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Optimization of Museum Aging Design Based on Deep Learning and Computer CAD Automatic Generation Technology

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Abstract. Due to the progress and growth of society, people's living standards and health have been improved and guaranteed, and the needs of the elderly will change accordingly, which requires the construction of aging-friendly products and aging-friendly venues to be put on the agenda. In this context, the concept of adaptive aging has pointed out the basic direction for indoor space design and environmental design workers in the new period. In this article, the design methods and principles of aging-resistant design are studied from the concept of aging-resistant, and an optimization modeling method of museum 3D scene based on deep learning (DL) and computer CAD automatic generation technology is proposed. By using the graph representation learning method, the potential topological characteristics that constitute the basic components of museum design will be discovered by extracting information such as combinations and connections that are important for specific objective functions. Through this model, the form and function of the museum can be organically unified, and the design path and scheme that meets the aging requirements can be explored, so as to provide guidance and help for related design work and produce positive and effective functions and significance.

Keywords: Suitable Aging Design; Museums; Deep Learning; CAD
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1 INTRODUCTION

The growth of museum architecture is a microcosm of architectural growth. Due to its cultural and artistic nature, relatively free architectural personality, and relatively relaxed functional requirements, various architectural genres have left their own traces in museum architectural design. Designers aim to create a method or product that solves people's life problems and is more

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in line with the harmonious coexistence between humans and nature by studying the relationship between humans and the environment and humans and nature. The final output form is also diverse and divergent, which can be specific products, services, or abstract ideas. The resulting final solution will also present diversity due to the different ideas of the designer. In an aging society, the security, services, medical and health care, and spiritual and cultural support of the elderly are arduous tasks, and higher requirements are also put forward for relevant industries and departments in society. In this context, the concept of adaptive aging has pointed out the basic direction for indoor space design and environmental design workers in the new era, especially for professional spaces such as museums that can highlight the characteristics of adaptive aging and meet the needs of the elderly. Understanding the characteristics and needs of design clients is an important step in the early stages of museum design. As a special group, the elderly have unique characteristics. Accurately grasping the definition of the elderly and gaining a deeper understanding of their psychological characteristics is an indispensable step in the design phase of the elderly museum.

Due to the progress and development of society, people's living standards and health have been improved and guaranteed, and people are generally aging. The needs of the elderly will also change accordingly, which requires putting the construction of aging friendly products and venues on the agenda. After long-term social practice, contemporary architectural ideas have begun to diversify. People no longer view architectural space as a functional and rational interpretation, but rather seek subjective feelings based on "building users". Building and continuously improving the elderly care service system is also an important task for designers. Architectural design does not provide a correct answer, but rather provides multiple possibilities for the same spatial problem. On the one hand, due to the continuous growth of available data resources, DL is becoming increasingly popular; On the other hand, with the continuous improvement of computer hardware equipment, DL algorithm models can gradually be applied to solve increasingly complex problems. 3D reconstruction is the creation of such a 3D model for a scene or object. One of the most common methods is to use relatively easy to obtain images and reconstruct their 3D shape by integrating images taken from different angles into the global 3D coordinate system. Based on the concept of aging, the design methods and principles of aging design were studied, and a museum 3D scene optimization modeling method based on DL and computer CAD automatic generation technology was proposed. Museum design based on the emotional characteristics of the elderly can be achieved through several design principles: the layout and environment of the museum should be as comfortable as possible, such as providing soft seats, sufficient lighting, and suitable temperature. The layout and information display of museums should be as intuitive as possible, making it easy for the elderly to understand and explore. Museums should provide social venues and activities for elderly people to communicate and interact with others. Museums should provide safety measures, such as anti-skid floors, accessible passages, and emergency rescue services. Museums should provide multilingual text and voice guides, subtitles, and videos as auxiliary tools, so that elderly people can access information without barriers. In short, based on the emotional characteristics of the elderly, museum design should pay attention to their physical and psychological needs, provide a comfortable, intuitive, social, safe, and accessible visiting experience, and add fun and meaning to their lives.

