Application of Artificial Intelligence in Cultural Heritage Protection

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Abstract. With the continuous development of science and technology, artificial intelligence has become the subject of extensive discussion in recent years. Artificial intelligence technology uses deep learning to apply this, it shows the trend of high development, such as the previous Go game that shocked the world, the fact that artificial intelligence "Alphago" defeated the world Go champion, people realized that the development of artificial intelligence exceeded people imagination. Various social industries are gradually introducing artificial intelligence technology to give them new vitality for development. This is exactly how the cultural heritage protection process should be combined with artificial intelligence technology. Cultural protection should enter the digital era, using virtual reality technology and applying segmentation algorithms to segment the prospects of cultural heritage. Complete all aspects of cultural heritage protection without applications. This article introduces the process of artificial intelligence in the protection of cultural heritage using virtual reality technology to realize the digitization of cultural heritage, realizing that the protection of cultural heritage keeps pace with the times. The experimental results of this paper show that the virtual reality technology combined with artificial intelligence is applied to the importance of cultural heritage protection, which improves the vitality of cultural heritage and more perfectly shows the charm of cultural heritage application.

Keywords: Artificial Intelligence, Cultural Heritage Protection, Virtual Reality Technology, Segmentation Algorithm

1. Introduction

1.1. Background and Significance
It was first created in the middle of the last century. In recent years, with the development of neural networks, intelligent algorithms, cloud computing and other related technologies, artificial intelligence has made great breakthroughs in computing power and applications, and has caused great breakthroughs in all sectors of society. Of interest [1, 2]. It has become an object of public interest and is also appreciated in national strategies. After 50 or 60 years of development, artificial intelligence has been widely used in our lives, which is closely related to our lives, and has brought profound changes to all sectors of the social production industry.
Since the beginning of this century, China has paid special attention to the protection and inheritance of intangible cultural heritage. At present, the intangible cultural heritage protection system has been established in advance, and 1372 items have been selected from the national intangible cultural heritage list. From the initial "exclusive protection" to "productive protection", continuous research, reflection and completion of the concept of intangible heritage protection and heritage [3]. In recent years, "industrialization" has become a new trend. Starting from the inherent needs of intangible heritage and the protection of heritage, we can proceed from this perspective. The discussion of artificial intelligence for the protection of cultural heritage has practical significance.

1.2. Related Work
Cultural protection and artificial intelligence (AI) have a long history. However, in recent times, exchanges and cooperation between these two fields have become less common. Hassabis D believes that a better understanding of biological brains can play an important role in artificial intelligence in building artificial intelligence machines. The historical interaction between the fields of artificial intelligence and neuroscience is investigated, and the latest advances in artificial intelligence are highlighted, which are inspired by the research of neural computing in humans and other animals. Finally, the experts emphasized the common theme, which may be a key step in advancing future research in the two fields of cultural protection and artificial intelligence. However, his research process is very complicated and the results are not very accurate [4].

Experts believe that artificial intelligence systems are program systems with extensive professional knowledge and experience. It uses artificial intelligence technology to make judgments and inferences based on the knowledge and experience provided by experts in a specific field. It imitates human experts to make reasonable decisions and solve complex problems that require expert decisions. A complete system can supplement design, planning, forecasting, evaluation, monitoring, decision-making and many other fields, and the established expert system can restructure and model cultural heritage.

1.3. Innovation
At present, the development of digital protection technology for cultural heritage mainly focuses on the following aspects

(1) The modern interactive development of digital information retrieval technology, modeling technology and virtual stage display technology for displaying cultural heritage enables users to interact without distance from cultural relics, and realizes full interaction between users and cultural products [5].
(2) Archaeological excavation virtualization uses virtual reality technology and the preliminary virtual archaeological experience of virtual archaeology to reshape the archaeological excavation process in a complete, multi-layered and clear way.
(3) Use 3D images in cultural heritage technology, and intelligently use cultural heritage sound, image capture technology and computer-aided design system for protection research. Advanced technologies such as information visualization and reverse engineering image processing have realized the three-dimensional digitization of cultural relics. Completely record the components and reorganization of one-dimensional, two-dimensional, three-dimensional and even multi-dimensional information on cultural relics.
(4) The improvement of life style uses virtual reality technology to make and use traditional handicrafts.

