Functional Outlook for "Digital Humanities+" Smart Cultural Tourism Application Products (Postprint)

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Abstract

[Purpose/Significance] Against the backdrop of the national initiative to integrate culture and tourism for collaborative development, this paper prospects and discusses the characteristic features of libraries applying digital humanities-related technologies and research outcomes to construct smart culture-tourism application products. [Method/Process] Eight smart culture-tourism application products (including mobile apps, mini-programs, and websites) focusing on revealing humanities content were selected for case investigation, with emphasis on analyzing five characteristic features. Subsequently, an analysis was conducted on the current market of smart culture-tourism application products and the advantages and disadvantages of libraries constructing "digital humanities+" smart culture-tourism application products. Based on the investigation and analysis results, three characteristic features that can utilize digital humanities-related technologies and research outcomes were proposed. [Results/Conclusion] Through case investigations of the eight selected subjects, five characteristic features that utilize and develop digital cultural resources were identified, including characteristic route planning and recommendation, characteristic thematic classification dimensions, and historical versus modern image comparison. The construction of these features primarily focuses on presenting the historical features of attractions more realistically to users and enhancing their interactive participation; however, the excavation of historical and cultural content remains relatively insufficient. The author recommends that the library profession can leverage its professional advantages to apply digital humanities-related technologies and research outcomes to smart culture-tourism application products, thereby expanding the social benefits of digital humanities research outcomes, while also facilitating the construction of characteristic features and providing smart culture-tourism services centered on revealing humanities content.

Full Text

Preamble

Abstract: [Purpose/Significance] Against the backdrop of national initiatives promoting the integration of culture and tourism for collaborative development, this paper explores and discusses the prospective application of digital humanities technologies and research findings in libraries to construct distinctive features for smart cultural tourism application products. [Method/Process] Eight smart cultural tourism application products (including mobile apps, mini-programs, and websites) focused on revealing humanistic content were selected for case study investigation, with particular emphasis on analyzing five characteristic functions. The study subsequently examined the current market for smart cultural tourism application products and analyzed the advantages and disadvantages of libraries constructing "Digital Humanities+" smart cultural tourism application products. Based on the research and analysis results, three characteristic functions that could utilize digital humanities-related technologies and research outcomes were proposed. [Result/Conclusion] Through case studies of the eight selected products, five characteristic functions that employ and develop digital cultural resources were identified, including specialized route planning and recommendation, distinctive thematic classification dimensions, and historical versus modern image comparison. These functional constructions primarily focus on presenting the historical features of attractions more authentically to users and enhancing user interaction and participation, though the excavation of historical and cultural content remains relatively insufficient. The author recommends that the library profession leverage its professional advantages by applying digital humanities technologies and research results to smart cultural tourism application products, thereby expanding the social benefits of digital humanities research while facilitating the development of characteristic functions that provide smart cultural tourism services centered on humanistic content revelation.

Keywords: smart cultural tourism; digital humanities; culture-tourism integration; smart cultural tourism application products
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Tourism has become an indispensable part of people's leisure and entertainment. In the past, tourism primarily revolved around visiting historical sites and museum collections, emphasizing physical tours of tangible locations. Today, however, as public cultural literacy continues to improve and national cultural soft power develops, tourism is no longer limited to visiting famous landmarks. The exploration of urban culture and the pursuit of humanistic information have gradually become important motivations for travelers. As an integral component of urban public service systems, libraries bear the responsibility of promoting urban history and culture. The government and relevant enterprises' efforts to facilitate culture-tourism integration provide excellent op-

portunities for libraries to upgrade their tourism services. Libraries also serve as digital centers and research bases for digital humanities studies [1], possessing rich digital resource collections and practical experience in applying digital humanities technologies. This provides both the data foundation and technical basis for transforming digital humanities research outcomes into characteristic functions of smart cultural tourism application products. This paper explores and discusses how libraries can construct relevant characteristic functions for smart cultural tourism application products by focusing on humanistic content as the core and employing technological revelation as the means, utilizing digital humanities technologies and research findings. It aims to guide libraries in considering how to employ digital humanities methods to excavate and utilize cultural tourism resources within their collections.