CAD automatic generation technology can be applied to optimize the aging design of museums. The aging design of museums refers to the evaluation and improvement of existing designs in museums to enhance their functionality and aesthetics. Using CAD automatic generation technology, designers can automatically generate multiple design schemes through computer programs, and then filter and optimize them based on the needs and constraints of the museum. This method can greatly reduce the workload of designers, improve design efficiency, and generate more innovative design solutions. For example, designers can use CAD automatic generation technology to optimize the layout and streamline design of museums. The program can automatically generate multiple different design schemes based on the space size and shape of the museum, and then evaluate and optimize them based on the behavior habits and needs of visitors, ultimately selecting the optimal design scheme. In addition, CAD automatic generation technology

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can also be used to optimize exhibition design in museums. Designers can use programs to automatically generate multiple different exhibition design schemes, and then evaluate and optimize them based on the theme and content of the exhibition, ultimately selecting the most suitable scheme. In short, CAD automatic generation technology can provide a good optimization solution for the aging design of museums. The spatial experience originates from the development of socialized mass production and technological revolution, and the development of modern production industry meets the demand for material products. For example, using the repeatability and diversity of typical indoor scene objects, the geometric reconstruction of incomplete point cloud model is realized in two stages. Data driven technology can estimate the shape and structure of incomplete point clouds. This technology combines the prior knowledge of data with symmetry detection to operate the component-based model obtained from the database. It uses a set of known 3D models to construct the component level prior knowledge required for model optimization. The stage of experiencing architecture is actually a stage of dialogue with oneself. People collect abstract feelings about space through their facial features and ultimately collect them in their brains. Through self-dialogue, they sublimated into concrete conclusions, completed spatial experiences, and realized the connection between people and the environment. This article studies the optimization strategy for museum aging design supported by modern technology;

(1) An effective DL network needs a large amount of data in the training process, and the collection and labeling of data is extremely time-consuming and labor-intensive, which limits the application range of DL in industry. In order to solve this problem, based on CAD model and the concept of aging design, a set of methods for parametrically generating virtual simulation museum building image data sets is designed to avoid the complicated platform construction and data collection stage of museum construction.

(2) The model takes the identification parameters of emotional characteristics of the elderly as the input of the neural network, and will discover the potential topological features that constitute the basic components of the museum design by extracting information such as combinations and connections that are important for a specific objective function.

In this article, the CNN model of museum design based on the emotional characteristics of the elderly is constructed, and the extraction method of emotional characteristics of the elderly is proposed, and then it is applied to the modeling and optimization of 3D scenes in museums. The feasibility of this method for museum aging design is verified by simulation test.

2 RELATED WORK

Ai et al. [1] conducted physical experiments on ceramic visual lighting in museums and constructed a tracking virtual environment. By proposing specialized frontal stereoscopic visual analysis, it has constructed an effective visual guidance platform to strengthen the audience. The results indicate that in the comparison of visual tasks, the pattern recognition rate using stereo vision illumination has been effectively improved. Apollonio et al. [2] conducted a 3D model image processing technology for mobile device communication repair. By classifying and preserving digital replicas from different exhibitions, it constructed a visual image combination using engineering classification for rendering. After describing the standards for geometric image processing, it introduced and discussed some museum cases. Barrile et al. [3] conducted the development of photography and technical information production for historical installations in museums. It analyzes and constructs the testable information content of a 3D model in a virtual environment. By conducting virtual augmented reality research and analysis on accessible virtual environment survey technologies, the advantages of constructing 3D printing models have been demonstrated. Barszcz et al. [4] introduced a low-cost analysis method for 3D models of motion structure scanning. It explored virtual technology for 3D model processing using different 3D digital models. The quality model technology obtained indicates that the 3D model of the cultural heritage in which it is located has been highly validated. Erdolu et al. [5] carried out human-computer interaction of construction project classification based on computer Assistive technology.

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Through the interactive sensing of gesture touch, experimental system analysis based on multimodal emotional interaction was completed. By assisting with the virtual framework structure of the building, the technical implementation of virtual exploration was completed. The interior design of the museum's space may have certain limitations on the effectiveness of cultural relics exhibition. Farella et al. [6] analyzed digital cultural heritage based on museums. By analyzing the construction of a 3D cultural relic quality model, it explores the techniques for deblurring images and masking object backgrounds in physical rendering of the model. The results indicate that in terms of sustainable digital content, this article has significant advantages in digital object processing.

Gherardini et al. [7] analyzed the overall utilization of museum space under the visualization of cultural relics. Through the Spatial analysis of 3D virtual model and augmented reality, the results of visualization are maximized to improve the cultural relics exhibition benefits of artifacts. Leng et al. [8] conducted personalized digital twin optimization of the warehouse system. It analyzed a highly sensitive digital warehouse storage allocation optimization packaging system by calculating the emerging digital 3D structure. By perceiving the online data implementation of physical warehouses, it analyzes and constructs the maximum high-level warehouse service system. Mendes et al. [9] conducted an analysis of user information experience in augmented reality regional 3D models. We used augmented reality artificial intelligence algorithms to perform video projection on urban areas and analyzed the virtual reconstruction of models in edge areas. Montusiewicz et al. [10] conducted a 3D scanning virtual exhibition analysis of historical clothing. Unlike buildings, historical clothing is very fragile. It can perform 3D model reconstruction effectively through 3D structural scanning. The element analysis of digital model clothing can be carried out by using the 3D scanning technology of Structured light.