2. Foreground Segmentation Algorithm
After capturing the photo sequence of the old building, the preprocessing of the photo can be converted into the image needed for reconstruction photo.

Main image processing used to perform image removal, image enhancement, camera calibration and geometric correction of the target area.
2.1. Morphological Reconstruction

This section mainly uses the idea of morphological reconstruction to eliminate unnecessary drainage problems. Because the drainage already has poor edge texture, the mesh is sensitive to noise, and excessive separation will occur during the separation process. In this part, the morphological reconstruction operation is mainly used to simplify the gradient image, accurately locate the contour line of the segmented area and eliminate the root cause separation degree [6, 7]. When segmenting, you need to mark the segmented area and define structural elements, and expand the segmented area until the segment area is full of structural elements. It effectively solves the excessive insulation caused by noise and weak texture area. The following is mainly reconstructed from the form, marking the drainage and expanding the minimum operation to solve the division and cutting of the excess drainage. The morphological reconstruction watershed gradient calculation formula is as follows:

$$\text{grad}(X) = (x \oplus b) - (x \otimes b)$$  \hspace{1cm} (1)

The morphological reconstruction watershed gradient calculation formula is as follows: In order to solve the phenomenon of excessive separation in the traditional water algorithm, the solution also includes the minimum operation of marking the segment area and expansion. Calculate the local minimum in the gradient map image through the extended minimum operation, use the local minimum to mark the segmentation area, compare the minimum extended size and the segmentation threshold to delete points from the image below the separation threshold, and extract only the label of the separation value area.

$$\Rightarrow I_c^{\text{mark}} = \text{HMIN}(\Rightarrow I_c^{\text{BLPF}} / h1)$$  \hspace{1cm} (2)

$\Rightarrow I_c^{\text{mark}}$ Indicates the minimum value of the image expansion, $h1$ indicates the given local minimum.

2.2. Watershed Algorithm

The idea of watersheds and watersheds in terrain is used in the development of image processing water segmentation algorithms. This method is mainly divided into water-based subsidence algorithm and rainwater-based drainage ridge model [8]. The first was discovered by Vincent and Soille on the basis of their predecessors. The algorithm mainly imitates the latter process of the flood, which is reflected by Corbin from another angle. It is an improvement of the former method. The latter is largely similar to whether it is based on the sinking method or the rain-based model. The authors have studied the analysis of many different watershed algorithms can be divided into the following three steps:

1. Describe the process: randomly access the given pixels and scan all the pixels in the image at the threshold scan width level.
2. Organization process: The best way to deal with data is to organize data.
3. Immersion process: After all pixels are sorted, the image watershed is submerged, starting from the smallest point of the image watershed pixel value. The method of measuring the overlapping area in the segmentation algorithm.

$$M_{\text{MO}} = \frac{2MO}{A1 + A2}$$  \hspace{1cm} (3)

Among them, $A1A2$ respectively represent the segmentation area and the real area. When $M$ and the threshold are compared, the performance of the segmentation algorithm can be measured. This method is widely used in satellite images and medical images.

2.3. Regional Consolidation

The color of each area of the image will be different, and the divided image will form different parts of the image. In the images of different colors, you can see that the front and background have been divided, just like seeing the shape of the related image.
Separating the background and front into small areas of the image means there will be fewer intersections and edge points, which can easily lead to excessive separation. The usual solution is to use other algorithms to merge small and medium parts of the vision, and then merge the entire area into a whole. The division and integration of regions are two interrelated methods of processing images, and the region that separates and combines conditional judgments is the consistency of regional gender characteristics. In image processing, due to the abnormal separation of regions, if the attributes of many regions of the image do not conform to the principle of measurement consistency [9]. However, if the features of many regions in the image meet the principle of measurement consistency, regional integration will be formed. To a certain extent, regional integration can be compared to regional growth, but the difference between the two is that regional growth is the continuous growth from the seed point to the development of the entire region. Regional integration is based on the process of merging between regions and adjacent regions.

