

Application and challenges of digital scanning and artificial intelligence technology in the restoration of garden landscape sites

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ABSTRACT

This study explores the application of digital scanning and artificial intelligence technology in the restoration of landscape heritage sites, focusing on analyzing its advantages in high-precision data collection, three-dimensional reconstruction and public interaction. Digital scanning captures the fine structure of the site, while artificial intelligence improves the restoration accuracy through image analysis and information completion, and promotes virtual display. The study also discusses challenges such as equipment cost, data accuracy and cultural sensitivity, emphasizing the need to better balance technological innovation and cultural authenticity in future applications to enhance the effect of digital restoration and public participation.

KEYWORDS

Digital Scanning; Artificial Intelligence; Landscape Heritage Restoration; Cultural Preservation

1 Introduction

Digital scanning with artificial intelligence is the means where contemporary technologies come to the rescue of the devoted landscape protection. Ancient structures are sturdy, and their 3D scanning along with virtual reproduction can either save or sustain them. While the digital scanning technology can lead to the recreation of the outer side of the building, artificial intelligence technology can ensure the reconstruction of this building, thanks to such tools as image processing, pattern recognition, and similar methods. This type of technology is highly applicable in cultural heritage preservation, which can assist not only for accurate data capturing but also improvements in the restoration procedures and the citizen-to-science interaction. This project intends to elucidate the benefits of utilizing digital scanning and artificial intelligence for conservation and restoration of cultural relics and research the emergence of humanistic and technical challenges resulting, which will shed light on the current cultural heritage preservation efforts in my nation^[1].

2 The Application Advantages of Digital Scanning and Artificial Intelligence in Landscape Heritage Restoration

2.1 Enhancing Data Accuracy and Detail

Digital scanning is of high accuracy and detail area measurement, which plays a critical role in the preservation of cultural relics and constructions. Through a 3D live building scan, we can achieve

high accuracy in the shape of the building looks, so that the resulting virtual model can be very realistic and vivid. Alongside that, the utilization of artificial intelligence technology to conduct restoration tasks for image analysis and pattern restoration in ancient buildings may further be purposed for strong restoration with guarantees of authenticity of the virtual restoration. For instance, AI can apply auto post-processing and data insert to cover up or solve the shortcoming of the scanning process, in turn making a considerable improvement in the restoration of cultural objects^[2].

2.2 Improving Restoration Efficiency

Artificial intelligence technologies that are being used today have massively improved the efficiency of fixing sites to whatever is required. Traditional repair methods mainly perform manual work, which is considerably time-consuming and pricey. With the full support of artificial intelligence, the restoration of sites can accomplish intelligent automation events, and complex image processing, structural restoration, and virtual reconstruction can occur in real-time. The inherent technology, which is set to be implemented, will significantly minimize the manpower and material resources used in restored sites, as well as improve their recovery process, thus proving an economical and effective way of restoring large locations^[4].

2.3 Facilitating Public Engagement and Accessibility

The effective outcome of the digital scanning and artificial intelligence technique not only hinges on the length of its usage but also on user engagement since it will be capitalized if many students are involved in the educational process. Through the assisted and enriched awakening of the pages in the historical relics on the digital platform, the public is not only exposed to what is on the website but also acquire and better understand the history and cultures beside enhancing their experience. It can be said that this new technological advancement is able not only to help more people join the effort of cultural heritage safekeeping but its paths of cultural transmission are also going to be opened. Virtual visits and interactive activities that are conducted with the provision of digital technology help the public transcendent geographical constraints and surmount learning barriers^[3].

3 The Main Application Methods of Digital Scanning and Artificial Intelligence in Landscape Heritage

3.1 3D Modeling and Virtual Reconstruction

3D models are an important means of virtual restoration of sites. Researchers digitally reconstruct and restore ancient buildings and express their fine geometric features. Such models not only provide a solid theoretical basis for theoretical research, but also provide citizens with a virtual place. By adopting technologies such as virtual reality (VR) and augmented reality (AR), 3D models can also be used to create an immersive environment, thereby realizing the protection and inheritance of the cultural value of historical buildings^[5].

