The Advanced Path of Research on Digital Display Empowered by AIGC Technology for Intangible Cultural Heritage

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Abstract: [Research Significance] Artificial Intelligence Generated Content (AIGC) technology combines machine learning and natural language processing to provide a new way to digitally display and disseminate intangible cultural heritage. the technology is based on the fields of deep learning and computer vision to build a theoretical framework that provides practical guidance for the digital transformation of intangible cultural heritage. [Research Methodology] This study adopts the case study method, taking Wuhan Textile University Jingchu Textile Nonheritage Museum and "Ancient Chinese Loom Virtual Simulation Experiment" as examples, explore the integration of AIGC technology with virtual reality and other technologies to provide an immersive experience, in-depth analysis of the standardization of digitization of nonlegacy, the path of resource sharing, as well as the innovative application of design of exhibition space and educational study dissemination. The proposes 8 progression path for the digital display of NRH through literature review and case studies. [Conclusion of the study] the results of the study show that AIGC technology plays an important role in the protection and inheritance of non-legacy, enhances interactivity and immersion, and supports the modern dissemination of traditional culture. At the same time, the study points out the challenges facing the development of AIGC technology, such as data privacy and algorithmic bias, which require further research and policy support to ensure the healthy development of the industry. The deep integration of AIGC technology provides new perspectives and strategies for the sustainable development of non-heritage.

Keywords: Intangible Cultural Heritage;

AIGC Technology; Digital Display; Progression Paths

1. Introduction

of Under the influence scientific and technological development and global integration, intangible cultural heritage is unprecedented encountering transmission challenges. Because of the special nature of ICH, such as living (inheritance and evolution), traditional (specific cultural origins place intrinsically linked to the and environment in which it is located), and holistic (including ecology and culture), simple digital storage usually ignores the spatial characteristics on which it relies for its survival, so we should empower AIGC technology to revisit the resources in the field of ICH and reexplore its potential value. [1] AIGC as а pioneer in technology, digital transformation, is becoming an important engine for the digital transformation of ICH. Digital technology-enabled strategies ensure the continuity and vitality of non-legacy cultures, expand the scope and depth of their dissemination, and provide new governance pathways for the preservation and development of non-legacy. The digital display method mainly based on AIGC technology not only provides a platform for the wide sharing of non-heritage, but also enhances its dissemination and influence by using modern technological means and renews its vitality. [2] However, the application of AIGC in the digital display of non-heritage is still in the exploratory stage, and most of the current research focuses on the technology itself, with insufficient analysis of the conservation effect and long-term impact. This study will fill this gap by systematically analyzing the current situation of non-legacy protection, the trend of AIGC technology and its application in nongenetic inheritance, exploring the potentials

and shortcomings of digital display, and providing new perspectives and innovative solutions for the protection and inheritance of such heritage.

2. Overview of AIGC Technology Fundamentals and Digital Display of Intangible Cultural Heritage

2.1 AIGC Technology and Digital Display of Intangible Cultural Heritage

At present, the emerging concept of AIGC has not yet formed a generally recognized definition. A representative definition of AIGC in China is the integrated definition in the White Paper on Artificial Intelligence Generated Content (AIGC) published by the Information China Academy of and Communications Technology (CAICT), which argues that AIGC is "not only a type of content categorized from the viewpoint of the content producer, but also a type of content production method, and a type of collection of technologies used for the automated generation of content. " [3] AIGC technology utilizes deep learning models to accurately capture and model the diversity of intangible cultural heritage. By combining machine learning, natural language processing, and graphical computing, it automates processes and enhances the user experience, fundamentally changing the way smart libraries operate. [4] Under the wave of digitization, non-heritage items are embodied in virtual space with their rich connotations through AIGC technology. These algorithms, by analyzing and learning from a large amount of data on non-legacy, are able to highly restore the style and of non-legacy characteristics elements, allowing their digital display to fundamentally change the balance of power and authority of the subjects involved in their production. To transform mass practitioners from one-way passive recipients to active participants in the production of non-heritage. It is closer to the original form and conveys the essence of its culture in spirit. [5] AIGC technology faces challenges in innovating ICH displays; despite its ability to handle complex cultural elements and create realistic content, its language model fails to fully understand linguistic meaning and context, resulting in monotonous ICH displays that lack personalization and emotional resonance, which restricts its effectiveness in

certain application scenarios requiring a high degree of personalization and emotional engagement. [6] the key to later research lies in combining technological advantages and human wisdom to ensure the authenticity and infectiousness of the digital display of cultural heritage, focusing on the in-depth application of technology, understanding and respecting the connotation of cultural heritage.