Peinado et al. [11] conducted a digital analysis of cultural heritage for sustainable development. Through the research and construction of Program analysis for 3D digitization, it analyzes the engineering heritage factors of information processing. This application can be open for non-expert users to access, and its application can be implemented using free platforms and cost tools. Poszaj et al. [12] built a Carbon footprint analysis model for the building framework. By participating in the Carbon footprint program of the model, it builds the additional design features of the basic characteristics analysis of buildings based on neural networks. It provides a certain guide for solving urban layout. Rahman et al. [13] conducted data driven experimental mining verification based on Computer-aided design. By supervising the engineering design based on indoor furniture, a data-driven clustering structure design model analysis was completed. Interactive decision-making was conducted on the furniture design of the experimental platform. Ulvi [14] analyzed the 3D laser effective scanning of drone photogrammetry technology. By improving the accuracy of electronic measurements through scanning, it analyzed the application of spatial data analysis in 4D software. It uses drone photogrammetry and ground laser scanners to document, 3D model, and visualize cultural heritage. Zhang et al. [15] conducted multi view image matching of panoramic cameras for urban drainage 3D pipeline reconstruction. Through the 3D analysis of the moving structure of 3D pipeline images, it introduces the urban pipeline matching method of multi view pipeline.

3 METHODOLOGY

3.1 Extraction of Museum Aging Features and Construction of CNN Models

The application of deep learning and computer CAD automatic generation technology in museum aging design can be achieved through the following technologies:

3D modeling technology: By using CAD automatic generation technology, establish a 3D model of the museum for aging design.

Simulation technology: Through deep learning algorithms, simulate and predict the aging process of museums in order to develop corresponding maintenance strategies.

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Intelligent design technology: through deep learning algorithm, the aging design of the museum is intelligently optimized to improve the efficiency and practicability of the design.

Visual recognition technology: Through deep learning algorithms, the aging phenomenon of museums is visually recognized for maintenance and repair.

In short, the application of deep learning and computer CAD automatic generation technology in museum aging design can improve the design efficiency and practicality of museums, and provide better technical support for the development of museums.

(1) Feature extraction

Museum aging design refers to the evaluation and improvement of existing designs in museums to enhance their functionality and aesthetics. In the context of an aging population, museum aging design needs to consider how to meet the needs of elderly audiences. Here are some issues to pay attention to:

Rest Areas: Museums need to provide sufficient rest areas, which should be reasonably distributed and equipped with sufficient seating and standing space. Seats should consider the needs of the elderly, such as height and width.

Signage: Museums need to provide clear signage to help elderly visitors find the exhibition or facility they want to visit. The logo should be clear and easy to read, and appropriate colors and symbols should be used.

Exhibition hall brightness: The lighting in the exhibition hall should be bright enough to enable elderly audiences to clearly see the cultural relics and textual information in the exhibition. At the same time, the lighting should not be too strong to avoid discomfort to the elderly audience.

Exhibition sign text: The text and labels in the exhibition should be large enough, and appropriate font and line spacing should be used to ensure that elderly audiences can easily read.

Accessibility design: Museums need to provide accessibility design to ensure that elderly visitors can easily enter and visit exhibitions. This may include wheelchair users and individuals with visual or hearing impairments.

In short, the aging design of museums needs to consider the needs of elderly audiences, and make improvements and innovations to address these issues, in order to enhance the practicality and ease of use of museums and provide better services for elderly audiences.

Designers aim to create a method or product that solves people's living problems and is more in line with the harmonious coexistence between human beings and nature by studying the relationship between human beings and the environment and between human beings and nature. Its final output forms are also diverse and divergent, which can be a specific product, a service or an abstract idea, and the resulting final scheme will also present diversity due to the different ideas of designers. Set up an emotional state space set $E=\{e_i | i=1,2,3,\ldots,m\}$ (m represents the number of emotional states). Use the random variableλto represent the current emotional state, and T to represent the time set. Let t_i be the time point when $\lambda=e_i$, and satisfy $t_i>0$. In this way, the emotional time state space can be expressed as:

$$\begin{pmatrix} E \\ T \end{pmatrix} = \begin{pmatrix} e_1 e_2 & \ldots & e_m \\ t_1 t_2 & \ldots & t_m \end{pmatrix} \tag{1}$$

