for systematically reshaping the interaction interface between tourists and cultural heritage, transforming experience design from a preset, standardized model into a dynamic, conversational, and continuously evolving process.

1.3 An Analysis of the Intrinsic Mechanism of Technology Empowering Experience Quality Enhancement

The intrinsic mechanism through which artificial intelligence technology empowers the enhancement of experience quality is not merely a simple tool substitution, but rather a profound process of experience reconstruction. Its core lies in reshaping the cognitive pathways through which tourists acquire, process, and internalize cultural information via technological mediation. Acting as an intelligent information filter and interpreter, technology can perform precise information matching and multi-level presentation based on tourists' prior knowledge and real-time interests, thereby effectively reducing cognitive load while simultaneously enhancing the depth and coherence of cognition. This process transforms one-way information transmission into a two-way, guided cognitive dialogue, facilitating the shift from superficial sightseeing to in-depth understanding[2].

A deeper mechanism involves technology's role in reshaping the experiential context and catalyzing emotional connections. By generating immersive narrative environments or intelligent interactive agents, artificial intelligence can blur the boundaries between physical space and digital content, creating a hybrid experiential field rich with emotional cues. Within such a field, tourists are no longer passive observers but are empowered as active participants. By simulating personalized conversations, providing contextualized storylines, or offering responsive environmental feedback, technology interacts directly with the tourists' emotional systems, stimulating their curiosity, resonance, and reflection. This process thereby assists in completing a closed loop of meaning construction,

progressing from information reception to emotional engagement and, ultimately, to the generation of personal meaning. This mechanism reveals that the key to technology enhancing experience quality lies in its deep intervention in and optimization of the tourists' cognitive-emotional cycle.

2. Key Technological Dimensions of Artificial Intelligence Application in Cultural Tourism

2.1 Intelligent Information Interaction and In-depth Content Interpretation Technologies

The core of intelligent information interaction technology lies in reshaping the interface between tourists and cultural information, with its implementation relying on the mature application of natural language processing and dialogue systems. By employing semantic understanding and context recognition, this type of technology can parse complex or ambiguous inquiries posed by tourists in natural language and generate coherent, accurate, and informative multi-turn dialogue responses. This fundamentally transforms the traditional interactive paradigm of one-way audio guides or fixed-menu queries, turning the information acquisition process into a dynamic, intention-understanding-based intelligent question-answering and guidance service, significantly enhancing information accessibility and the naturalness of interaction. Furthermore, such interactions are progressively integrating multimodal inputs, including voice, gestures, and even eye-tracking, enabling a more nuanced capture of users' unconscious behaviors and potential interests, thereby propelling interaction towards a more humanized stage of "context awareness."

In-depth content interpretation technologies further endeavor to excavate and present the multi-dimensional meanings embedded within cultural heritage. These technologies typically integrate computer vision for recognizing artifact forms and details, natural language processing for parsing historical documents and records, and rely on large-scale knowledge graphs for associative reasoning. Through the fusion and analysis of dispersed, heterogeneous multimodal data sources, this type of technology can automatically generate in-depth explanatory content that transcends basic factual descriptions, incorporating networked associations and historical context. This effectively assists tourists in constructing a systematic cognitive framework, placing isolated objects of appreciation into a broader cultural, artistic, and historical context, thereby enabling a leap from superficial information transmission to deep knowledge construction. Its technological frontier lies in the use of generative models to dynamically produce comparative and speculative interpretive texts based on the tourist's cognitive background, thus stimulating critical thinking and transforming one-way knowledge inculcation into a heuristic cognitive dialogue[3].

2.2 Generation and Construction Technologies for Immersive Experience Environments

The generation of immersive experience environments relies on the synergy between extended reality technologies and 3D generation algorithms. Extended reality creates a mixed-reality experiential field by overlaying or integrating digital information onto real physical spaces, enabling static historical sites or exhibits to dynamically present their original appearances, evolutionary processes, or related narrative scenes. 3D generation algorithms can restore damaged or non-existent buildings, artifacts, and historical scenes with high fidelity based on limited archaeological data or historical descriptions, offering tourists the potential for an embodied experience akin to traveling through time and space. Together, these technologies expand the physical boundaries and perceptual dimensions of the experience.

