

Research on the Application of Artificial Intelligence in Intelligent Services of Museums

--Taking the National Palace Museum as an example

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Abstract. In many museums in China, the use of artificial intelligence for transformation has been a new path of development. At the same time, the use of artificial intelligence technology has broken through the limitations of time and space, allowing people to visit museums anytime and anywhere, to get the information they need, and to observe and experience all aspects of the museum's activities. The use of artificial intelligence technology for museum development has great relevance and value to the development of museums. This paper discusses the intelligent development path of the Forbidden City Museum from the perspective of several intelligent services, such as intelligent reception, intelligent exhibition and intelligent tourism, and makes relevant suggestions in this regard.

Keywords: artificial intelligence; museums; digitalization; the Palace Museum.

1. Application of artificial intelligence in museums

Artificial intelligence is an applied technology that integrates a variety of disciplines, including computers, physics, linguistics and other disciplines, simulating and surpassing human intelligence, as a purpose, the application of high-tech technology to the machine, so that the machine has the same thought and behavior as humans. As an important carrier of human material and spiritual civilization, museums are charged with the historical task of collecting, preserving, disseminating and displaying human beings and their environment. At the advent of the era of artificial intelligence, museums will transition from primary intelligence to higher-level intelligence, and artificial intelligence will bring new vitality and development opportunities to museums. Through a summary of museum technology systems and specific practices, the article discusses how AI can be applied to museums and dissects the development opportunities it presents.

The State Administration of Cultural Heritage held "Hyperlinked Museums: New Approaches, New Publics" in Shanghai in 2018 and launched "Passing on Culture with Technology: the AI Museum Project" with Baidu to make culture come alive through artificial intelligence technology." The "AI Museum Project" is supported by a series of Baidu products and technologies, including intelligent search, intelligent maps, image recognition, voice navigation, machine translation, AI education and so on. In fact, before the implementation of the "AI Museum" project, many museums at home and abroad are trying to interact with artificial intelligence technology with the audience in order to enrich their visiting experience and maximize its social value.

In domestic museums, the Qin Shihuang Imperial Tombs Museum and Baidu have joined forces to launch the "Baidu Qin Shihuang Terracotta Warriors Intelligent Restoration Project", visitors can simply use the Baidu AR function to "wake up" the army of Qin Shihuang's tomb; in 2018, the tomb of Qin Shihuang, users can use AI technology to take photos of these artifacts and let them "speak". In foreign museums, the U.S. National Museum uses Dexibit software to forecast visitor visits in order to analyze them. The National Museum of Norway is also experimenting with machine learning and deep neural network technology, using machine vision to identify and label images and to compile statistics on the collection.

The combination of AI technology and museums will promote the development of museums, allowing visitors to "talk" with cultural relics, and improve the operation and services of museums, especially the future development and use of robotics and neural network technology, will promote the direction of intelligent museums.

2. The Palace Museum's artificial intelligence service status

In today's era of artificial intelligence and big data, museums have begun to try to use artificial intelligence technology to meet the needs of the public. The Forbidden City is the largest cultural heritage in Chinese history, with thousands of years of history of precious cultural relics, in recent years, the Palace Museum gradually get rid of the solemnity of the past, in line with the trend of the era of artificial intelligence, artificial intelligence technology into intelligent reception, intelligent exhibition, intelligent tours and other intelligent services, can make more people have the autonomy to selectively visit the Forbidden City, so that the image of the Forbidden City has become more affable and interesting, thus promote the sustainable development of traditional culture.

2.1 Intelligent reception

Intelligent reception is an intelligent service that can monitor the resources, visitors, staff and managers of the scenic spot in real time, and strengthen the intelligent management system through a seamless connection with tourism-related departments, ultimately achieving effective protection of scenic resources.

Back in 2017, the Forbidden City has opened 80,000 daily online reservation tickets nationwide, and online ticketing is gradually gaining recognition and support. With the help of big data, the scenic area has implemented time-slotted ticket sales, allowing visitors to enter the park at their own choice during specific time periods. Scenic area management uses the big data platform to grasp the basic information such as the flow of people and vehicles in the scenic area and guide visitors to visit scientifically, which is conducive to real-time monitoring of the scenic area from multiple angles in an all-round way to ensure the safety of visitors.