3. Experiment of the Virtual Display System for Cultural Heritage Protection
The virtual reality system is also known as the Virtual Reality Platform. It provides users with an immersive, interactive and imaginative application platform that provides unparalleled and impressive virtual world clothing display and virtual reality the combination promotes the virtualization process of the museum.

3.1. Vr System Classification
Virtual reality systems (VR systems) can be divided into four: desktop virtual reality, immersive virtual reality, augmented virtual reality, and distributed virtual reality.

| Product characteristics | application fields of developing | software           | hardware equipment     |
|-------------------------|----------------------------------|--------------------|------------------------|
| Panoramic technology    | Stereoscopic glasses             | Low hardware       | CAD/ CAM               |
| software QuickTime vr   |                                  | requirements       |                        |
| Virtual reality modeling| Location tracker                 | The cost is relatively low | Planning and design   |
| language VRML           |                                  |                     |                        |
| Network 3D interactive  | Data glove                       | Yipu and its promotion | Architectural design   |
| cut3d                   |                                  |                     |                        |
| Java3D                  | Projection equipment             | Lack of total immersion | Desktop games          |

3.2. Vr System Comparison
Generally, all four types of virtual reality systems can enhance the user's immersion, interactivity and imagination. Taking the clothing museum as an example, Shanghai Textile builds a virtual clothing display system based on transportation equipment, performance characteristics and user interaction, and compares and analyzes the characteristics of the four VR systems in clothing display [10, 11].

The virtual VR system is a medium connecting themes and objects, and a bridge between the public and the exhibition. Assuming that the planner is based on the principle of interaction between the virtual reality system and the audience, and the principle of optimizing the data volume of the software system and exhibition hardware equipment is adapted to the principle of the room. The good arrangement of the VR system and the principle of the exhibition space are the purpose of establishing a good machine interface platform.

4. Static Panoramic Technical Analysis
There are many forms of virtual display of museum clothing, mainly static panoramic virtual display, dynamic panoramic virtual display and 3D modeling virtual display. These three forms have their own
characteristics in production tools, production methods and production processes. The following compares the three display forms of media, content, weather and other aspects.
The relationship between the data pattern similarity calculated by the panoramic virtual model.

4.1. Panoramic Virtual Display
The static panoramic clothing display based on virtual reality technology is a kind of virtual display, also called virtual reality. It is a huge image, and the interaction between people and images can be realized through computer technology. Due to low development costs and low technical difficulty, static virtual landscapes are gradually being widely used, especially in the construction of virtual museums.

Table 2. Dynamic video virtual display software

| VR shooting hardware | video editing software | audio       |
|----------------------|------------------------|-------------|
| Gear 360             | Adobe premiere         | Audacity    |
| Theta ssc            | Adobe after effects    |             |
| Key mission 360      | Autopano giga          |             |
| GoPro omni           | Autopano video pro     |             |
| OZO                  |                        |             |

The dimensionless model based on FEA proposed by experts can predict the failure mode of a small-size unknown model based on a large-size contact model with the same boundary, and further realize that it can predict the failure of unknown models with different boundary types based on the large-size basic model. Mode: At the same time, it can also predict the failure mode of the large-scale model constrained by the four-sided constraint, which broadens the use of the artificial intelligence experimental environment database [12].

![Figure 1. B1-N1 are used as inputs](image-url)
Figure 2. Comparison of state values of basic model 1 obtained from CA and FEA-based dimensionless model

It can be seen from the figure that when the basic model reaches 19, the damage value of the large and small model reaches the same value, and when it is greater than 19, the damage value of the small model grows faster.

5. Conclusions

In today's era, intelligent machines driven by artificial intelligence technology can replace human physical, mental and intellectual work on a large scale, saving people more time and energy to develop intelligence and leisure. The dominant application factor promotes the development and progress of technology through its own initiative and innovation. At the same time, people are also the main body to prove the rationality of the control technology application. Artificial intelligence technology is increasingly being applied in various fields of society and brings innovation in the industry. Looking into the future, artificial intelligence technology will surely play a huge role in the protection of cultural heritage and be widely used as it continues to improve.

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