2 Current State of the Culture-Tourism Industry and Related Research

2.1 Current State of the Culture-Tourism Industry

China is promoting culture-tourism integration from top to bottom. At the 13th National People's Congress in 2018, the State Council first proposed "integrating the responsibilities of the Ministry of Culture and the National Tourism Administration to establish the Ministry of Culture and Tourism as a constituent department of the State Council… the Ministry of Culture and the National Tourism Administration will no longer be retained" [2]. Subsequently, the National People's Congress approved this proposal and advanced its implementation in an orderly manner, officially establishing the Ministry of Culture and Tourism on April 8, 2018. This institutional reorganization and proposal implementation signaled China's intention to further promote the integrated development of cultural and tourism industries, treating the advancement of cultural industry development and tourism resource development as powerful "arms" for enhancing national cultural soft power. The goal is to further strengthen and demonstrate cultural confidence through culture-tourism integration and promote Chinese culture "going global." On the 9th China Tourism Day in 2019, China designated "Culture-Tourism Integration, Better Life" [3] as the theme, once again expressing the core idea that culture-tourism integration development must take people's needs for a better life as the starting point and ultimate goal to advance cultural construction and tourism development.

Against the backdrop of government-promoted culture-tourism integration, the market has gradually seen the emergence of applications and platforms featuring urban cultural recommendations and artistic interactive experiences. Internet enterprises have captured the development opportunities in smart cultural tourism and, focusing on high technology, have begun to "enter" the tourism market. For example, Tencent has collaborated with various local culture and tourism bureaus in recent years to successively launch tourism applications and mini-programs such as "Yunnan Tourism on One Mobile Phone," "Dunhuang

Cloud Tour," and "Digital Mausoleum of the First Qin Emperor." In late 2019, Tencent announced the establishment of the "Tencent Culture-Tourism Industry Research Institute" [4] to facilitate the integration of technology with culture-tourism scenarios. One week later, China Tourism News, the Public Opinion Survey Laboratory of the Chinese Academy of Social Sciences, and Alibaba Group jointly announced the formation of the "Culture-Tourism Industry Index Laboratory" [5], aiming to promote transformation, development, and integrated innovation in the culture-tourism industry through the construction of a multi-disciplinary research platform. From this starting point, internet enterprises will become an indispensable important force on the path of smart cultural tourism development.

2.2 Smart Cultural Tourism and Digital Humanities

With the emergence and development of smart technologies represented by the Internet of Things, concepts such as "smart earth" and "smart city" have gradually integrated into people's daily lives and spread to more fields. In March 2010, Zhenjiang was the first to propose the concept of "smart tourism." Smart tourism primarily consists of a smart information layer for data collection, an intelligent exchange layer supporting interconnectivity, and an intelligent processing layer responsible for data analysis, visualization, integration, and intelligent use [6], aiming to enhance tourism experiences through the most advanced information technology and big data to form an entire intelligent service ecosystem [7]. After China began promoting the process of culture-tourism integration in 2018, the concept of smart cultural tourism gradually emerged. Compared with smart tourism, smart cultural tourism places greater emphasis on the excavation and presentation of cultural resources, using culture as the connotation, tourism as the carrier, and technology as the driving force [8]. It utilizes various information technologies such as the Internet of Things, big data, and artificial intelligence to integrate communication and information resources, analyze and excavate cultural tourism resources, and ultimately penetrate users' entire tourism service scenarios through smart cultural tourism products. Smart cultural tourism products are carriers of smart cultural tourism content, with presentation forms including application products (such as mobile apps, mini-programs, and websites), service products (such as offline exhibitions and personalized scenic area services), and derivative products (such as cultural and creative products). This paper primarily studies the functional construction of smart cultural tourism application products.

The core technologies of smart cultural tourism are Internet of Things technology, mobile communication technology, cloud computing technology, and artificial intelligence technology. Compared with smart tourism, it places more emphasis on the excavation of humanistic resources, which aligns with the characteristics of digital humanities that combine computer technology with humanistic research. Digital Humanities (DH), originating from Humanities Computing, is a new interdisciplinary research field that conducts humanistic research

supported by emerging technologies such as computer technology, network technology, and multimedia technology [9]. It takes humanistic knowledge as its main research content, and its technical system includes digitization technology, data management technology, data analysis technology, visualization technology, VR/AR technology, machine learning technology, etc. [9]. If these digital humanities technologies and their corresponding research results are applied to smart cultural tourism application products, they will help deeply excavate the humanistic resources of scenic spots and present humanistic content more intuitively to users through knowledge organization and visualization technology, expanding the audience for digital humanities research results and bringing the "tacit knowledge" excavated by humanities scholars to the public, narrowing the distance between humanities research and the general public.