2.2 Intelligent Exhibition - Duanmen Digital Museum

Intelligent museum through the existing collection of digital processing, such as 3D animation, so that the collection in digital form, in a vivid, realistic digital form, presented on a variety of digital media, coupled with human sensing and artificial intelligence assistance, so that the collection can be based on the actions of the audience, intelligent display. Through the display, so that the cultural relics "live", so that people from "passive visit" to "active participation", a deeper understanding of the connotation and value of cultural heritage.

The "Duanmen Digital Museum" of the National Palace Museum is a digital technology as a carrier to the Forbidden City's digital, virtual form of "cultural heritage" interactive display space, is the use of new technologies, new media on the history of the Forbidden City and the traditional art of a new interpretation and performance. In the design of the exhibition hall, highlighting the organic combination of the Palace's historical architecture and digital display space; in the design of exhibits, the use of digital technology to overcome physical barriers, different types of cultural relics in one space. At the same time, also for the type of cultural relics and display requirements, a variety of forms of interactive and display, in order to enable readers to more intuitive, more comprehensive understanding of the Palace collection.

The designers divided the theme of "The Forbidden City is a museum" into three exhibition areas. The first is "From the Forbidden City to the Forbidden City," which is located in the center of the Duanmen Tower, so that all who enter the tower can see it at first glance. This section, taken as a whole, allows the audience to have a more complete understanding of the history of the Forbidden City and the Forbidden City. Secondly, the Forbidden City, an area located on the east side of the tower, is divided into seven exhibits that digitally show the audience the paintings, calligraphy, artifacts, interior furnishings, costumes and embroidery artifacts of the Palace. It allows everyone to interact with the collections of the National Palace Museum in the most intuitive and realistic way. Third, "The Forbidden City - The Palace of the Son of Heaven", an area located on the west side of the Citadel, with a relatively independent display area. The exhibition presents a new perspective on the interior and exterior of the ancient architecture of the Forbidden City in its most detailed form.

All of the exhibition programs are dedicated to providing visitors with an engaging experience, a sense of satisfaction, that is, a comprehensive and correct understanding of the collections and an enhanced communication with the ancient architecture. Taking into account the different types of collections, the Palace Museum presents the digital virtual forms of the artifacts in an intelligent way, giving the audience a comprehensive understanding of history, culture, and traditional art. And in the visual image design of the exhibits, each exhibit follows a simple and elegant artistic style, despite the different display contents and interaction methods of each exhibit.

2.3 Intelligent tour - VR technology tour

Through the observation and analysis of the tour process, the purpose of the Forbidden City visitors visit include: to understand the history of the Forbidden City, to participate in special exhibitions, to feel the festive atmosphere, to feel the history, to enjoy the special services, etc.. The diversity of visitors reflects the comprehensive development of all aspects of the work of the Forbidden City, as well as the diverse charm emanating from the Forbidden City culture, while also indicating the direction and direction for the future development of the museum. Virtual Palace Museum VR demonstration system is mainly applied to the promotion of the Forbidden City culture and the experience of the Forbidden City tourism, virtual scene construction within the virtual Forbidden City, set dynamic water, lighting, panoramic views and other three-dimensional objects, thus improving the simulation of the virtual system.

Wang Yuegong, deputy director of the Palace Museum, mentioned at the 2020 VR Industry Global Summit that VR technology occupies a pivotal position in the Palace's digital Forbidden City system. The Palace introduced panoramic VR technology to create a "Panorama Palace" feature that allows visitors and spectators to experience a 360-degree panoramic view of the Palace and to access parts of the Palace that are not yet open through VR technology. During the epidemic, the number of visitors per day has exceeded 300,000, popular with the majority of users. In the Forbidden City's VR showroom, visitors can view the "Forbidden City - The Emperor's Palace" in virtual reality. Through the VR experience, you can look down on the Forbidden City from the air, but also virtual archaeology, the Forbidden City and Jingdezhen's palace kiln site for in-depth research, to appreciate the Forbidden City corner tower unique "nine beams and eighteen pillars and seventy-two ridges" construction process, so we better appreciate the ingenuity of the ancients.

Nowadays, there are more and more technology-based, digital museums, AR and VR and other high-tech can not only bring more information to visitors, but also through advanced technology, the details of history, through the latest technology, so that these relics "live".