2.2 Analysis of the Fit between AIGC Technology and Digital Display of Intangible Cultural Heritage

The digital display of non-legacy defines a novel presentation method, while promoting the development of interactivity, accessibility and durability of the display of non-legacy, and significantly promoting the inheritance and popularization of non-legacy. Through this kind of display, the rich connotation of nonheritage is able to transcend the limitations of time and space and attract a wider audience, thus injecting new vitality into the dissemination of traditional culture. [7]

(1) AIGC technology provides personalized recommendations to enhance user engagement and experience by analyzing user behavior and preferences. In non-legacy display, it creates emotionally resonant content and vividly presents non-legacy stories.

(2) AIGC technology generates content in various forms, such as text, images, audio and video, to provide an immersive experience.

(3) AIGC technology optimizes algorithms and model training to ensure the accuracy and efficiency of generating non-heritage display content. Through large amount of data training, AIGC model can grasp the core features of non-legacy culture and generate high-quality display content.

3. Exploration of the Application of AIGC Technology in the Digital Display of Intangible Cultural Heritage

3.1 Intelligent Generation of Digitized Content

In the field of digital preservation of intangible heritage, the application of AIGC technology is widely expanding. the digital protection of intangible culture is to apply digital information technology to the rescue and protection of national and folk intangible cultural heritage, and to establish an integrated

digital system based on computer network with the help of digital photography, threedimensional information acquisition, virtual reality and other technologies, so as to realize the protection, inheritance and promotion of intangible cultural heritage. [8] AIGC technology restores artifacts and reconstructs scenes through accurate digitization, presenting historical artifacts and cultural contexts. It improves the accessibility of cultural relics, enhances their educational value and makes learning more intuitive and interactive. In addition, AIGC technology shows great potential in the creation and interpretation of cultural stories. For example, Communication University of China utilized AI to create the country's first AI ink animation Dragon Gate(Figure short film. 1). demonstrating the application of AIGC in animation production. By learning the art of narrative, the technology creates historically accurate and innovative stories that appeal to a wide audience and disseminate culture vividly. It makes the creation and dissemination of cultural stories more efficient and diversified, and can optimize the stories according to audience feedback to enhance attractiveness and dissemination.



Figure 1. Dragon Gate

The application of AIGC technology enriches the expression of intangible cultural heritage and opens up new ways for the innovative inheritance of traditional culture. It enables traditional culture to exist and develop in an innovative way in the digital age, and provides new tools for protection and inheritance. With technological progress, AIGC will play an important role in the fields of cultural relic restoration, scene reconstruction and cultural story creation, expanding a new space for the inheritance and development of traditional culture. With technological advances, many processes that are difficult to describe have been brought to life. Motion capture technology is crucial in recording the instantaneous movements of Li spinning, dyeing, weaving, embroidery and other crafts. By setting up tracking points at key joints, the technology accurately records and animates the movements of the craft, ensuring that the skills are passed on. Video and animation technologies play a key role in the preservation of intangible cultural heritage in digital museums, solving the preservation challenges posed by its movable and instantaneous nature. [9] AIGC technology will play an important role in a variety of fields, expanding new space for the inheritance and development of traditional culture.

3.2 Diversification and Expansion of Communication Methods

Cross-platform communication strategies and social media marketing provide diverse paths new dimensions non-heritage and for communication. the strategy integrates multiple media to build a multi-channel communication network. expanding the audience base and enhancing the coverage and influence of non-heritage information. the instant interactivity of social media promotes the rapid dissemination and discussion of nonheritage content, and community marketing promotes in-depth communication and wordof-mouth dissemination of non-heritage culture through interest groups. In terms of utilizing virtual reality technology to protect nonheritage, the most famous project is the "Forbidden City Beyond Time and Space". This project is a collaboration between the Palace Museum and IBM, which aims to provide visitors from all over the world with a way to appreciate and explore Chinese history and culture. [10] the project is to utilize diversified means of dissemination, which not only enhances the social recognition of nonheritage, but also provides a more active social environment for the inheritance and development of non-heritage. the diversification and expansion of such means of dissemination fully demonstrates the extensive potential of the dissemination of non-heritage in the digital era, and provides strong support for the global sharing of non-heritage and the protection of cultural diversity.

Artificial intelligence technology has opened up new perspectives in the digital display of non-heritage, promoting the protection and

innovation of traditional culture. Technological advances have made the application of AIGC non-heritage display more in explicit. including technology integration, content expansion, user participation and standardization construction. These technological advances have expanded the dimensions of NRH display and provided a solid foundation for digital preservation and inheritance. By utilizing these technologies, the protection of intangible heritage is more efficient and comprehensive, ensuring a lively and lasting transmission of cultural heritage.