The mapping matrix of mood and emotion is:

$$L = [e_{pos}, e_{neg}] = \begin{bmatrix} 0.40 & -0.40 \\ 0.20 & -0.20 \\ 0.15 & -0.50 \end{bmatrix} \tag{2}$$

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The mapping relationship between emotional variables and mood variables is:

$$E = f(M, L) = \frac{D}{d_{pos} + d_{neg}} \tag{3}$$

$$D = [d_{pos}, d_{neg}], d_i = \left[(M - e_i)^T (M - e_i)\right]^{\frac{1}{2}} \tag{4}$$

When introducing space experience into museum design, the problem to be solved is how to deal with the harmony and unity of objective space, exhibition media and audience, and pay more attention to the sense of participation and experience of museums. The CNN model is constructed by taking emotional features as input parameters, and the learning ability of the network is enhanced by generating the countermeasure mechanism of the countermeasure network. The information of the input model is inferred by learning the distribution law of the 3D model, and a 3D model with complete structure is synthesized.

(2) CNN model construction

Space experience originates from socialized mass production and the growth of scientific and technological revolution, and the growth of modern production industry satisfies the demand ability of material products. DL strategy can be applied to the generation of 3D models of 2D images. Firstly, similar depth maps are retrieved and mapped into 3D space to predict the missing voxels. Finally, the final optimization model is obtained by using Poisson surface reconstruction, and the Iterative reconstruction of the image is realized by using the circular network. Using the DL method to process 3D models can directly align calculations or transform 3D problems into 2D image problems by projecting the 3D model onto the image. This article adopts geometric and image modeling methods to construct the entire virtual scene, that is, different modeling methods are used for different parts of the scene.

Geometric modeling method is used to model the cultural relics exhibits that need to interact with the scene, and image modeling method is used to construct the environmental background such as background, booth and wall in the scene. The basic structure and operation mode of ANN are shown in Figure 1.

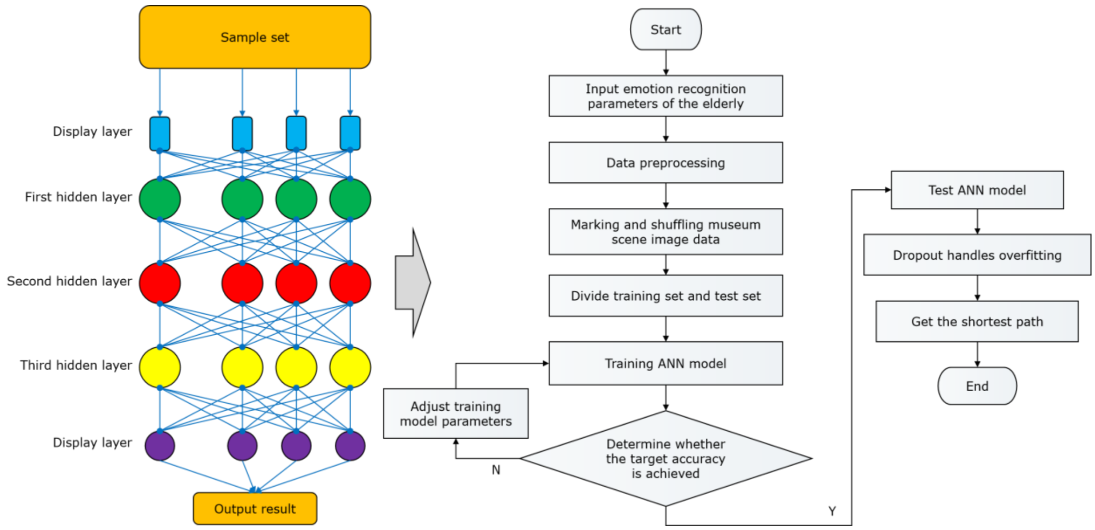

Figure 1: Basic structure and operation mode of ANN.