2.3 Related Research

In the wave of smart cultural tourism construction, the library industry is also making continuous attempts and explorations. Wang Shiwei began paying attention to the tourism function of libraries in 1995 and has published multiple research findings. In his latest research, he proposed that "public libraries should break spatial boundaries for deep culture-tourism integration… public libraries need to actively adapt to new demands such as study tours, technology tourism, leisure tourism, elderly tourism, and customized tourism, continuously advancing the deep integration of public libraries and culture-tourism to meet the public's new aspirations, expectations, and needs for a better cultural life" [10], clarifying the goals of library culture-tourism integration development. Jin Long focused on the innovation of study tours in public libraries and proposed countermeasures such as establishing study tour brands, building professional talent teams, and cooperating with tourism agencies [11]. Li Zifeng focused on the curriculum development of study tours in public libraries and proposed detailed construction strategies for four major categories of courses: "architectural resources courses, literature resources courses, activity resources courses, and information technology resources courses" [12]. Han Ye et al. conducted research and analysis on domestic and international examples of public library culture-tourism integration, listing three main models currently employed in China: study tours, internet-famous libraries, and "Library+" models, and offered their own insights and suggestions for future development [13]. Zha Wei selected the six elements of tourism—"transportation, sightseeing, accommodation, food, shopping, and entertainment"—as entry points to analyze the development of libraries in these areas, and subsequently discussed the cultural responsibilities of libraries in culture-tourism integration development [14]. Cheng Chuan et al. conducted a literature analysis of library tourism and leisure research findings from 1987 to 2016 over a 30-year period and found that while researchers have made certain contributions to studies on the connection between tourism/leisure and libraries, problems such as lack of diversity in research perspectives, excessive subjectivity in strategic suggestions, and unclear research subjects have emerged [15]. Shan Hongbo focused his research on the integration of libraries

and tourism, proposing four integration models and five integration paths [16].

These findings indicate that current domestic research on library and culture-tourism integration primarily concentrates on service practices, models, and strategies for culture-tourism integration, focusing mainly on how to conduct offline activities. Some libraries have already begun practical attempts. For example, the National Library organized a "Reading Journey Along the Central Axis" study tour project that led participants to explore traditional Chinese culture through expert lectures and field visits [17]. The Ningbo Library created a "Ningbo Model" for public library culture-tourism integration through subway-hotel libraries, human geography libraries, and the "Reading the World" service brand [18]. The Shanghai Jiading Library excavated historical celebrities and distinctive urban cultural resources to create a characteristic cultural tourism route—the "Jiading Cultural Tourism Route"—integrating historical sites, humanistic landscapes, and intangible cultural heritage [19]. However, research on smart cultural tourism and the construction of smart cultural tourism application products remains relatively scarce.

According to literature statistics, foreign industries began gradually paying attention to smart tourism and smart cultural tourism research and construction around 2015, with literature volume reaching a growth peak in 2017 [20]. Foreign scholars believe that the development of smart tourism and smart cities are closely related, and that the technologization of tourism departments and the recent spread of smart city models are two interrelated processes that jointly shape the image of smart tourism [21]. Foreign industry research on smart cultural tourism mainly focuses on two aspects. On one hand, it emphasizes studying how to use digital technology for cultural heritage protection and development. For example, the European Commission approved the establishment of the "Cultural Routes of the Council of Europe" project in 1987 [22], aiming to demonstrate how different European countries have contributed to protecting Europe's common cultural heritage across time and space. To date, 40 cultural routes have been certified, and these routes have become one of the pillars of cultural tourism [23]. Another study 致力于从社交网络的旅游信息中识别文化遗产资源并添加相应的地理标记，目的在于创建世界文化遗址数据集 [24]. The other research focus emphasizes the application of various high technologies to support smart tourism. For example, some scholars have researched developing smart tourism application products based on visual search technology, with current image search and recognition accuracy reaching 86% [25], while others have focused on using low-cost unmanned aerial vehicles to construct 3D modeling of historical and cultural buildings, ultimately hoping to apply these to smart cultural tourism application products [26].

In summary, current domestic academic research focuses on the service practices, models, and strategies of culture-tourism integration, primarily exploring how to conduct offline activities. Systematic research and large-scale practice on smart tourism and smart cultural tourism have yet to be developed, with few discussions on specific smart cultural tourism products and their functional

construction. In contrast, foreign industries have recently begun discussing the concept of "smart cultural tourism," with research mainly concentrating on cultural heritage development and protection and the application of high technologies to the tourism industry. Although these studies involve cultural content and digital technology, they have not yet effectively combined the two or applied digital humanities technologies and research results to smart cultural tourism application products.

