Research on Big Data Analysis of Martial Arts Culture and Cultural Inheritance Strategies from the Perspective of Digital Humanities Theory

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Abstract: *This paper adopts the digital humanities theory as a framework, combines big data analysis of martial arts culture, and explores inheritance strategies for martial arts culture, addressing issues such as the inheritance gap, loss of techniques, and inefficient dissemination. By studying technologies such as 3D motion capture and 3D modeling, it achieves digital recording and reproduction of martial arts culture, and utilizes methods like machine learning and data mining to reveal its regional characteristics, audience needs, and development trends. The research finds that digital technologies can significantly enhance the recording accuracy and dissemination breadth of martial arts intangible cultural heritage, and through immersive experiences and precise recommendations, increase audience engagement. The analysis of regional characteristics provides a basis for differentiated inheritance strategies, while the education-society collaborative model optimizes the inheritance system.*

Keywords: *digital humanities, martial arts culture, big data analysis, cultural inheritance*

1. Introduction

Under the wave of information technology, the protection and inheritance of intangible cultural heritage are encountering new opportunities. Martial arts, as a treasure of Chinese traditional culture, carry profound historical heritage and philosophical thoughts, yet they face challenges such as inheritance gaps and loss of techniques due to the acceleration of modernization. The introduction of digital humanities theory provides new methodologies and technical pathways for the inheritance of martial arts culture. The systematic collection and analysis of big data on martial arts culture can reveal its historical evolution and school characteristics, laying a foundation for in-depth research. On this basis, constructing a resource library that integrates text, images, and even three-dimensional dynamic capture data can ensure the authenticity and integrity of cultural heritage. Furthermore, applying technologies such as virtual reality (VR) and augmented reality (AR) to construct immersive experience scenarios can effectively stimulate the learning enthusiasm of young groups and solve the dilemma of inheritance gaps. At the same time, these digital achievements can be transformed into high-quality cross-cultural products, such as films, television, and animations, crossing language and regional barriers, effectively enhancing the international influence of martial arts culture and thereby strengthening national cultural soft power [1].

Therefore, the integration of digital humanities and big data technology not only opens up innovative paths for the protection and inheritance of martial arts intangible cultural heritage but also promotes its modern transformation and global dissemination, which has significant practical significance for promoting excellent traditional Chinese culture and strengthening cultural confidence.

2. Diagnosis of the Current Situation and Problems in Martial Arts Culture Inheritance Based on Big Data Analysis

Currently, the inheritance of martial arts culture faces multiple dilemmas, which can be analyzed from three dimensions: resource distribution, inheritance system, and social environment. Firstly, at the resource level, although martial arts have numerous schools, ranging from national to folk levels, their diversity and dispersion coexist, posing challenges to systematic protection. Secondly, the inheritance system has structural defects; although there is national policy support, there are still limitations at the implementation level [2][3]. Moreover, the traditional master-apprentice system is gradually declining,

with old masters passing away and young people's interest waning, jointly leading to an inheritance gap. Finally, changes in the social and cultural environment pose another challenge, as fast-paced life squeezes its living space, while the impact of foreign cultures and excessive commercialization dilute its spiritual connotation and weaken its appeal [4].

Big data technology provides a new path to solve the aforementioned dilemmas. The comprehensive digitization of martial arts cultural resources enables efficient management and in-depth utilization. Specifically, by utilizing technologies such as three-dimensional dynamic capture and virtual environment reconstruction, a three-dimensional digital archive can be constructed to achieve accurate and permanent recording of techniques. At the dissemination level, the Internet and mobile communication technologies break through spatiotemporal limitations, enabling martial arts culture to reach a global audience instantly. Personalized recommendations based on user profiles can accurately push content to different groups, significantly enhancing the precision and effectiveness of dissemination. Furthermore, social media builds interactive communities, promoting experience sharing and emotional connections among enthusiasts, and creating a favorable ecosystem for the popularization and revitalized inheritance of martial arts culture.

However, the in-depth application of big data technology still faces practical challenges. Digital inheritance remains in its early stages, with current efforts predominantly focused on the superficial recording of techniques, while the exploration of their deeper connotations is still insufficient. Deepening the application requires leveraging cutting-edge technologies such as VR and AR to create immersive experiences, but this demands sustained funding and professional technical support. Additionally, international dissemination strategies need improvement. As a significant symbol of Chinese culture, the global influence of martial arts still has potential for growth. Current dissemination relies heavily on competitions and performances, lacking systematic strategies [5], and language and cultural barriers hinder in-depth exchanges. Therefore, it is imperative to establish diversified international communication channels to enhance global understanding and recognition, and to foster deeper international cooperation.