The construction of such environments focuses not only on the authenticity of visual restoration but also emphasizes the narrative quality and emotional engagement of interactive design. Through spatial computing and real-time rendering technologies, the system can dynamically adjust narrative threads, trigger related events, or alter the environmental atmosphere based on the tourist's position, gaze, and actions. This responsive design transforms the environment itself into an intelligent narrative vehicle that can be explored and interacted with, turning tourists from bystanders into participants who drive the narrative's progression. This technological dimension aims to construct a highly immersive, emotionally evocative, and personalized story space, elevating cultural experience from mere visual observation to a holistic, contextualized immersion.

2.3 Personalized Service Generation Technology Based on Tourist Profiling

The generation of personalized services based on tourist profiling is founded on the construction of

a dynamic, multi-dimensional tourist data model. This model, through the fusion and analysis of tourists' explicit behavioral data (such as visitation trajectories, dwell times, and interaction records) and potential preference data (such as content clicks, semantic searches, and social sharing tendencies), and possibly incorporating limited demographic characteristics, achieves continuous learning and updates regarding an individual's interest graph, cognitive level, and experiential patterns. This data-driven modeling process aims to transcend static group classifications and achieve a refined depiction of each tourist's unique cultural consumption patterns and learning preferences[4].

Based on dynamic profiling, the generation of personalized services manifests as a real-time algorithmic system for content filtering, route planning, and experience recommendation. This system can adaptively combine and generate unique visitation suggestions, content pushes, and interactive sessions from a vast cultural resource library and preset experience modules according to the tourist's real-time status and contextual environment. This process is not a simple information matching; rather, it involves the intelligent orchestration of the sequence of experiential elements, the rhythm of cognitive load, and the curve of emotional experience. Its ultimate goal is to achieve a precise alignment between service provision and individual needs, creating a highly adaptable and smooth exclusive experience flow, thereby maximizing each tourist's cognitive gains and emotional satisfaction.

3. Pathways and Effects of Artificial Intelligence in Enhancing Cultural Tourism Experience Quality

3.1 Enhancement of Experience Process Fluency and Cognitive Depth

Artificial intelligence technology significantly optimizes tourists' movement and decision-making processes within both physical and informational spaces through predictive and responsive mechanisms. Intelligent guidance systems dynamically plan routes based on real-time location and crowd flow data, reducing unnecessary time consumption and choice conflicts. Natural language interaction interfaces eliminate formatting barriers and hierarchical disorientation inherent in traditional information retrieval, making information acquisition direct and efficient. This smoothing of the experience process essentially liberates tourists from complex operational and managerial tasks, allowing their cognitive resources to be allocated more towards core activities of observation and comprehension, thereby ensuring the continuity and seamlessness of the overall experience process[5].

While reducing cognitive load, this technology systematically promotes the expansion of cognitive depth through structured knowledge delivery and associative content presentation. Machine learning algorithms can assess tourists' real-time comprehension status and subsequently provide appropriately challenging supplementary information or guiding questions to stimulate the desire for exploration. Knowledge graph technology can weave discrete cultural knowledge points into an interconnected network, naturally revealing multiple contexts such as historical origins, artistic characteristics, or social significance when interpreting a single object. This construction of a cognitive framework from point to surface assists tourists in transcending superficial sensory impressions and forming a more systematic, logical, and critical level of understanding of cultural themes. This enhancement pathway reveals how technology, through the dual role of external process optimization and internal cognitive support, transforms traditional sightseeing into an efficient and intellectually rewarding learning journey, with its effect manifested in the increment and reconstruction of tourists' knowledge structures.

3.2 Enhancement of Emotional Resonance and Meaning Construction in Experiential Content

The stimulation of emotional resonance relies on the embodied and narrative contexts created by technology. The multi-sensory environments constructed by immersive generation technologies directly act upon tourists' emotional perception systems by restoring historical scene atmospheres, presenting dynamic evolutionary processes, or designing metaphorical visual symbols. Intelligent narrative agents can adjust the story's pace and emotional tone based on interaction cues, placing tourists themselves within the narrative progression, thereby enhancing their sense of identification and emotional involvement. This context creation, mediated by technology, transcends the abstraction of textual or audio explanations, providing a concrete and powerful stimulus source for emotional responses[6].