3 Investigation of Characteristic Function Construction in Smart Cultural Tourism Application Products

Against the backdrop of government promotion and internet enterprise support, the market has seen an influx of smart cultural tourism application products. These include government-led comprehensive tourism support applications like "Tour Shanghai" that combine tourism support with urban services, city cultural activity display windows like "Cultural Cloud," deep government-enterprise cooperation projects like "One Mobile Phone Tours Yunnan" and "One Mobile Phone Tours Wulong," and internet enterprise-led mini-programs such as "Cloud Tour Dunhuang," "Digital Mausoleum of the First Qin Emperor," and "The Grand Canal Through Time and Space." These mobile applications and mini-programs have all attempted to digitally present scenic spots and excavate cultural content to varying degrees, constructing numerous characteristic functions that multi-dimensionally display the external landscapes and internal culture of cultural tourism attractions before users, enriching their touring experiences.

This study selected several application products (including mobile apps, mini-programs, and websites) that focus on revealing cultural content as key research objects. Through individual case investigations, the study explored the current construction of characteristic functional points in smart cultural tourism application products to provide references for libraries constructing such products.

3.1 Selection of Research Objects

The selected research objects primarily comprised mobile applications, mini-programs, and online websites focusing on revealing humanistic content. The ultimate goal was to offer suggestions for libraries, particularly the Shanghai Library, in constructing and optimizing smart cultural tourism application products. Therefore, three cultural tourism application products centered on Shanghai's urban culture and led by the Shanghai municipal government, Shanghai research institutions, and Shanghai library, archive, and museum institutions were first selected. Subsequently, referencing the "2020 All-Media Communication Excellence (New Media) Recommendation Projects for Chinese Cultural Relics" [27], the top two smart cultural tourism application products that center on specific scenic spot cultures, feature multi-dimensional digital presentation, and involve library, archive, and museum institutions in their construction—

"Cloud Tour of the Palace Museum" online website and "Cloud Tour Dunhuang" mini-program—were selected as research objects. The sibling products "Digital Mausoleum of the First Qin Emperor" and "The Grand Canal Through Time and Space" were also included. Finally, Google Arts & Culture, a leading international digital culture application product encompassing collections from over 70 countries and regions and featuring online collections from more than 3,226 museums as of 2018 [28], was selected as a supplementary research object. Partial research findings are shown in Table 1 .

3.2 Analysis of Characteristic Function Construction

Through individual case investigations and analysis of the aforementioned research objects, five characteristic functions utilizing digital cultural resources were identified. These functions either employ digital simulation technology or establish digital humanities content associations to present the historical evolution, figures, and events behind scenic spots before users. Meanwhile, some applications mobilize user enthusiasm by incorporating interactive mini-games, guiding users to self-explore interesting humanistic allusions, enhancing user participation and endowing cultural cores with new vitality.

3.2.1 Application of VR, AR, and 3D Digital Technologies The investigation revealed that six applications—Tour Shanghai, Starting from Wukang Road, Cloud Tour of the Palace Museum, Google Arts & Culture, Cloud Tour Dunhuang, and Digital Mausoleum of the First Qin Emperor—all employ Virtual Reality (VR) and Augmented Reality (AR) technologies for online digital display of scenic architecture and art exhibits. Among them, Tour Shanghai uses VR technology to present travel scenes through high-definition modeling and panoramic video, creating immersive experiences. Through AR real-scene scanning functions that integrate spatial positioning and imaging technologies, it provides users with online exhibitions and peripheral scenic spot information guide services. It also uses 5G communication technology to live-stream the beautiful scenery along Shanghai's Huangpu River in real time, presenting immediate views of scenic spots to users. Starting from Wukang Road primarily applies AR technology in three functions: doorplate number recognition, building recognition, and map guidance, connecting historical figures, events, and book materials extracted from the Shanghai Library's collection with specific buildings to provide cultural services for users touring Wukang Road. On the other hand, cultural applications such as Google Arts & Culture, Cloud Tour of the Palace Museum, Cloud Tour Dunhuang, and Digital Mausoleum of the First Qin Emperor mainly use VR technology to restore the full views of art galleries, the Palace Museum, Dunhuang grottoes, and the Terracotta Warriors, providing online browsing services through 360-degree panoramic views. They also use AR technology to establish special virtual exhibition halls, giving users an immersive feeling and guiding them to explore the full details of artists' works online. The Digital Treasure Gallery of Cloud Tour of the Palace Museum and the mini-program "The Grand Canal Through Time and Space" employ 3D

technology to model the collections in the Palace Museum and various boats, tools, animals, and figures related to the Grand Canal, allowing users to intuitively understand the composition of related cultural objects from all angles and more three-dimensionally presenting the prosperity of ancient China.