3. Big Data Analysis of Martial Arts Culture

3.1 Data Sources and Processing

3.1.1 Collection of Martial Arts Culture Data

The collection of martial arts culture data involves comprehensive documentation of martial arts techniques, social environments, developmental trajectories, customary practices, and related human geographical resources. Therefore, the collection process should comprehensively utilize advanced technologies such as three-dimensional motion capture, three-dimensional modeling, and environmental simulation to achieve multi-dimensional and high-precision recording of martial arts techniques. Three-dimensional motion capture technology can accurately capture the details of martial arts movements, three-dimensional modeling can reconstruct the scenarios of martial arts practice, and environmental simulation technology helps restore the historical and social context of martial arts activities, thus providing more vivid and authentic materials for the inheritance of martial arts culture.

3.1.2 Data Preprocessing and Cleaning

In the research on big data analysis of martial arts culture and cultural inheritance strategies, data preprocessing and cleaning are crucial steps to ensure the quality and effectiveness of subsequent data analysis. This process not only involves the preliminary organization of raw data but also includes in-depth cleaning to eliminate noise, redundancy, and inconsistencies, thereby providing a reliable foundation for subsequent data analysis.

3.2 Data Analysis Methods

In the inheritance and development of martial arts culture, machine learning and data mining technologies have opened new avenues for the preservation and dissemination of martial arts intangible cultural heritage. Through in-depth analysis of big data on martial arts culture, it is possible not only to reveal its developmental trajectory but also to provide scientific decision-making support for international promotion.

Machine learning technology is primarily applied to digital reconstruction, intelligent classification,

and personalized recommendations. By utilizing three-dimensional motion capture and deep learning algorithms, high-precision digital reconstruction of martial arts movements can be achieved, preserving traditional techniques while enhancing teaching by analyzing the commonalities and differences among different schools. Recommendation systems based on user behavior enable precise content delivery, increasing public engagement, while sentiment analysis of social media can quantify public opinion, providing a basis for optimizing promotion strategies.

Data mining technology focuses on exploring underlying patterns, including trend prediction, spatial distribution, and audience research. Through time series analysis, the rise and fall trajectories of different schools can be traced, and future trends can be predicted. Combined with geographic distribution information, it can accurately depict regional characteristics, revealing strengths and weaknesses in inheritance. By performing cluster analysis on audiences, the interest preferences of different groups can be quantified, guiding content customization and marketing design. The patterns and correlations extracted from vast amounts of data provide critical decision-making support for the precise protection, optimized resource allocation, and sustainable development of martial arts culture.

3.3 Analysis Results and Discussion

3.3.1 Development Trends of Martial Arts Culture

In the context of globalization, the inheritance of martial arts culture faces both opportunities and challenges. The rise of digital technology has injected new vitality into its preservation, dissemination, and innovation. Specifically, digital preservation utilizes technologies such as three-dimensional motion capture to achieve precise recording of techniques and the restoration of endangered schools. Digital dissemination relies on the internet and diverse media to break through spatiotemporal barriers and expand global influence. Digital management optimizes resource allocation and safeguards rights and interests through the construction of shared platforms. Digital consumption has given rise to new formats such as immersive experiences, providing economic impetus for inheritance.

3.3.2 Regional Characteristics of Martial Arts Culture

Martial arts culture has developed distinct regional characteristics over its long historical evolution. These characteristics are the result of the combined effects of natural geography, economic levels, social customs, and historical contexts in various regions, and they also reflect the inheritance and development of martial arts as intangible cultural heritage in different geographical areas [6]. Through big data analysis, the formation mechanisms of these regional characteristics can be deeply analyzed, providing empirical evidence for formulating precise inheritance strategies.

Geographical environment serves as the physical foundation for shaping martial arts styles. The vast plains of northern China gave rise to powerful and expansive boxing styles, while the complex terrain of southern water towns fostered agile and refined techniques. The rise and fall of regional economies directly influence the dissemination and vitality of martial arts schools. For instance, the prosperity of the Jiangnan region during the Ming and Qing dynasties gave birth to numerous influential schools. Simultaneously, unique socio-cultural atmospheres and historical trajectories collectively shaped the value orientations and technical systems of various schools, forming a multidimensional landscape of martial arts culture's regional characteristics [6].