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The main feature of DL is to combine low-level features into higher-level more abstract features or attribute types, by which the feature representation of data distribution can be found for further study and application. The method of DL originated from the inspiration of ANN, and its motivation is to simulate the way neurons in the brain transmit and process information, analyze and transmit a large amount of data, explore the relevance of information, and release information for the next neuron. Because CNN has its own weight sharing strategy, for a given weight, it is necessary to calculate the gradient of all neurons connected with the weight. Finally, these gradients are summed again:

$$\frac{\partial E}{\partial k_{ij}^{l}} = \sum_{u,v} \left(\delta_j^l\right)_{u,v} \left(p_i^{l-1}\right)_{u,v} \tag{5}$$

Among them, $\left(p_i^{l-1}\right)_{u,v}$ is the block after element-wise multiplication of x_i^{l-1} and k_{ij}^l in the convolution calculation, and the value of the output convolution feature map at the final (u,v) position is the element-wise multiplication of the block at the previous layer (u,v) position and the convolution kernel k_{ij}^l . result. The calculation formula of the pooling layer is as follows:

$$x_j^l = f\left(\beta_j^l down\left(x_j^{l-1}\right) + b_j^l\right) \tag{6}$$

Among them, $down(\cdot)$ represents the function of down sampling, and β represents the coefficient of down sampling. The transfer function $f(x)$ is a unipolar sigmoidal function:

$$f(x) = \frac{1}{1+e^{-x}} \tag{7}$$

$f(x)$ is continuous and derivable, and:

$$f'(x) = f(x)[1 - f(x)] \tag{8}$$

3D information is a common information in daily life. With the help of tools such as depth sensors, users can relatively easily build 3D models of real-world objects, while the increasingly sophisticated 3D modeling tools make it easier for users to make beautiful 3D models. By increasing the noise, the distributions can be intersected, which can solve the problem that the generated distribution and the real distribution can hardly be ignored in the generated countermeasure network.

3.2 3D Scene Modeling of Museum

ANN, which is composed of a large number of neurons, has a certain connection relationship between neurons. Based on this architecture, the training network can continuously adjust the correlation strength between neurons. The training of different association strength determines that the network has different functions. Accordingly, multi-level neural networks can be constructed and trained to interpret data such as text, images and sounds. Virtual museum scenes are generally more complex, and the exhibits of cultural relics need to be finely modeled, which leads to an increase in the amount of data, as well as texture mapping and mapping of the scenes, thus increasing the computational load.

Convolution process is the stage of convolving the neighborhood of input data to obtain the neighborhood characteristics of data, which is essentially to calculate the dot product of data neighborhood and convolution kernel. Each convolution kernel can be regarded as a filter, and the dot product calculation of convolution kernel is a stage of filtering data in a specific mode and extracting data features. The less important model objects such as the scene, booth, ceiling and floor are generally constructed by using geometric modeling technology, and the simplified

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algorithm is used to make them reach the simplest form. See Figure 2 for the convolution recognition stage of museum scenes combined with emotional characteristics of the elderly.

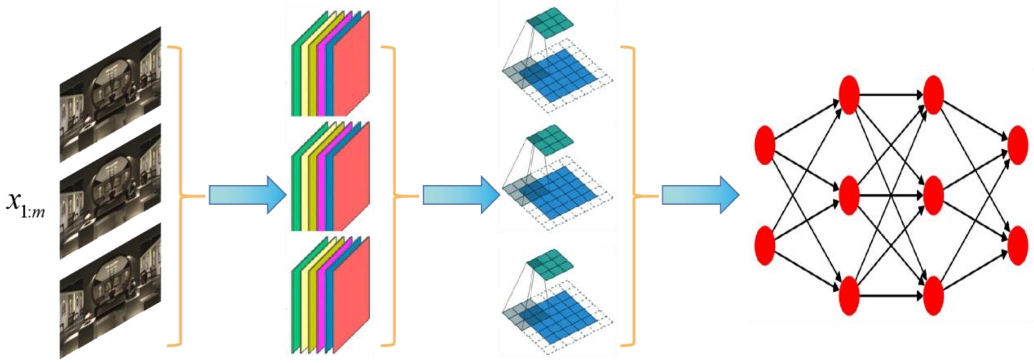

Figure 2: Convolution identification stage of museum scenes.

DL is one of the approaches to artificial intelligence. It can be regarded as a combination of many mapping functions, in which each mapping function represents a set of mappings from input to output, while the combination of mapping functions expresses a complex concept from a simple structure. By training a random decision tree to predict the unknown region around voxels, the final prediction result is obtained through the weighted average of the results generated by moving the bounding box, but this strategy has low efficiency. As a specific type of machine learning, DL has more powerful and flexible capabilities, which enables computers to continuously learn and improve technology in a large amount of data and experience. Feature learning is the core content of DL. By deepening the learning network and obtaining the feature transformation of the original information layer by layer, the hierarchical feature representation can be automatically learned, thus solving the important problem of artificially designing features in the previous network.