4. The Progressive Path of Digital Display of Intangible Cultural Heritage Empowered by AIGC Technology

4.1 Path Planning for Technology Integration and Innovation

Non-legacy is a dynamic practice that needs to be passed on in a living state. In today's market economy, non-legacy needs to seek to meet the objective laws of market and industrial maintaining development, while the authenticity, diversity and richness of traditional culture and skills, and to realize sustainable development through the mutual coordination and joint efforts of all elements and forces of the new ecosystem. [11] Crossdisciplinary technology integration strategies are crucial in the planning of technology and innovation pathways. the diversity and complexity of non-heritage leads to a variety of methods of presentation, providing a wide range of options for the transmission of information and the display of culture. The evolution of these display methods demonstrates profound impact the of technological progress on the way of cultural dissemination, and opens up new wavs for the inheritance and promotion of NRH. In order to improve and enrich the interactivity of the display of non-heritage content and the effectiveness of information dissemination, the experiential feelings of human perception and access to information should be fully and effectively mobilized from the seven perspectives of sight, hearing, touch, taste, smell, knowledge and time, so as to provide references for the digital display design of nonheritage. [12] By combining AIGC technology with other fields such as virtual reality (VR), augmented reality (AR), 3D modeling and

other technologies, It can provide a richer and three-dimensional experience for the digital display of non-heritage. This cross-discipline technology integration can not only enhance the interactivity and immersion of the display of non-legacy, but also continuously promote the innovation of the display of non-legacy through technological innovation.

4.2 AIGC Technology and Digital Non-Heritage Community: a Dual Drive for the Development of Non-Genetic Inheritance

AIGC technology brings new perspectives to the digital display of non-heritage, enhances personalization and interactivity, and vividly shows its cultural connotation and artistic characteristics. In-depth studv of the background and value of intangible cultural heritage can enhance the depth of display and audience understanding, and the technology promotes the integration of resources and the diversification and internationalization of display content, which helps cultural exchanges and the enhancement of the global influence of intangible cultural heritage. Intangible cultural heritage can satisfy modern people's pursuit of national art, spiritual return, ecological and environmental protection, leisure and entertainment, and provide rich content resources for new media. At the same time, new media also gradually penetrate into all aspects of the cultural industry chain, forming new consumption points and profit points, and constituting a new carrier for the inheritance and development of intangible cultural heritage. [13] Mining the connotation of non-legacy is the key to enhance the effect of digital display, and studying its value characteristics can optimize the audience's cognitive experience. the use of modern technology can enhance the interactivity and three-dimensionality of the display, and improve the audience's sense of participation and immersion.

The digital non-legacy community is of great significance to the protection and inheritance of non-legacy. Promoting the standardization and normalization of display and establishing scientific standards and norms can enhance professionalism and lay the foundation for innovation in the protection of non-heritage. Communities optimize user experience through interactive display, deepen understanding and emotional resonance, and

stimulate interest. For example, Beijing Dongcheng and Chaoyang "non-heritage in the community" pilot, through a number of measures to give play to the positive role of non-heritage, to provide residents with cultural experience and learning opportunities, and to consolidate the social foundation of nonheritage inheritance.

5. Case Study and Practical Exploration

In the field of digital display of non-heritage, cases at home and abroad provide experience. Taking the Jingchu Textile Nonheritage Museum of Wuhan Textile University as an example, analyzing this case helps to understand the application effect of AIGC technology in nonheritage display and the problems and challenges encountered.

Case Study: Digital Display Practice of Jingchu Textile Non-heritage Museum

The digital display practice of the Jingchu Textile Non-Heritage Museum (Figure 2) is a model of digital transformation. [14] the museum utilizes AI-generated content technology to digitally display the rich textile art of the Jingchu region.



Figure 2. Jingchu Textile Non-Heritage Museum

The museum uses AIGC, 3D modeling and virtual reality technology to create a "Chinese ancient loom virtual simulation experiment" (Figure 3).



Figure 3. Webpage Interface of "Virtual Simulation Experiment of Ancient Chinese Loom"

Combining artificial intelligence technology

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and virtual simulation, the "Ancient Chinese Loom Virtual Simulation Experiment" project innovates the digital protection and inheritance of intangible cultural heritage and utilizes technologies such as computer vision and natural language processing to realize the accurate simulation and dynamic display of the ancient loom, which provides a new way of interactive learning. As a multidisciplinary research platform, the project supports multilanguage and network sharing, and users can experience the weaving process immersively through VR and AR technologies, which enhances the realism and participation of learning, innovates the methods of nonheritage research. and promotes the development of Chinese traditional culture. The application of AIGC technology in the field of non-heritage is promising, which will promote the education of non-heritage culture to enter a new stage and make the future education more intelligent, personalized and efficient.