3.3.3 Audience Analysis of Martial Arts Culture

Audience analysis of martial arts culture involves the systematic deconstruction of audience interests, needs, and behavioral patterns, providing a scientific basis for formulating precise dissemination strategies and promoting its sustainable development. The audience demographics exhibit significant diversity. The youth group is largely influenced by popular culture such as films and video games, with their interest primarily focused on the dynamic skills and cultural symbols of martial arts. Adults place greater emphasis on the value of physical fitness and cultural immersion. The elderly group tends to gravitate toward traditional martial arts like Tai Chi to fulfill wellness needs and spiritual fulfillment [7].

Contemporary audience demands further demonstrate multi-layered characteristics. At the entertainment level, digital media stimulates interest; at the practical level, martial arts satisfies health maintenance and willpower training needs; at the spiritual level, its philosophical ideas serve as an important pathway for constructing cultural identity; at the social level, community practice activities fulfill the need for belonging. These four dimensions of demand collectively constitute the internal driving force for the inheritance of martial arts culture in modern society.

4. Cultural Inheritance Strategies of Martial Arts from the Perspective of Digital Humanities

4.1 Innovation in Inheritance Models Based on Digital Humanities

With the rapid development of information technology, digital humanities has become an important branch of cultural studies, focusing on the systematic and scientific research and preservation of cultural heritage through digital technologies. First, digital acquisition technologies provide technical support for the comprehensive documentation of martial arts intangible cultural heritage. By utilizing technologies such as three-dimensional motion capture, modeling, and environmental simulation, a multidimensional record of martial arts techniques, developmental trajectories, customary practices, and related human geographical resources can be achieved. Second, digital technologies facilitate the efficient management and dissemination of martial arts culture. Through channels such as the internet and mobile media, martial arts culture can be widely propagated. Digital products like films, animations, and video games can attract diverse audiences, stimulate their interest, and promote cultural inheritance. Third, by redeveloping martial arts resources, diverse cultural products can be created to meet market demands. For example, integrating martial arts elements into modern entertainment products can enrich their cultural connotations and enhance their market competitiveness. Furthermore, the application of technologies such as virtual reality (VR) and augmented reality (AR) can create immersive experiences, allowing audiences to deeply appreciate the charm of martial arts through entertainment.

Therefore, innovating martial arts inheritance models through digital humanities not only effectively addresses the challenges of preserving and inheriting martial arts intangible cultural heritage but also opens new pathways for its innovative development.

4.2 Inheritance Strategies in the Educational Field

Integrating school education with master-apprentice transmission represents an innovative and effective strategy for preserving and inheriting martial arts intangible cultural heritage. This model can overcome the limitations of traditional master-apprentice systems in terms of scope and speed of inheritance, while leveraging the educational resources and platforms of schools to achieve widespread dissemination and in-depth education of martial arts culture [8].

First, school education provides a systematic theoretical learning environment for martial arts inheritance. Traditional master-apprentice transmission emphasizes observation and imitation, which can preserve the purity of techniques but often lacks theoretical guidance, making it difficult for students to deeply understand the cultural connotations and philosophical ideas of martial arts. By offering courses such as history of martial arts and martial arts philosophy, schools enable students to systematically grasp the cultural background and developmental history of martial arts while practicing the techniques, thereby fostering a comprehensive understanding of the discipline. Second, combining the personalized guidance of master-apprentice transmission with the large-scale training of school education can effectively expand the scope of inheritance. School education leverages its broad student base to popularize martial arts culture and reserves potential inheritors for technical transmission. Simultaneously, by selecting outstanding students to enter the master-apprentice system for advanced personalized guidance, the quality and efficiency of inheritance can be enhanced while maintaining the purity of the techniques. Furthermore, digital technology provides new pathways for integrating the two approaches. This technology not only enables high-precision recording and reproduction of martial arts techniques but also breaks spatiotemporal limitations through virtual reality and online courses, allowing students to access high-level teaching resources. Finally, the integration of the two approaches also helps build a sense of community identity around martial arts culture [8]. By organizing activities such as martial arts clubs and competitions in schools, student interest can be enhanced, and communication and collaboration among teachers and students can be promoted, fostering a positive martial arts culture atmosphere.