The enhancement of meaning construction results from technology-assisted personalized interpretation and connection formation. Personalized service generation systems recommend content related to tourists' existing knowledge backgrounds or value concerns based on their profiles, and this

high degree of relevance serves as an important prerequisite for the generation of personal meaning. Interactive technologies allow tourists to annotate, combine, and reinterpret cultural content, and even participate in co-creative narrative branches-a process that transforms passive information reception into active meaning exploration and integration. Artificial intelligence here plays the role of a "catalyst" and "scaffold," supporting and deepening the constructive process through which tourists connect external cultural information with their inner selves, reflect upon it, and form personalized understandings, by providing rich materials, diverse perspectives, and a flexible interactive framework. Therefore, technology not only amplifies the intensity of emotion but, more critically, guides emotional energy towards profound meaning generation. Its effect is the production of experiential memories and value identification that possess greater adhesiveness and personal uniqueness.

3.3 Optimization of Post-Experience Satisfaction and Lasting Impact

The perception of satisfaction generated immediately after the experience concludes largely stems from the precise and dynamic alignment between demand and supply throughout the experiential process. Personalized generation technology based on tourist profiling ensures that the content, routes, and services provided are highly consistent with individual preferences, and this sense of alignment directly translates into a positive evaluation of the experience's value. A seamless process and profound cognitive gains further consolidate this satisfaction, forming positive feedback on the overall effectiveness of the experience. Artificial Intelligence, through its continuous perception-analysis-response cycle, ensures that this matching is no longer a static, pre-designed feature but rather a dynamic adjustment process that permeates the entire experience, thereby enhancing the probability and intensity of satisfaction generation at multiple touchpoints.

The optimization of the lasting impact of the experience is reflected in technology's facilitating role in memory consolidation, sharing extension, and reflection deepening. Personalized digital mementos (such as customized digital storybooks or visual reports incorporating individual visitation trajectories) objectify experiential memories in a highly relevant and aesthetically pleasing form, facilitating long-term preservation and review. Mildly reflective questions or related content pushes initiated by intelligent systems based on tourist behavioral data can reactivate relevant memories and thoughts for a period after the experience concludes, thereby extending the psychological impact cycle of the experience. These technological interventions enable a single cultural tourism experience to transcend its original temporal and spatial constraints, integrating into the tourist's personal long-term knowledge system and network of meaning, thus achieving sustainability of influence. This post-experience optimization mechanism precipitates momentary satisfaction into long-term attitude changes and behavioral intentions, such as the willingness to revisit, a sustained increase in cultural interest, and lasting identification with specific cultural values, marking the successful extension of experience quality from immediate perception to a long-term lifecycle.

Conclusion

Through systematic theoretical construction and analysis, this study demonstrates that the enhancement of cultural tourism experience quality by artificial intelligence technology constitutes a multi-layered, whole-process deep intervention involving cognitive reshaping, emotional catalysis, and meaning support. Technology is not merely a tool; rather, through its full-chain capabilities of perception, cognition, and generation, it reconstructs the fundamental ways in which tourists acquire information, integrate into environments, and construct meaning. The research specifically reveals three core pathways: Firstly, technology optimizes the fluency of the experience through intelligent interaction and environmental computing, while deepening the cognitive level through knowledge graphs and associative interpretation. Secondly, by means of immersive generation and narrative interaction, technology strengthens emotional involvement and provides "scaffolding" for personalized meaning construction. Thirdly, based on personalized generation from dynamic profiling and post-experience interaction, technology achieves the efficient conversion of satisfaction and the long-lasting extension of experiential influence. Looking ahead, future research can be further deepened in two directions: one is to explore the application of explainable artificial intelligence and transparent algorithms in cultural interpretation, in order to balance technological intelligence with tourists' cognitive autonomy; the other is to focus on the integration of cutting-edge technologies such as cross-modal affective computing and brain-computer interfaces with cultural tourism experiences, aiming to achieve more precise and profound emotional interaction and experience measurement at the neuroaesthetic level, ultimately fostering the development of a smart cultural tourism ecosystem with

greater humanistic depth and ethical consideration.

Fund Projects

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