





## 3D Reconstruction of Chinese Traditional Sculpture based on Artificial Intelligence Drawing

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**Abstract.** Chinese traditional sculpture art has a relatively long history, and it is also relatively famous all over the world. Chinese traditional sculpture art is not only a display of painting techniques and carving techniques, it also has the function of preserving Chinese history and culture. The traditional engraving technology will use the basic theory of drawing to design related factors. However, this kind of carving art is more cost-intensive and human and material resources. Computer-aided technology can assist CAD technology to reconstruct traditional Chinese sculptures. However, it is also difficult for traditional CAD reconstruction techniques to take into account the cultural information, shape information and time correlation of traditional Chinese sculptures. This research uses MPCNN and LSTM technology in artificial intelligence algorithm to assist computer-aided technology and CAD technology to realize the 3D reconstruction task of traditional Chinese sculpture. The research results found that this artificial intelligence theory-assisted CAD reconstruction technology can intuitively restore the pattern information, shape information and cultural information of traditional Chinese sculptures, which is mainly due to the fact that MPCNN-LSTM technology can accurately mine and evaluate the relevant characteristics of traditional Chinese sculptures.

**Keywords:** Chinese traditional sculpture; Artificial intelligence; Computer-aided system; CAD reconstruction.

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### 1 INTRODUCTION

Chinese traditional sculpture is an art that inherits Chinese culture, and it is also another embodiment of painting art. There is a relatively large connection between Chinese traditional sculpture and Chinese painting. However, sculpture art is a three-dimensional art, and painting is a

two-dimensional graphic art [1]. Sculpture design and appreciation is more difficult. The appreciation of traditional Chinese sculpture is not only the pattern art of the sculpture itself, but the shape and shape of the sculpture are the values emanating from the sculpture art. The sculpture artist will draw the two-dimensional outline or three-dimensional view of the sculpture according to the needs of artistic expression, and then the sculptor will carve according to the corresponding drawings. However, with the demand of urban landscape or the increase of the demand of residential area, this puts forward higher requirements for the art of sculpture [2]. The traditional way of painting and sculpting is not only time-consuming, it is also difficult to achieve the diversity of images or shapes of sculptural art. At the same time, traditional Chinese sculpture art not only reflects traditional Chinese culture through patterns or shapes, but the three-dimensional effect of sculpture can also show the artistic value displayed by sculpture. This is a way that traditional design schemes are difficult to achieve.

Computer-aided technology can not only be used in teaching of various subjects, but it can also assist the design of traditional Chinese sculptures by downloading CAD drawing software. CAD technology can provide a variety of painting skills and painting colors, and it can change the design of traditional Chinese sculptures in real time through a computer-aided system, which is a more efficient way. With traditional paper and pen drawing, it cannot achieve real-time changes to the sculpture's drawing pattern [3]. CAD technology also provides size and three-dimensional effect display solutions, which allows sculpture art designers to feel the artistic value embodied by traditional Chinese sculpture technology. Computer-aided technology can display the three-dimensional effect of traditional Chinese sculpture art. CAD drawing method can not only provide a variety of shape information required by sculpture art, it can also provide accurate size and pattern color information. If computer-aided technology and CAD technology are applied to the three-dimensional effect reconstruction of traditional Chinese sculpture art, it can not only save the time and material resources of the sculpture designer, but also enrich the sculpture designer's spatial imagination and enrich the sculpture art. value. Compared with traditional sculpture design techniques, it is a solution that can better grasp the image, shape and cultural information of sculpture art.

At the same time, although computer-aided technology and CAD can provide rich sculpture art design resources, these two methods cannot learn the artistic and cultural information embodied in Chinese traditional sculpture art, which also limits the use of traditional Chinese sculpture to a certain extent. 3D reconstruction effect. Sculpture is not just a display of patterns and artistic shapes; it is a display of artistic culture. Therefore, an intelligent method is also needed to quantitatively analyze the cultural factors existing in Chinese traditional sculpture art. Theoretical skills of artificial intelligence are a way of dealing with large amounts of data, which can convert information such as patterns or videos into relevant data forms. If artificial intelligence theoretical skills are applied in the evaluation of cultural information of traditional Chinese sculpture, it can quantitatively analyze the relationship between cultural information and the pattern and shape information of traditional sculpture. Therefore, it is also a new direction to combine the theoretical skills of artificial intelligence with computer-aided technology and CAD drawing technology to complete the reconstruction of the three-dimensional effect of traditional Chinese sculpture.