4.3 Inheritance Strategies at the Societal Level

4.3.1 The Role of Social Training Institutions

In the protection and inheritance of martial arts intangible cultural heritage, social training institutions play a significant role. They not only impart martial arts skills but also serve as irreplaceable actors in cultural dissemination, digital transformation, and the construction of enthusiast

communities. Their functions are primarily demonstrated in the following aspects:

First, social training institutions serve as crucial platforms for transmitting martial arts skills. By offering systematic courses, they provide learning opportunities for youth while creating pathways for adults to enhance physical fitness and self-cultivation. These institutions possess professional coaching teams and teaching plans, ensuring comprehensive skill acquisition for trainees and effectively promoting the popularization and advancement of martial arts.

Second, social training institutions act as bridges in the dissemination of martial arts culture. Through organizing activities such as martial arts performances and competitions, they attract public attention, enhance the social influence of martial arts, and facilitate exchanges and cooperation among different schools. Furthermore, many institutions utilize digital means such as live streaming and online courses to break geographical barriers, enabling broader access to martial arts culture and further expanding its reach.

Third, in the digital transformation of martial arts intangible cultural heritage, social training institutions actively participate in digital collection work. By recording videos and taking photographs, they document valuable techniques and cultural contexts, providing essential materials for subsequent research. On the other hand, they leverage digital technology to develop educational software and applications, innovating teaching methods and injecting new technological vitality into the preservation and inheritance of martial arts heritage.

Finally, social training institutions make remarkable contributions to building communities of martial arts enthusiasts. By organizing activities such as training camps and seminars, they provide platforms for enthusiasts to exchange insights and share experiences, thereby supporting the inheritance and development of martial arts culture.

4.3.2 Public Participation and Community Activities

Public participation and community activities serve as crucial components in the inheritance of martial arts culture. Experiential learning activities, such as open classes and competitions, deepen cultural understanding and stimulate enthusiasm for preservation; community activities, such as cultural festivals and health lectures, integrate martial arts into daily life, sustaining cultural vitality. Digital projects, including online museums and VR experiences, enhance public engagement and collect data to support research and innovation. In terms of international promotion, events such as international martial arts festivals and cultural exhibitions facilitate cross-cultural exchange and elevate the global influence of Chinese culture.

4.4 International Dissemination and Exchange

4.4.1 International Competitions and Cultural Exchange

In the era of big data, international competitions serve as a key window for the global dissemination of martial arts culture. To enhance their effectiveness, strategies such as enriching cultural connotations, promoting cross-cultural communication, and leveraging new media effectively should be adopted to transform these events into powerful platforms integrating both competition and culture. This approach not only expands the international influence of martial arts but also promotes its global inheritance and development, positioning it as a significant vehicle for the "going global" of Chinese culture.

4.4.2 Establishment of Overseas Martial Arts Schools

The establishment of overseas martial arts schools represents not only an important channel for the dissemination of martial arts culture but also a vital component of the "living inheritance" of martial arts intangible cultural heritage. Through the application of digital technologies to martial arts intangible cultural heritage, the teaching quality of overseas martial arts schools and the efficiency of cultural dissemination can be effectively enhanced, thereby advancing the international propagation and inheritance of martial arts culture.

Conclusion

The development of information technology has brought new opportunities for the protection and inheritance of martial arts intangible cultural heritage. Digital technology not only provides efficient support for recording and preservation but also opens new pathways for dissemination, consumption, and innovative development. Its future prospects are broad, mainly reflected in the following aspects:

First, in terms of collection technology, the maturation of technologies such as three-dimensional motion capture and modeling will enable comprehensive and precise documentation of martial arts techniques and their living environments. In the future, the integration of artificial intelligence will make the collection process more intelligent, automatically identifying and annotating key movement nodes, thereby providing valuable materials for in-depth analysis and teaching. Second, in the propagation of martial arts culture, technologies such as VR and AR will enable more diverse and interactive presentations of martial arts culture. Through immersive experiences or integration into media such as films and video games, the charm of martial arts can be vividly reproduced, attracting younger audiences and opening new channels for international dissemination. Online education and social media platforms will make skill learning and exchanges more convenient, helping to cultivate a new generation of inheritors and laying the foundation for sustainable development.

Funding Project

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