

Research on Intelligent Generation and Construction of Multimodal Teaching Resource Bank of Liaoning Regional Culture and Art Driven by AI

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Abstract. In the context of the digital economy, the rapid advancement of artificial intelligence (AI) technology has provided new technological support for the informatization of education and the digitalization of culture. Liaoning, a key component of Northeast China's old industrial base, is rich in diverse regional cultural and artistic resources. These resources are not only important carriers of Chinese traditional culture but also valuable materials for local characteristic education. However, the current digitalization of Liaoning's regional cultural and artistic resources faces challenges such as scattered resources, limited forms, and low utilization rates, which hinder the needs of cultural inheritance and educational innovation in the new era. This study focuses on the intersection of AI and educational informatization, exploring innovative approaches to leverage AI technology for the digitalization of Liaoning's regional cultural and artistic resources. By constructing a multimodal teaching resource library, it aims to systematically protect and inherit Liaoning's distinctive cultural and artistic heritage, while also providing high-quality digital teaching resources for all levels of education, thus promoting the innovative development of regional cultural education. The theoretical value of this study lies in expanding the application boundaries of AI technology in cultural education, while its practical significance is reflected in providing replicable and scalable technical solutions for the digitalization of regional cultural resources.

Keywords: AI technology; Liaoning regional culture; graphic design.

1. Introduction

With the rapid advancement of information technology, artificial intelligence (AI) has emerged as a key driver for transformation across various industries. In the education sector, the application of AI technology has opened up unprecedented opportunities for educational informatization. Liaoning, a core area of Northeast China's old industrial base, boasts a rich historical and cultural heritage and unique regional artistic and cultural resources. From the ancient Hongshan Culture to the modern industrial culture, from the vibrant folk customs to the magnificent natural landscapes, these resources provide abundant material for art design education. However, the digitalization of Liaoning's regional cultural and artistic resources faces numerous challenges, such as resource dispersion, limited forms, and low utilization rates. These issues severely impede the inheritance of regional culture and educational innovation. Therefore, exploring innovative approaches to leverage AI technology in the digitalization of Liaoning's regional cultural and artistic resources is crucial for promoting the innovative development of regional cultural education, both theoretically and practically.

2. Overview of Regional Cultural and Artistic Resources in Liaoning

2.1. Richness of regional cultural and artistic resources in Liaoning

Liaoning is rich in diverse cultural and artistic resources, encompassing history, folklore, and natural landscapes. The Hongshan Culture, a significant representative of early Neolithic Chinese culture, has unearthed jade and pottery artifacts that showcase the advanced craftsmanship and unique aesthetics of ancient Liaoning. Modern industrial culture highlights Liaoning's role as the cradle of Chinese industry, with industrial relics and old factories rich in cultural significance. Additionally, Liaoning's folk arts, such as Errenzhuān (a traditional form of storytelling) and Liaojū (a traditional

opera), are beloved for their unique artistic forms and vivid performances. In terms of natural landscapes, Liaoning boasts the majestic mountains and rivers of the Changbai Mountain range and the picturesque coastline of the Liaodong Peninsula, which serve as a rich source of inspiration for artistic creation.

2.2. The current situation and problems of digital construction of regional cultural and artistic resources in Liaoning Province

Although Liaoning is rich in cultural and artistic resources, its digitalization efforts still face numerous challenges. One major issue is the dispersion of these resources, with many cultural and artistic assets scattered across various museums, libraries, archives, and private collections, lacking unified management and integration. Another challenge is the lack of diversity in digital formats; most digital resources are limited to basic formats like images and text, lacking interactivity and immersive experiences. Additionally, low utilization rates are a pressing issue, as many digital resources have not been effectively integrated into the education system, leading to resource wastage.

3. Application Advantages of Artificial Intelligence Technology in The Digital Construction of Cultural and Artistic Resources

3.1. Data Processing Capabilities of AI Technology AI technology boasts robust data processing capabilities, enabling it to swiftly process vast amounts of cultural and artistic resource data.

By employing machine learning and deep learning algorithms, AI can categorize, identify, and analyze complex cultural and artistic data, thereby enhancing the efficiency of resource organization and management. For instance, in image recognition, AI can automatically identify key features in images of cultural relics, providing auxiliary support for their classification and authentication.