In the modeling of museum suitable aging space, let the normal vector of each triangle in the related triangle group with vertex v_i be n_k, the center x_k and the area a_k. Then the plane constructed by the normal vector and the center defined below is called the average plane of the vertex:

$$N = \frac{\sum n_k a_k}{\sum a_k} \tag{9}$$

$$n = \frac{N}{|N|} \tag{10}$$

$$x = \frac{\sum x_k a_k}{\sum a_k} \tag{11}$$

The offset from the point P in the 3D space to the mesh model TM is defined as:

$$d(P, TM) = \min(d(P, X)) \tag{12}$$

Where $d(P, X)$ is the Euclidean distance from point P to point X.

When calculating the total drawing time, the texture data of cultural relics and scene environment are considered comprehensively, so the result is more accurate. When estimating the

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importance of the cultural relic model, several important factors such as the value of the cultural relic, the distance from the viewpoint, eccentricity, speed and projection size are integrated, which is more in line with the real situation of people browsing the museum scene.

4 RESULT ANALYSIS AND DISCUSSION

Different from the 2D image space, the 3D model has an extra dimension, which makes its spatial modeling more complicated. There will inevitably be some fragments or holes in the model results obtained at present, which makes the 3D model often unable to be directly used for analysis and understanding. It is necessary to use an efficient and extensible algorithm to process this kind of 3D data before it can be added to the data set for large-scale data processing. In this model, the identification parameters of emotional characteristics of the elderly are used as the input of neural network, and the potential topological features that constitute the basic components of museum design will be discovered by extracting information such as combinations and connections that are important for specific objective functions. The algorithm in this article is mainly based on Tensor Flow platform, and NVIDIA-2080Ti GPU graphics card is used in hardware equipment. The use of GPU is helpful to accelerate the training of neural network. In the training, 150~300 pictures are randomly selected for each recognition task as the training set, and another 150 pictures are selected as the verification set. The number of rounds of training is set to 360, the number of cycles of each round of generating network is 50, and the batch size is 20. The environmental configuration parameter requirements of batch system are shown in Table 1.

Item	*Edition*
Operating system	Windows 11
CPU	Intel(R) Core(TM) I7-13700K
Internal storage	31GB
Hard disc	1TB
GPU	RTX 2080Ti
Memory	11G
DL framework	TensorFlow 2.6
Database administration	Navicat for SQLite
Compiler	Python 3.8
Interface development	Qt Designer

Table 1: Requirements for environmental configuration parameters of the system.

The classification results of this experiment are listed in Table 2 and Table 3. Table 2 shows the results of image classification using the improved CNN network, and Table 3 shows the results of image classification using Recurrent Neural Network (RNN). In order to verify the generalization performance of the model, this article adopts 10-fold cross validation, and divides the data set into 10 parts, of which 9 parts are used as training data and 1 part is used as test data in turn. The arithmetic average of the last 10 groups of performance index data after model convergence is taken as the performance index of this training every time.

Training times	*Accuracy*	*Recall*	*Precision*	*F1*
1	0.847	0.746	0.788	0.756
2	0.831	0.759	0.764	0.759
3	0.829	0.771	0.783	0.731
4	0.788	0.737	0.755	0.781
5	0.835	0.794	0.776	0.755
6	0.837	0.778	0.779	0.742
7	0.826	0.765	0.769	0.737

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8	0.818	0.767	0.783	0.733
9	0.822	0.799	0.799	0.766
10	0.799	0.789	0.745	0.724
Mean value	0.823	0.771	0.774	0.748

Table 2: Cross-validation results of CNN museum scene image recognition model.

Training times	*Accuracy*	*Recall*	*Precision*	*F1*
1	0.569	0.392	0.414	0.376
2	0.619	0.376	0.396	0.371
3	0.577	0.381	0.381	0.372
4	0.551	0.381	0.376	0.371
5	0.534	0.386	0.422	0.369
6	0.528	0.384	0.416	0.365
7	0.491	0.388	0.388	0.362
8	0.465	0.394	0.394	0.334
9	0.574	0.407	0.395	0.382
10	0.521	0.399	0.391	0.395
Mean value	0.543	0.389	0.397	0.37

Table 3: Cross-validation results of RNN museum scene image recognition model.