## 2 RELATED STUDIES

Zhu [4] has used machine learning algorithms and feature recognition to design a feature recognition method for ceramic sculpture modeling, and a sparse representation modeling scheme is also used here. It performs Gaussian modeling on the pixels of the relevant features of the sculpture. The research results show that this scheme has high performance for the recognition of ceramic sculptures, and it also suppresses the noise problem in the recognition of sculpture images. Yang [5] has also found that sculpture art can be an important carrier of spiritual culture and historical culture. It uses electronic information technology to design a sculpture three-dimensional

design platform, which allows the sculpture to be digitally designed. It also discusses the role of digital enhancement techniques in restoring images of sculptural artworks. It also proposes a sculptural image processing scheme based on genetic algorithm. Zheng [6] studied the sculpture design and production system in Shanghai from the perspective of urban landscape design. It also studies the patterns and other relationships of some sculpture parts that appeared in Chinese history, and then it studies the shape characteristics of Chinese sculpture consciousness from the aesthetic characteristics of sculpture and the diffusion nature of sculpture, which provides ideas for sculpture design in Shanghai. Zhu and Wei [7] has studied the design theory of sculpture art using micro-nano technology. It also combines the theory of traditional sculpture art with the theory of technology to design sculpture art. It introduces the definition of sculpture. The commonalities and differences of art. It also summarizes the feasibility of the application of micro-nano technology in sculpture design. The study found that the application satisfaction of micro-nano technology in sculpture can reach above 8. Lu et al. [8] has also found that the traditional sculpture design method has the defects of discontinuity and poor real-time computing power. It uses computer-aided technology and real-time controller to realize a new type of sculpture design technology. The study found that the powerful computing power of computer-aided systems can enable efficient and precise design of sculptures.

This research fully considers the spatial and temporal relationships contained in the related factors of Chinese traditional sculpture to design the intelligent system. It will use multi-path MPCNN and LSTM technology in the field of artificial intelligence to mine the spatial effect relationship and time effect relationship contained in Chinese traditional sculpture pattern information, shape information and cultural information. It can then use computer-aided techniques and CAD techniques for 3D reconstruction of the sculpture. Section 1 of this study introduces the development significance of traditional Chinese sculpture and the background significance of intelligent algorithms and computational aided technologies. Section 2 illustrates the development of sculptural design techniques by means of a literature review. The application of MPCNN and LSTM technology and CAD technology in 3D reconstruction of traditional Chinese sculpture is studied in Section 3. Section 4 introduces the local and global effects of intelligent algorithms in evaluating the pattern information, shape information and cultural information of traditional Chinese sculptures. Finally, it teases the entire study.

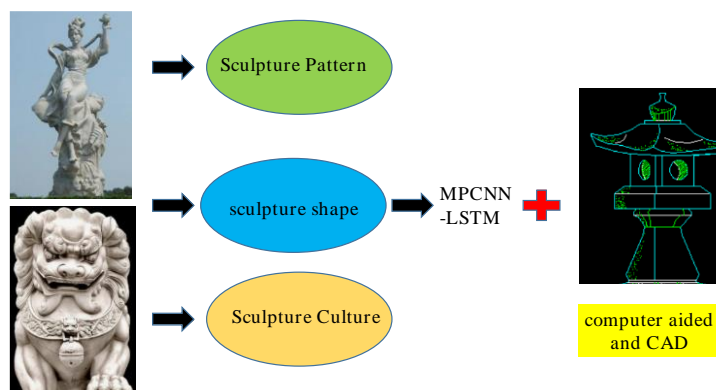
### **3 APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNIQUES AND COMPUTER-AIDED SYSTEMS IN 3D RECONSTRUCTION OF TRADITIONAL CHINESE SCULPTURES**

#### **3.1 Method of Spatial Effect of Three-Dimensional Reconstruction Of Traditional Chinese Sculpture**

This paper will use artificial intelligence techniques to assist computer-aided technology and CAD drawing technology to achieve the task of 3D reconstruction of traditional Chinese sculptures. The CAD drawing software included in the computer-aided technology contains relatively rich drawing strategies and spatial three-dimensional sense, which can fully consider the traditional sculpture technology to carry out reconstruction [9]. However, traditional Chinese sculpture art will contain relatively rich three-dimensional sense and historical and cultural information, and these spatial features cannot be mined by traditional CAD technology through data [10]. The theoretical skills of artificial intelligence can fully excavate the spatial characteristics of traditional sculptures from the perspective of data. It can process the culture and shape information of traditional Chinese sculpture into data, and it can use these data to learn the relationship between traditional Chinese sculpture technology and pattern, shape and culture, which is beneficial to the three-dimensional reconstruction of traditional sculpture art.

There are many techniques that can deal with the spatial features of traditional Chinese sculpture art. The convolutional neural network method CNN is an early technology used to extract and mine spatial features. The extraction of spatial features of each research object is inseparable

from the CNN algorithm. This is not only because the CNN algorithm can efficiently process the spatial effect of mining research objects, it can also efficiently analyze the huge amount of data and the relationship between the data. mapping. Moreover, CNN technology also requires relatively low computing resources, unless it is a large data set. General research objects can meet the requirements. However, CNN technology also has certain defects, it is difficult to extract the spatial effect of traditional Chinese sculpture from different angles. Therefore, this study considers the influence of Chinese traditional sculpture art pattern, culture and shape information, it designs a multi-path convolution method MPCNN technology to learn the internal relationship between Chinese traditional sculpture related factors from different perspectives.



**Figure 1:** The application relationship between intelligence theory and computer-aided technology/CAD in traditional Chinese sculpture.