3. The development of intelligent services on the National Palace Museum recommendations

3.1 Strengthen the intelligence of passenger flow monitoring

"can't walk", "can't squeeze in", "can't see" and other problems have a great impact on the museum visitor experience. The use of artificial intelligence for scientific traffic flow measurement and control of restricted traffic flow is of great practical importance to improve the quality of visitors' tours, safeguard the lives of visitors, and protect the safety of museum artifacts.

As early as 2013, the Forbidden City set up a "visitor safety monitoring system" to achieve real-time collection of visitors. The system allows the Palace to understand the immediate flow of visitors in each area and thus determine the overall capacity of the area. Today's museums should be based on the experience of audience reception, grasp the law of audience visits, safety-oriented, audience-centered, scientific calculation of the maximum number of visitors, the use of intelligent monitoring technology, so that the museum better understand the flow of visitors, and thus enhance the experience of visitors.

3.2 Innovative tour guide methods

Interpretation service is an important part of the guided tour service, which transmits joy in interaction while allowing the audience to feel the richness of cultural heritage, thus allowing the audience to respect heritage culture from the heart and assume the mission of inheriting culture and social education.

The museum should provide the same tour experience to different visitors by equipping a set of interpretation equipment including multiple languages, such as English, French, German and Spanish, and non-common foreign languages such as Urdu, Nepali and Bengali, on the basis of traditional guide services to meet the needs of visitors from various countries for guided tours. In addition, interpretation voice packages in ethnic languages such as Tibetan and Uyghur and dialects from all over China can also be developed.

With the development of artificial intelligence technology, we should accelerate the development of intelligent navigation system similar to the "palm of the Forbidden City", which provides palace interpretation, route pushing, points of interest and other functions, and enables visitors to find the exhibits they are interested in through GPS precise positioning, and provides more convenience and rich navigation options.

3.3 Expanding online services

With the continuous development of the country's higher education, the audience's awareness level and learning styles are becoming more and more diversified. In the process of visiting, audiences can not only experience the authenticity of cultural relics firsthand, but also improve their knowledge systems and enhance their visiting experience through online methods.

The Palace Museum uses both "digital exhibits" and "cloud exhibitions" to allow visitors to choose the right online collection service for their needs. Learning to use a variety of channels to carry out online services: "Palace Forum" online lectures, "panoramic Palace" in the form of virtual displays to lead visits to the Palace; "digital collection" for visitors to provide "I want to go to the Forbidden City" micro-classes, guide children into the Forbidden City, feel the traditional Chinese culture, to provide personalized cultural services for the audience, but also to meet the audience's diverse psychological and cultural needs.

Today, museums' online services are flourishing, and major museums around the world are providing diversified online services to visitors, however, the lack of audience interaction is a common phenomenon in various forms of online exhibitions from domestic and international. As a result, there is room to improve the level of engagement with audiences in online museum services.

Most museums' online models appear homogenized, mostly with cloud exhibitions, digital exhibits and live broadcasts, while museums provide information to audiences in the form of output, rather than understanding the needs of audiences according to their own strengths and the content of their exhibitions, and audiences are always in a passive state of listening and understanding. At present, the urgent problem that most museums' online services need to solve is still how to communicate knowledge to audiences through effective interaction.

Human-object communication is a natural advantage that museum online services do not have. Therefore, the museum's online visit mode must be innovative in thinking and interacting with the audience in the cloud without the restriction of physical space and with the platform of the Internet, thus making the connection between the audience and the museum closer.

4. Conclusion

The advent of the era of big data has led to tremendous changes in the collection, storage, analysis, and utilization of data. As a public cultural and educational organization that provides knowledge, education, and appreciation to the public, museums are bound to be impacted by innovations in data application technologies. How to obtain useful information quickly and apply it to the public among the many data is the new problem and new opportunity faced by museums.

Currently, museums in China have made remarkable achievements in the digitalization process, but there are still shortcomings in intelligent services. In the era of artificial intelligence, under the guidance of the "service-oriented" functional transformation policy, museum construction should focus on new technologies, with the Internet of Things, artificial intelligence and other modern new technologies to create intelligent museums, establish a sound intelligent services, to provide better personalized services for the audience. Only in this way can we better promote the construction of intelligent museums, in order to make its long-term, healthy development.

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