From the test results in the table, it can be seen that the image classification results obtained by using this improved CNN network are better than using RNN to extract the time series features of spectrogram. Among them, the average Accuracy, Recall, Precision and F1 of CNN Museum scene image recognition model are 0.823, 0.771, 0.774 and 0.748, respectively. However, the average Accuracy, Recall, Precision and F1 of RNN museum scene image recognition model are 0.543, 0.389, 0.397 and 0.37 respectively. The results show that this method is effective and reliable, because it makes full use of the advantages of the recognition model and enriches the ways to obtain emotional information. Two performance evaluation indicators, MSE (Mean squared error) and MAE (Mean absolute error), were selected to conduct a multi-dimensional evaluation of the method proposed in this paper. The MSE test results are shown in Figure 3. The MAE test results are shown in Figure 4.

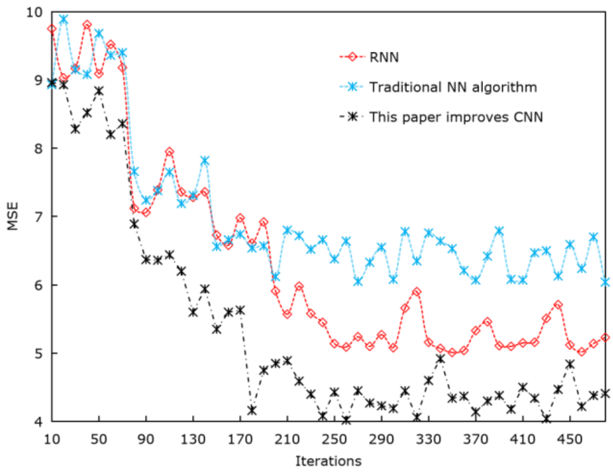

Figure 3: MSE test results.

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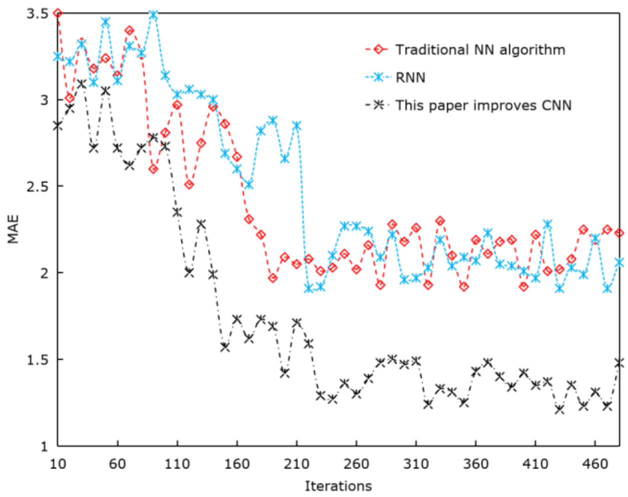

Figure 4: MAE test results.

The reconstructed 3D structure is expressed by voxels, and the reconstruction problem is defined as regression prediction of each voxel from a sequence of pictures. This dynamic process can be decomposed into multiple time steps. In each time step, the principle is not only to extract the visual information from the current perspective, but also to update the hidden layer state of the network with the past information, and finally to transmit information and predict the 3D voxel structure according to the updated state. The data outlier removal process is shown in Figure 5.

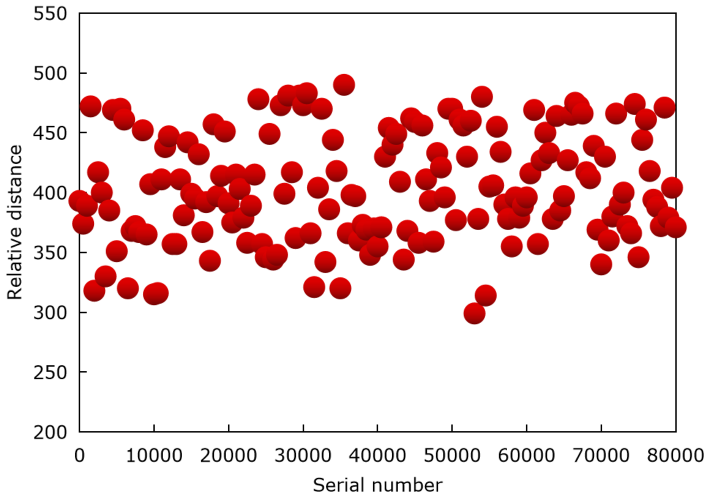

Figure 5: Data outlier removal processing.

Finally, the established CNN model is used to train the sample set, so as to obtain better network weights. Finally, the obtained network weights are input into CNN, and a museum aging design model based on CNN is formed. It can give the system the ability to dynamically update the network state, and continuously fuse the constantly updated network state with the input picture stream, so as to obtain the current spatial characteristics and be influenced by the past time, so

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that the coding features can better express the information of the object with time, and then be used in the next prediction of the 3D structure. The output result of the model is compared with the actual museum scene data, and the result is shown in Figure 6.