These functions rely on increasingly mature simulation and communication technologies to "bring" scenic buildings and art exhibition halls before tourists. Tourists can actively select attractions of interest and have the attractions "walk up" to them for detailed browsing without leaving home. Meanwhile, detailed 3D modeling can also substitute for scenic spots under restoration and maintenance for tourist visits. For example, the free VR software "Notre-Dame de Paris: A Time Travel Experience" launched by French game company Ubisoft utilizes the 3D modeling of 18th-century Notre-Dame de Paris restored in the game *Assassin's Creed Unity*, allowing users to virtually visit this cultural treasure in real-time while the cathedral undergoes restoration [29]. In addition to viewing the appearance of scenic spots and artworks, such functions help establish linkages among various cultural tourism resources, develop multi-level online exhibitions, and associate physical exhibits with various types of cultural resources, facilitating the construction of digital humanities networks and enriching users' exhibition experiences.

3.2.2 Specialized Route Planning and Recommendation Tourism route planning and recommendation are common services provided by tourism portals. Under the current promotion of culture-tourism integration, some smart cultural tourism application products have also launched specialized routes and themes focusing on urban cultural excavation, such as the "40 Recommended Shanghai Intangible Cultural Heritage Tourism Routes" provided by Tour Shanghai and the "Themes" function offered by Google Arts & Culture. The thematic content of these specialized routes covers various aspects including historical figures, events, and cultural customs, focusing on the excavation of historical and cultural content. Such route planning and recommendation can provide users with comprehensive services including scenic spots, cuisine, stories, and souvenirs under specific themes, while also facilitating the recommendation of 冷门资源和特定资源 by applications, forming differentiated cultural tourism products, excavating urban cultural "treasure troves," and establishing users' emotional connections with destinations.

The design and organization of these specialized routes often involve multiple dimensions such as institutional information, figures, architecture, historical events, time, and scenic spots, connecting various resources including pictures, old photographs, newspapers, and periodicals. Although currently presented mainly in the form of long tweets with pictures and text, they have already preliminarily constructed digital humanities resource networks to some extent.

3.2.3 Distinctive Thematic Classification Dimensions Investigation of cultural tourism application products focusing on art and cultural display re-

vealed that, in addition to common classification dimensions such as time and location, these applications typically provide distinctive thematic classification dimensions based on their own resource characteristics to guide users in finding content of interest more conveniently. For example, Cloud Tour Dunhuang, which uses grotto murals as display objects, provides thematic classification dimensions of color, art form, and dynasty. Google Arts & Culture, centered on artworks, extracts various attributes of artworks in the form of knowledge graphs and conducts different dimensional classification combinations, providing distinctive thematic classification dimensions such as color, artwork material, artist, art movement, historical time, and historical figures.

These distinctive classification dimensions cater to the display needs of application-specific resources, presenting resource content characteristics more intuitively before users. On the other hand, detailed classification dimensions also reflect that these platforms have conducted detailed annotations of resources, providing users with more refined content revelation and facilitating further excavation of humanistic content.

3.2.4 Historical and Modern Image Comparison The investigation found that both Tour Shanghai and Shanghai Tianditu provide image comparison content between historical photographs and current photos, narrating the historical changes of urban architecture through time-space traversal. Tour Shanghai often selects historical pictures of buildings as display homepages to arouse user interest when introducing Shanghai architecture, and provides relevant photos of the building's current appearance on the detail page, forming a planar image comparison between history and present. Shanghai Tianditu presents historical maps, historical road names, and even entire historical maps of Shanghai more intuitively through historical map layers. In addition to relatively traditional modules such as historical place names, historical photos, and historical protected roads, Shanghai Tianditu provides a distinctive "Historical Image" function. This function does not simply display Shanghai's historical maps or add a historical layer but enables 联动 between current maps and historical maps, allowing users to intuitively see the changes in urban construction of a selected area over time on a single page. Shanghai Tianditu currently provides two historical images from 1948 and 1979 that can be compared with the 2019 current map, allowing users to adjust the proportion of historical and current maps on the page themselves, as shown in Figure 1 [Figure 1: see original paper].

Cultural tourism cannot be separated from "history," and historical picture materials are the most intuitive display of scenic spot historical information. Appropriate and vivid historical pictures help attract users' attention and spark their interest in exploring the content. The image comparison function connects the "past life" and "present life" of scenic spots, constructing magnificent chapters of urban landscape transformation.