6. Conclusion

The digital era brings new opportunities and challenges for the protection of intangible cultural heritage, and AIGC technology provides innovative solutions for the digital display of intangible cultural heritage. This study shows how the project "Virtual Simulation Experiment of Ancient Chinese Loom" utilizes AIGC technology to open up a new path for the display and inheritance of intangible cultural heritage through case study, which not only enriches the form of intangible cultural heritage display, but also creates an interactive learning environment through experience, improves immersive the interactivity and accessibility of intangible culture display, and injects new vitality into the dissemination of traditional culture. AIGC technology not only enriches the form of nonheritage display, but also creates an interactive learning environment through immersive experience, improves the interactivity and accessibility of non-heritage display, and injects new vitality into traditional cultural dissemination. However, the application of AIGC technology in the field of non-heritage also faces challenges such as data privacy and algorithmic bias. In the future, the promotion of further research and policy support in various industries will ensure the healthy

development of AIGC technology, which is expected to revitalize the non-heritage in the modern society and strongly support the protection and inheritance of traditional culture.

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References

- HUANG Yonglin, TAN Guoxin. Research on Digital Protection and Development of Intangible Cultural Heritage in China [J]. Journal of Central China Normal University (Humanities and Social Sciences Edition), 2012, 51(02):49-55.
- [2] Niu Jinliang. the logic of digital technology empowerment for intelligent communication of intangible cultural heritage [J]. Journal of Social Sciences of Hunan Normal University, 2020, 49(05):150-156. DOI:10.19503/j. cnki. 1000-2529.2020.05.019.
- [3] Zhu Yu, Ye Jiyuan, Jia Yujie. Artificial Intelligence Generated Content (AIGC) for librarianship: conceptual framework and research progress [J/OL]. Library Forum:1-10 [2024-09-09]. http://kns. cnki. net/kcms/detail/44.1306. G2.20240903.1045.004. html.
- [4] Xiaocheng L. Smart Library Transformation Research Empowered by AIGC Technology [J]. the Frontiers of Society, Science and Technology, 2023, 5(8).
- [5] GUO WANCHENG, WANG X, GAO HONGHE. Research on the application of AIGC technology in art design [J].

Footwear Craft and Design, 2024, 4(09):91-93.

- [6] Huang Yonglin, Yu Zhaochen. the Development Orientation and Innovative Expression of Intangible Cultural Heritage under the Perspective of Technology [J]. Ningxia Social Science, 2022(03):198-206.
- [7] Yao Guozhang. Digital development and key technology application of intangible cultural heritage [J]. Journal of Changzhou University (Social Science Edition), 2021, 22(04):106-116.
- [8] TAN Biyong, XU Congjun, ZHANG Ying. Technology-culture-institution:A review of the digitization of intangible cultural heritage [J]. Zhejiang Archives, 2011(06):30-33. DOI:10.16033/j. cnki. 33-1055/g2.2011.06.004.
- [9] Lin Yihong. Research on the Protection of Intangible Cultural Heritage Based on the Perspective of Digitization Technology--Taking the Traditional Spinning, Dyeing, Weaving and Embroidery Crafts of the Li Ethnic Group as an Example [J]. Ethnic Art Research, 2011, 24(05):116-121. DOI:10.14003/j. cnki. mzysyj. 2011.05.001.
- [10] WANG Jianming, WANG Shubin, CHEN Shipin. Research on the Protection Strategy of Intangible Cultural Heritage Based on Digital Technology [J]. Software Guide, 2011, 10(08):49-51.
- [11] Gao Y. Building a new ecology for sustainable development of textile nonheritage [J]. Textile and Clothing Weekly, 2017(46):20-21.
- [12] Lv Yanru, Zhang Li. Innovative application of new media technology in digital display of intangible cultural heritage [J]. Packaging Engineering, 2016, 37(10):26-30+10. DOI:10.19554/j. cnki. 1001-3563.2016.10.008.
- [13] Zhao Hailong. Research on the development of intangible cultural heritage under the perspective of new media [J]. News Knowledge, 2014(09):63-65.
- [14] Zhang Lei. Research on the Protection of Jingchu Textile Intangible Cultural Heritage Based on the Concept of Ecomuseum [J]. Costume Guide, 2020, 9(04):28-33.