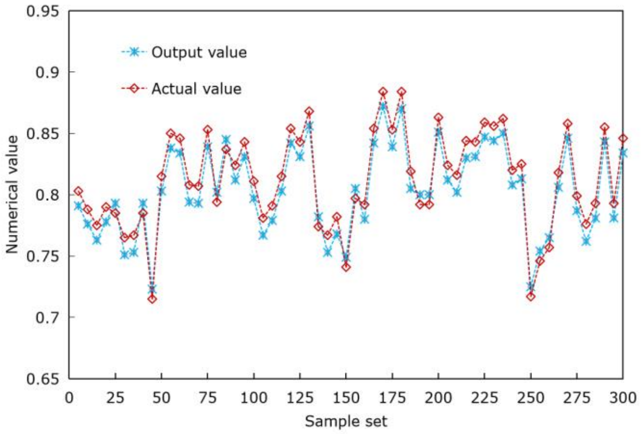

Figure 6: Learning results of machine learning.

The learning results of CNN are convergent, can better approximate the original data, and perform well in local data and medium-and long-term trend fitting, which has the basis for modeling museum scenes. Through training, the model can be guided to select more informative perspectives in the whole reconstruction process and send them to the reconstruction module in a reasonable order, so that the model can obtain more visual information needed for reconstruction with fewer perspectives to complete reconstruction.

It can be seen that with the increase of iteration times, the algorithm in this article converges quickly and tends to be stable, in contrast, the convergence speed of RNN algorithm is slow and produces great oscillation. In the later stage of training, compared with RNN algorithm, this algorithm obtains lower loss function value and classification error rate, and the curve of loss function and classification error rate of this algorithm is smoother. Select 100 elderly people to rate the use of the aging museum scene designed in this article, and the results are shown in Figure 7.

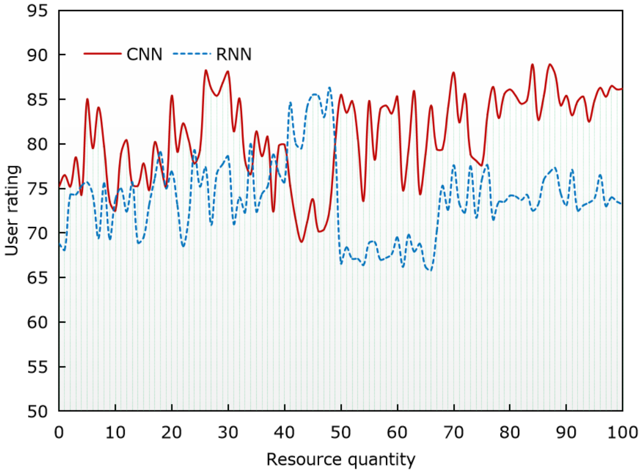

Figure 7: User usage rating.

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It can be seen that the overall score of the museum scene designed in this article is high. Therefore, it is feasible to apply the automatic generation technology based on DL and computer CAD to the optimization of museum aging design. DL can predict the global structure of the target object with a small number of perspectives or even a single perspective. Object reconstruction can guide the training of perspective planning, which can help the reconstruction process to obtain information efficiently and improve the quality of reconstruction.

5 CONCLUSION

Today, the design direction of museums is changing from function to experience, and the essence comes from the pursuit of humanistic spirit by society. The needs of the elderly will change accordingly, which requires the construction of aging-friendly products and aging-friendly venues to be put on the agenda. This article mainly discusses and studies the modeling and aging design of virtual museum, and puts forward an optimized modeling method of museum 3D scene based on DL and computer CAD automatic generation technology. Combine the found building blocks into a new design that meets the needs of the elderly, and evaluate the feasibility of the generated candidate solutions. The results show that this method is effective and reliable, because it makes full use of the advantages of the recognition model and enriches the ways to obtain emotional information. When introducing space experience into museum design, the problem to be solved is how to deal with the harmony and unity of objective space, exhibition media and audience, and pay more attention to the sense of participation and experience of museums. When calculating the total drawing time, the texture data of cultural relics and scene environment are considered comprehensively, so the result is more accurate. When estimating the importance of the cultural relic model, several important factors such as the value of the cultural relic, the distance from the viewpoint, eccentricity, speed and projection size are integrated, which is more in line with the real situation of people browsing the museum scene. In the future, we will consider combining CNN with octree structure to enhance the modeling effect of high-resolution images.

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