3.2. The Innovation and Interactivity of AI Technology AI technology can bring innovation and interactivity to the digital construction of cultural and artistic resources.

By utilizing technologies such as virtual reality (VR) and augmented reality (AR), AI can create immersive cultural and artistic experiences, allowing users to experience the charm of culture and art as if they were there. For example, with AR technology, users can scan images of cultural relics to see 3D models and detailed introductions, enhancing their understanding and interest in cultural and artistic heritage.

3.3. Personalized Recommendation Function of AI Technology AI technology can provide personalized recommendations of cultural and artistic resources based on users' learning and browsing habits.

By analyzing user behavior data, AI algorithms can accurately recommend cultural and artistic resources that align with users' interests and needs, thereby enhancing resource utilization and user engagement. For instance, on a cultural and artistic education platform, AI can suggest regional cultural and artistic courses and resources that match students' learning progress.

4. The Innovative Path of AI Technology Enabling The Digital Construction of Regional Cultural and Artistic Resources in Liaoning

4.1. Build a multimodal teaching resource library

The collection and integration of multimodal resources, utilizing AI technology, involve a comprehensive gathering of cultural and artistic resources in Liaoning, including texts, images, audio, and video. Through image recognition and speech recognition technologies, the collected resources are digitized and integrated into a unified resource library. For instance, the performance of

Errenzhuan in Liaoning's folk culture is recorded and audio collected, and using speech recognition technology, it is converted into text scripts, enriching the form and content of the resources. The classification and annotation of the resource library are automated using machine learning algorithms, based on the type, era, and region of the cultural and artistic resources, establishing a detailed classification tag system. For example, artifacts from the Hongshan Culture are classified and annotated by type and excavation site, making it easier for users to quickly find and use relevant resources. Additionally, natural language processing technology is used to perform semantic analysis and keyword extraction on the resource descriptions, further enhancing the efficiency of resource retrieval. The dynamic update mechanism for the resource library ensures regular supplementation and updates. By collaborating with museums, libraries, and other cultural institutions, the latest information on cultural and artistic resources is obtained promptly. AI technology is also used to maintain the resource library intelligently, automatically detecting and repairing errors and damages in the resources, ensuring the quality and stability of the resource library.

4.2. Develop immersive cultural and artistic experience system

Using VR/AR technology to create immersive experience scenes, leveraging the unique cultural and artistic resources of Liaoning, we can develop an immersive cultural and artistic experience system. For instance, by using VR technology to create a virtual scene of the Hongshan Culture site, users can virtually tour the site and gain insights into the life and cultural customs of ancient Liaoning. By using AR technology, we can add virtual information and interactive elements to museum artifacts, enhancing the cultural experience for visitors. Integrating AI interaction features enhances user experience by incorporating AI interaction functions such as voice narration and intelligent navigation into the immersive experience system. Through speech recognition and natural language processing technologies, personalized voice narration services are provided to users, offering detailed cultural and artistic knowledge based on their needs and interests. Additionally, AI's intelligent navigation function can plan the best tour routes for users, guiding them to better experience cultural and artistic resources. Combining online and offline immersive experience activities, we can integrate online immersive experience systems with offline cultural and artistic venues. For example, organizing online VR exhibitions combined with offline physical exhibitions allows users to preview the exhibition content online through VR technology, followed by a visit in person, thus enhancing their understanding and appreciation of cultural and artistic resources. Through these online and offline integrated experience activities, we can expand the reach of cultural and artistic resources and increase public attention and participation in regional cultural and artistic activities.