3.2.5 Artistic Design and Interactive Engagement The investigation found that the construction purpose of smart cultural tourism application products is no longer limited to passively waiting for user visits but emphasizes user participation and interaction. Many smart cultural tourism mobile applications and mini-programs have attempted to design various interesting interactive functions to guide users to more comprehensively understand application resources and increase users' exploration interest, attracting the attention of younger users. For example, Cloud Tour Dunhuang incorporates interactive modules such as "Mural Coloring" and "Scarf Design," integrating cultural tourism resources into interactive mini-games. This approach more vividly displays the details of Dunhuang murals, increases the 趣味性 of cultural tourism experiences, and provides users with personalized cultural and creative design products. Its "Today's Painting Words" function allows users to obtain "privately customized" exclusive murals daily while learning the history and fables behind the murals. Digital Mausoleum of the First Qin Emperor launched an interactive game "Who Am I" on its homepage, using facial analysis technology to analyze users' selfies and "customize" their exclusive Terracotta Warriors, increasing the application's social attributes and further attracting the attention and communication of young users. Google Arts & Culture also has a similar technology-based ArtSelfie function, where users can upload selfies and match their similarity with thousands of famous paintings in museums to find out which painting's figure they most resemble. These interactive engagements can increase application vitality and add 趣味性 to users' cultural exploration journeys.

3.3 Summary of Characteristic Function Construction Characteristics

Through investigation and research, the above five characteristic functions that call upon and develop digital cultural resources were summarized. These functions adhere to the culture-tourism integration development requirements with culture as the core, either constructing virtual exhibition halls through technical means or connecting various related resources to build digital humanities networks. Their purpose is to present urban culture and the historical heritage of scenic spots more meticulously and three-dimensionally before users, guiding users to walk, watch, and learn simultaneously, allowing them to experience more urban cultural influence during their travels. Comprehensive analysis of these characteristic function constructions reveals two main characteristics of current smart cultural tourism application products.

3.3.1 Using Digital Technology to Bring Cultural Attractions "Closer" to Users Whether using VR, AR, and 3D technologies for online virtual display of scenic spots or presenting the historical features of attractions more realistically before users through image comparison, the main purpose of these functional constructions is to enable users to "visit" cultural attractions and art collections worldwide without leaving home. Compared with traditional photo displays, using simulation technology for virtual presentation can give users a

stronger sense of immersion and increase their autonomous exploration, providing space for users to freely appreciate the details of each exhibit and allowing cultural attractions to actively "approach" users.

3.3.2 Mobilizing Digital Resources to Let Users "Play with" Cultural Tourism Creativity Another common characteristic of these functions is increasing user interaction while collecting public cultural creativity. Traditional tourism portals basically provide tourism support services and information, with limited interaction with users beyond travelogue sharing, and users can only passively appreciate related digital cultural resources without driving personalized reorganization of cultural resources. Today's smart cultural tourism application products, however, increase interaction channels with users through various interesting games and interactive segments, collecting users' "cultural tourism creativity" and interest points while attracting more young users.

4 Exploring "Digital Humanities+" Smart Cultural Tourism Application Products

Through investigation of current smart cultural tourism products in the market, it was found that some products have begun to employ digital humanities-related technologies, but only concentrated on digitization technology and VR/AR technology, without effectively utilizing other digital humanities technologies. Digital humanities technologies and research findings can further optimize some characteristic functions discovered in the investigation of smart cultural tourism application products, such as specialized route planning and recommendation, distinctive thematic classification dimensions, and historical versus modern image comparison. As the "leader" in digital humanities infrastructure construction [30] and a promoter of digital humanities-related research, libraries should advance the functional construction combining digital humanities and smart cultural tourism application products to build "Digital Humanities+" smart cultural tourism application products. This can help research scholars present their research findings to the public while allowing libraries to leverage their collection resource advantages in smart cultural tourism application products, enabling users to participate in constructing cultural heritage knowledge networks.

4.1 Opportunities and Challenges in the Smart Cultural Tourism Application Product Market

In recent years, the upsurge of learning traditional Chinese culture has continued, people's enthusiasm for studying history and culture has been growing, and the demand for leisure humanistic tourism has been increasing. Although some comprehensive tourism portals and internet enterprises have collaborated with government agencies to attempt constructing smart cultural tourism application products, content construction on historical and cultural themes remains relatively thin. Most smart cultural tourism application products only focus

on revealing information about historical buildings and provide fragmented and lightweight humanistic services, lacking in-depth humanistic knowledge revelation and excavation, leaving considerable market gaps to be filled.

Challenges often accompany market opportunities. The market has already seen a batch of smart cultural tourism application products that are beginning to develop toward providing refined cultural tourism services. Two internet giants, Tencent and Alibaba, have respectively cooperated with government agencies to develop smart cultural tourism application products based on government tourism resources. In addition, current fragmented and entertainment-oriented cultural tourism services can already meet the needs and consumption experiences of some ordinary users, posing a challenge regarding how libraries can effectively exert their professional advantages.