3.2 AI-driven Image Analysis and Restoration

The use of artificial intelligence technology for image analysis and cultural relics restoration can improve the accuracy of site restoration. Artificial intelligence can automatically identify and analyze

damaged parts, and use deep learning algorithms to automatically complete damaged parts, thereby improving the authenticity of the restoration effect. This solution reduces labor costs while making the restoration process more systematic and efficient. For example, using deep learning methods, artificial intelligence can more accurately reconstruct complex images and provide strong technical support for cultural relics protection^[6].

3.3 Interactive Virtual Tours

Virtual tour technology allows tourists to interact with cultural relics in a virtual context, improving educational functions and participation. "Virtual tour" is a way of communication across time and space that transcends time and space. Such interaction not only increases citizens' interest in monuments, but also helps to spread the historical and cultural value of monuments through digital tools, thereby promoting the identification and protection of cultural heritage to a greater extent^[7].

4 Application Practices of Digital Scanning and AI in Landscape Heritage Restoration

4.1 Case Study: Digital Restoration of the South Gate of Shangjing Palace City

In pairing the concept of digital reconstruction with the South Gate of Shangjing Palace City in the Liao Dynasty of China, researchers resorted to digital scanning and the use of artificial intelligence technology. Through these means, the exact architectural form of the actual structure can be realized. The conception of this study is as follows: acquire detailed information by 3D laser scanning of the site, deploy artificial intelligence technology for data processing, and complete the restoration of the building to reach the end goal, which is virtual restoration. This sustained both the original South Gate appearance and allowed tourists to virtually enter the place, which positively influenced its public demonstration and dissemination^[8].

4.2 Challenges in Technical Implementation

Even though digital scanning, AI, and many others have given reasonable results during the restoration of relics and ancient buildings, the above problem with technology lies in its high equipment cost and data inaccuracy. Currently, the cost of digital scanning equipment, such as LiDAR, is high, and your system requires qualified maintenance personnel to be operated. More than that, the control of input data/information as well as the limitation of growing computational speed slows down the process of implementation. To achieve precise results of the restoration, the technical team regularly applies multiple scanning and data processing means, which may extend the time and the budget of the project^[9].

4.3 Addressing Cultural Sensitivity

Cultural relics' authenticity versus effective digital presentation is one major problem of the field, which needs to be solved. In digital art restoration, our restoration relies heavily on human intervention. Furthermore, the possibility of new interpretations or unnecessary editing of the original artwork can hinder its authenticity. Hence, culture-centric architectural design must be accommodated appropriately to avoid any hindrance to the system. It is crucial that cultural heritage in a digital environment retains its original shape and historic values within the bounds of

its stylistic features to the greatest extent possible and that, in unpredictable conditions, no excessive digital processing of cultural relics takes place. Moreover, digital display design should aim at improving people's knowledge and respect for cultural heritage by taking into account the visual effects, but does not diverge from authenticity, as a result, there will be more enjoyment and respect for cultural heritage^[10].

5 Conclusion

So to conclude, digital scanning and artificial intelligence show great application prospects in the restoration of gardens and ancient buildings, which certainly can guide high-precision data acquisition, virtual reconstruction, and public interaction ideas in new ways. Besides assisting in the cultural relics protection, it has become a channel through which the public participate in the protection work and enjoy the appeal of cultural relics, which are seen as witnesses to history. However, the speedy advancements in science and technology call for enhanced intersectional collaboration and civic participation in the future. By engaging in multidisciplinary research, we can further take advantage of the guidance that heritage domains such as archaeology, computer science, and visual art offer, ensuring that the development of a coherent and efficient digital restoration system is achieved. Thirdly, the constituent get-together and the feedback of citizens can develop the cultural susceptibility and social acceptance of the reconstruction plan simultaneously. The result of this study may serve as a springboard for creating new ideas and methods for carrying out successful retention of cultural relics in our country.

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