4.3. Build a personalized cultural and artistic education platform

AI-based personalized learning path planning utilizes AI technology to analyze students' learning progress, interests, and knowledge levels, thereby creating tailored cultural and artistic learning paths for each student. Based on individual characteristics, the platform recommends cultural and artistic courses and resources that match the students' learning levels and interests. For instance, if a student is interested in the Hongshan Culture, the platform can recommend relevant archaeological knowledge courses, artifact appreciation courses, and field trips, helping them systematically learn about the Hongshan Culture. The AI platform also provides real-time feedback on personalized cultural and artistic learning resources, including text materials, images, and video tutorials, based on the students' learning paths and progress. Additionally, through an intelligent evaluation system, the platform offers real-time feedback on students' learning outcomes, providing targeted improvement suggestions and tutoring plans based on their answers and work performance. For example, after a student completes a painting themed around Liaoning's regional culture, the AI system can analyze the style and technical aspects of the work and provide corresponding improvement suggestions to help enhance the student's cultural and artistic creation skills. Establishing a cultural and artistic education community promotes communication and collaboration. On the personalized cultural and artistic education platform, a community is established to facilitate communication and collaboration

among students, teachers, and cultural and artistic enthusiasts. Within this community, activities such as cultural and artistic discussions, exhibitions of works, and online seminars can be organized to foster interaction and cooperation among users. Through these community activities, students' interest in learning and creativity are stimulated, and their teamwork spirit and awareness of cultural inheritance are cultivated. At the same time, AI technology is used to analyze and manage the communication content in the community intelligently, so as to provide users with a better quality and safe communication environment.

5. Case Analysis: Application of AI Technology in The Digital Construction of Regional Cultural and Artistic Resources in Liaoning Province

5.1. Case Selection and Background Introduction: Taking the digitalization project of a museum in Liaoning as an example, the museum houses a vast collection of Hongshan Culture artifacts

However, due to the dispersion of resources and the lack of diversity in form, the digital display and educational applications of these artifacts have been less effective. To better protect and promote the Hongshan Culture and enhance the museum's digital capabilities, the museum has decided to introduce AI technology for digitalization.[1]

5.2. Application process of AI technology in digital construction: multi-modal resource collection and integration

Using high-precision scanning equipment and photography technology, a comprehensive image collection and 3D modeling of the Hongshan culture artifacts in the museum are conducted. Additionally, audio explanations of the artifacts are recorded using voice collection devices, and these are converted into text scripts through speech recognition technology. The collected images, 3D models, audio, and text are integrated to create a resource library for Hongshan culture artifacts. An immersive experience system is developed, leveraging the characteristics of Hongshan culture artifacts and VR technology to create an immersive artifact display system. Users can enter a virtual Hongshan culture site via VR devices, visit the scenes where artifacts were unearthed, and learn about their historical background and cultural significance. The immersive experience system incorporates AI interaction features, such as voice explanations and intelligent tours, to provide users with a richer cultural experience. A personalized education platform is developed based on the educational value of Hongshan culture artifacts. The platform uses AI technology to analyze students' learning situations and recommends suitable Hongshan culture courses and resources for them. Additionally, a cultural and artistic education community is established on the platform, organizing activities such as painting competitions and handicrafts related to Hongshan culture, promoting communication and cooperation among students.[2]

5.3. Application Effects and Outcome Evaluation: Resource Integration and Utilization Efficiency Improvement Through the application of AI technology, museums have successfully integrated multimodal resources of Hongshan culture artifacts, establishing a comprehensive resource library.

The utilization rate of these resources has significantly increased, and the digital display formats of cultural relics have become more diverse and engaging, attracting a larger audience to visit and learn. The development of an immersive experience system has enhanced the effectiveness of cultural dissemination by providing visitors with a new cultural experience, deepening their understanding and appreciation of Hongshan culture. Visitors can more vividly experience the charm of Hongshan culture in virtual settings, significantly enhancing the effectiveness of cultural dissemination. Personalized Education Promotes Students 'All-Round Development The construction of a personalized cultural and artistic education platform has provided students with a personalized

learning environment, stimulating their interest in learning and creativity. Through courses and community activities on the platform, students' cultural and artistic literacy has been comprehensively improved, and their awareness of cultural inheritance and teamwork spirit have also been cultivated.[2]

6. Challenges and Countermeasures of Empowering The Digital Construction of Liaoning Regional Cultural and Artistic Resources By AI Technology

6.1. Technical Challenges and Countermeasures: Data Quality and Accuracy Issues The application of AI technology relies on high-quality data; however, during the digitalization of cultural and artistic resources, issues such as low data quality and poor accuracy may arise.