In summary, in the current market environment, libraries constructing smart cultural tourism application products have two major opportunities: increasing demand for humanistic tourism and a market lacking specialized smart cultural tourism application products. However, the fact that internet enterprises have gained first-mover advantage and that lightweight cultural tourism services have gained market recognition will be the main challenges facing libraries in building smart cultural tourism application products.

4.2 Advantages and Disadvantages of Libraries Constructing "Digital Humanities+" Smart Cultural Tourism Application Products

As "recorders" of human historical development processes, libraries collect various types of historical and cultural resources. Some of these resources have gradually transformed into data resources during the development of digital libraries over the past two decades. These data resources are not only the foundation of digital humanities infrastructure construction but will also become the "cornerstone" for libraries providing cultural tourism services—the most valuable asset of libraries. The core of smart cultural tourism construction revolves around culture; only with rich cultural resources can we excavate the connections behind them, construct knowledge networks, and ultimately provide corresponding tourism services. In addition, as urban cultural centers, libraries maintain close connections with numerous experts and scholars and have practical experience in conducting humanistic field activities. These experts, scholars, and practical experiences will also become the "smart brains" for libraries constructing smart cultural tourism application products. On the other hand, a large number of digital humanities achievements are currently produced by libraries, archives, and museums. Particularly in China, approximately 70% of digital humanities papers published in library, information science, and archival science journals are authored by these institutions [30], indicating that libraries have certain experience in applying digital humanities technologies and possess digital humanities research results that can be transplanted into smart cultural tourism application products as characteristic functions.

However, libraries' relatively weak independent technological development capabilities and low market sensitivity are also obvious disadvantages. How to cooperate with high-tech enterprises, explore market demands, track market trends, and launch product functions needed by users will be issues that libraries need to address when constructing smart cultural tourism application products.

In summary, the main advantages of libraries using digital humanities technologies to construct smart cultural tourism application products include three aspects: abundant characteristic historical and cultural data resources, rich expert and scholar reserves, and practical experience with digital humanities technologies. However, libraries also face two major disadvantages: relatively weak technological development capabilities and lack of market sensitivity. They need to consider how to combine digital humanities technologies with smart cultural tourism application products and how to transform digital humanities research results into characteristic functions of smart cultural tourism application products, presenting humanistic advantages more distinctly before users.

4.3 Functional Prospects for "Digital Humanities+" Smart Cultural Tourism Application Products

The new trend of internet enterprises cooperating with government agencies to jointly promote culture-tourism integration construction is gradually emerging. Relying on the information technology of internet enterprises and the tourism resources of government agencies, some cultural tourism application products that penetrate users' entire tourism scenarios have been built. However, the excavation and construction of historical and cultural content remain relatively insufficient. Libraries should leverage their strengths, avoid their weaknesses, seize opportunities, face challenges directly, and explore how to apply digital humanities-related technologies and research results to the functional construction of smart cultural tourism application products.

4.3.1 Deepening the Application of VR/AR Technology to Create "Historical and Modern Scene Reproduction" VR/AR technology is currently a relatively widely used digital technology, mainly applied in functions such as online digital display of scenic buildings and exhibits and on-site guided tours. The "scene reproduction" capability of this technology has not yet been effectively developed and utilized. The investigation found that historical and modern image comparison is a relatively distinctive function in smart cultural tourism application products, allowing users to have a "time-travel" experience. However, Shanghai Tianditu currently only provides services using 2D map images, lacking immersive presence and unable to comprehensively display the transformation process of urban landscapes. If digital humanities research findings on urban historical features can be combined with VR/AR technology to construct a "historical and modern scene reproduction" function, it can "truly" present the historical ancient cities restored by historical humanities scholars to the public. For example, the "Venice Time Machine" project,

representing the "Europe Time Machine" [31], is a digital humanities research project that hopes to use AI, machine learning, and big data for ancient map research and 3D modeling to restore historical urban landscapes. If the ancient maps and 3D modeling from this project's results can be combined with the current landscapes of corresponding cities through VR/AR technology, users can appreciate the historical features of the city simultaneously while touring it through smart cultural tourism application products and smart wearable devices, allowing them to travel through time to trace the city's transformation history and understand its past and present.