To address this, a strict data collection and review mechanism should be established to strengthen control over data sources, ensuring the authenticity and accuracy of the data. Additionally, AI technology can be used for preprocessing and quality assessment of collected data, enabling timely detection and correction of errors. **Technology Update and Maintenance Costs** AI technology is advancing rapidly, with new algorithms and applications constantly emerging. For the digitalization of cultural and artistic resources in Liaoning, the high costs associated with technology updates and maintenance pose significant challenges. To tackle this, a mechanism for technology updates should be established, collaborating with specialized AI technology research institutions to introduce advanced technologies and applications in a timely manner. Moreover, training for technical personnel should be intensified to enhance their technical skills and innovation capabilities, thereby reducing the costs associated with technology updates and maintenance. **System Compatibility and Integration Issues** During the digitalization process, integrating multiple systems and platforms, such as resource libraries, immersive experience systems, and educational platforms, may lead to compatibility issues that affect the overall effectiveness of the digitalization project. To address this, standardized data interfaces and communication protocols should be adopted to ensure seamless integration and data sharing among systems. Additionally, system testing and optimization should be strengthened to improve system stability and compatibility.[3]

6.2. Cultural Challenges and Countermeasures: Understanding and Inheriting Culture The application of AI technology requires a deep understanding and accurate interpretation of cultural and artistic resources.

However, in practice, there may be issues such as inaccurate understanding of cultural connotations and inadequate inheritance. To address these challenges, it is essential to enhance cultural research and talent development by forming professional teams dedicated to the study of cultural and artistic resources, delving into their deeper meanings and values. Additionally, cultural training for AI professionals should be strengthened to improve their ability to understand and utilize these resources. **Cultural Innovation and Integration:** During digitalization efforts, it is crucial to innovate and integrate cultural and artistic resources to meet the cultural needs of the new era. However, there may be issues such as insufficient innovation and poor integration. To tackle this, cultural innovation should be encouraged, and creators should be supported in using AI technology to innovate and create new forms of cultural and artistic expression that reflect contemporary and regional characteristics. Moreover, research on the integration of cultural and artistic resources should be intensified to explore effective methods for combining different resources, promoting a diverse and integrated cultural landscape. **Balancing Cultural Protection and Utilization:** While leveraging AI technology for the digitalization of cultural and artistic resources, it is important to balance cultural protection with utilization. Over-digitalization can harm cultural and artistic resources, undermining their protection. To address this, a robust cultural protection mechanism should be established, ensuring strict adherence to cultural protection laws and standards during the digitalization process to safeguard the safety and integrity of these resources. Additionally, the evaluation and supervision

of digitalization projects should be enhanced to ensure a balanced approach to cultural protection and utilization.[4]

7. Conclusion

AI technology provides robust technical support and innovative impetus for the digitalization of Liaoning's cultural and artistic resources. By developing a multi-modal teaching resource library, creating an immersive cultural and artistic experience system, and building personalized cultural and artistic education platforms, these innovative approaches can effectively address the challenges in the digitalization of Liaoning's cultural and artistic resources, promoting their protection, inheritance, and innovation. However, the application of AI technology also presents challenges in technology and culture. To overcome these challenges, it is necessary to establish a mechanism for technological updates, enhance cultural research and talent development, and balance cultural preservation and utilization. This will help fully leverage the advantages of AI technology, providing broader development opportunities for the digitalization of Liaoning's cultural and artistic resources. In the future, as AI technology continues to evolve and innovate, its application in the digitalization of cultural and artistic resources will become more extensive and profound, injecting new vitality into the inheritance and development of regional cultural and artistic heritage.

References

- [1] Johnson, K., et al. Generative AI for Cultural Heritage Preservation: A 2024 Perspective[J]. *ACM Computing Surveys*, 2024, 57(1): 1-45.
- [2] Liu Wei and Zhang Minghua. Design of an Intelligent Retrieval System for Multi-modal Cultural Resources Based on Deep Learning [J]. *Modern Library and Information Technology*, 2023,39(6):56-64.
- [3] Chen Zhiqiang and Li Na. 2023-2024 Report on the Transformation and Development of Digital Education [M]. Beijing: Educational Science Press, 2024.
- [4] Wang, L., & Chen, Y. Multimodal Learning for Cultural Heritage: New Developments in 2024[J]. *IEEE Access*, 2024, 12: 15678-15692.