4.3.2 Using Knowledge Graphs and GIS Technology to Construct "Literary Tourism Knowledge Maps" The investigation found that many smart cultural tourism application products have launched specialized route planning and recommendation services, mostly introducing scenic spots along routes in the form of long tweets with pictures and text. The thematic content of these specialized routes involves historical figures, events, and customs, but the geographic information and embedded literary resources have not been effectively associated, resulting in a disconnect between tourism information and related literary content. If relational structured data of literary resources can be used as the underlying support, knowledge graphs can be constructed for knowledge association, and GIS technology can project the knowledge graphs onto maps, integrating literary data with geographic data to apply digital humanities research results to smart cultural tourism application products. There are already digital humanities research projects on literary maps using GIS technology, such as the first phase project of the "Chinese Literature Knowledge Graph"—the "Tang and Song Literature Chronological Map." This project uses chronology and "geolocation" as two core elements to solve the problem of temporal and spatial separation in chronologies and literary history, achieving spatiotemporal integration of literary information presentation [32] and projecting the Tang and Song literature knowledge graph onto both ancient and current maps to realize GIS and literature interaction. If such research results can be applied to smart cultural tourism application products to form a "literary tourism knowledge map" that interconnects literary research, literary resources, and geographic information, it can, on the one hand, promote traditional literary research results to the public in a concise manner, narrowing the gap between traditional literature and the general public, and on the other hand, create panoramic literary tourism experiences for users.

4.3.3 Introducing Digital Narrative Thinking to Guide Users in Co-creating "Historical and Cultural Stories" The investigation found that current application products such as Cloud Tour Dunhuang and Google Arts & Culture have conducted specialized thematic metadata annotations on their resources and provided corresponding classification dimensions for user retrieval and clustering. They have also established many interesting interactive functions to guide users to use cultural resources for re-creation. Both specialized

thematic annotation and interactive functions aim to increase users' exploration interest and further excavate the cultural heritage of collection resources, which aligns with the characteristics of digital storytelling. Digital storytelling is narrative generated through the interactive behavior of digital programs [33], focusing on exploring various possibilities of human-computer interactive narrative from the characteristics of digital media themselves to achieve diversification of digital narrative [34]. Abroad, there have been successful cases of libraries, archives, and museums using digital storytelling to develop collection resources, such as the digital narrative creation activities of President Lincoln by the Abraham Lincoln Presidential Library and Museum, the "Destination: Australia - Sharing Our Post-War Migrant Stories" project by the National Archives of Australia, and the "Object-Oriented Multi-user Game" by the UK National Archives [34]. These projects encourage public participation in digital humanities project construction, collect popular digital memories, and create more meaningful cultural results through interactive activities, crowdsourcing platforms, and cultural game development. Smart cultural tourism application products can also introduce digital narrative thinking. On the one hand, narrative achievements created by humanities scholars using digital humanities technologies such as IIIF (International Image Interoperability Framework), semantic annotation, and linked data, such as the "Dunhuang Mural Digital Narrative System Based on IIIF" developed by Wuhan University [35], can be incorporated into smart cultural tourism application products to guide users to participate in annotation and collect public wisdom for projects. On the other hand, simplified narrative creation function modules can be deployed in smart cultural tourism application products to guide users to use collection data resources to create narrative activities, collect digital memories from the perspective of popular narrative, increase user immersion, and simultaneously create greater cultural and social benefits.

5 Summary and Outlook

As Wu Jianzhong proposed in "Toward the Third-Generation Library," the third-generation libraries currently under construction should "focus on resource integration. On the one hand, they should activate the original documentary resources, and on the other hand, they should develop new resources and organically integrate various resources" [36]. This is the direction libraries should strive for in the environment of culture-tourism integration development: deeply excavating collection resources, intellectualizing and networking humanistic information to provide more intuitive humanistic services to users. Simultaneously, libraries should attempt to apply digital humanities-related technologies and research results to the functional construction of smart cultural tourism application products. As one of the "leaders" in digital humanities infrastructure construction [30], libraries also need to become the "bridge" between digital humanities and smart cultural tourism. In the future, libraries will not only provide basic data and research platforms for research scholars but also present scholars' research results to the public through smart cultural tourism

application products, guide users to participate in digital humanities project construction, strive to build a collaborative channel for digital humanities information, and form a knowledge update cycle network. On the other hand, libraries should also focus on tracking research on tourism resources, attempt to integrate cultural resources with tourism resources, map historical scenes onto current urban landscapes, project humanistic knowledge onto tourism entities, and thread humanistic stories through tourism routes, making libraries with accumulated digital humanities resources and emphasis on excavating humanistic information connections the "unsung heroes" behind smart cultural tourism application products.

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Note: Figure translations are in progress. See original paper for figures.