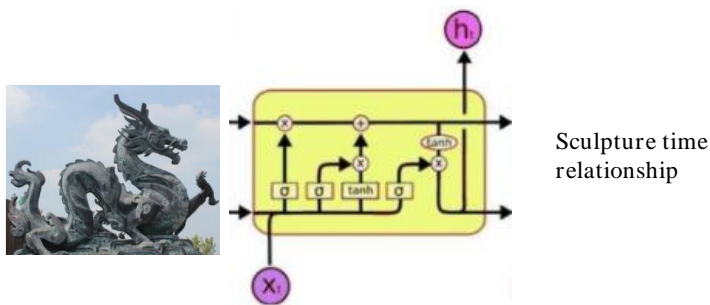
Figure 1 introduces the application of artificial intelligence theory, computer aided technology and CAD theory in the characteristics and mining of related factors of traditional Chinese sculpture through the method of the scheme flow chart. First of all, for methods containing artificial intelligence strategies, it is necessary to prepare accurate and large data sets, and it is necessary to ensure that the form of the data sets can meet the format requirements of CNN and LSTM technical calculations. At the same time, the eigenvalues of pattern information, shape information and cultural information contained in traditional Chinese sculptures cannot have abnormal data, otherwise this will affect the distribution of weight values in MPCNN and LSTM methods. Therefore, it needs to guarantee the accuracy and diversity of the dataset. Then, these prepared feature data of traditional Chinese sculpture related factors are fed into MPCNN and LSTM networks for iteration and training. In the iterative process of the intelligent algorithm, it needs to continuously change the relevant parameters according to the changes of the validation set until the network can reach the convergence state. Once the relevant features are mined and learned, it can be passed to the CAD system of the computer-aided system for the task of 3D reconstruction of the relevant sculptural factors.

### 3.2 The Time Factor of Chinese Traditional Sculpture Art

The development of traditional Chinese sculpture art has gone through hundreds of years of development history. Sculpture art in different periods will show different historical cultures. The pattern information and shape information displayed by the sculpture art of different periods are different, which has a relatively great relationship with the historical culture and the contemporary economic and political state. Therefore, it is necessary to consider the time factor of traditional Chinese sculpture art when using computer-aided technology and CAD drawing method to carry

out three-dimensional reconstruction of relevant factors. The time factor is something that cannot be correlated in traditional ways, and this is the crux of an AI strategy. If the intelligent strategy does not consider the time factor contained in traditional Chinese sculpture art when learning the relevant factors and characteristics of traditional Chinese sculpture, it will easily lead to inaccuracy of the weight distribution.

LSTM technology is an inescapable strategy when considering time-related mining tasks. LSTM technology is mainly used in related tasks of speech recognition, it will fully consider the connection between the moments before and after the language, and the relationship between the same sentence also has a certain concept of time. Due to the successful application of LSTM technology in the field of temporal effect extraction, it has also been transplanted into related fields to extract relevant temporal factors. This research will use LSTM technology to mine the relationship between pattern information, shape information and cultural information of traditional sculptures and the existence of historical time. This can fully assist the computer-aided system to perform more accurate three-dimensional reconstruction tasks of traditional sculpture. If the LSTM technology can fully explore the relationship between the sculpture and the time factor, it can more fully reconstruct the three-dimensional effect of the sculpture in line with the historical factors.



**Figure 2:** The method and process of mining the time factor of traditional Chinese sculpture.

Figure 2 introduces the effect of mining the time relationship between Chinese traditional sculpture pattern information, shape information and cultural information. It can be seen from Figure 2 that LSTM technology is different from CNN. CNN mainly performs convolution calculations to extract relevant nonlinear relationships and feature effects contained in spatial angles. LSTM technology mainly uses the corresponding gate structure to mine the concept of time. The reason why the door structure can mine the time relationship of traditional Chinese sculpture is mainly because the door structure can work together, and it will calculate the distance of data at different times. If the data distance between two moments is relatively small, it means that the correlation between the two data is relatively strong. This can use the gating mechanism to give greater weights to retain this time information. However, data that is less relevant to the current moment is filtered by the forget gate.

### 3.3 Introduction to Computer Aided Technology and CAD

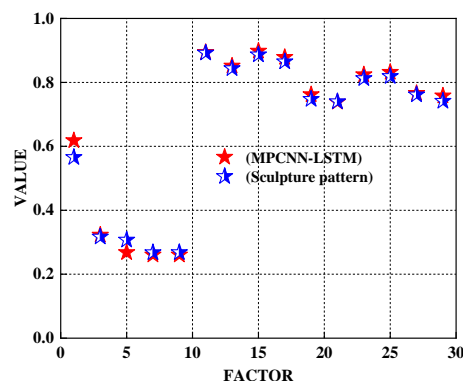
Computer-aided technology is a system that uses computer systems to display and process relevant research object materials. It can not only display the courseware content such as PPT in the teaching system, but also assist the design through different software. CAD technology can rely on computer-aided systems to design related patterns or shapes. CAD technology is a relatively intuitive drawing method, it already contains various shapes and color information required for drawing, and it can also carry out precise drawing control through the dimensional relationship and the constraint relationship between shapes. With the continuous development of

CAD technology, it can also draw three-dimensional renderings. This provides high technical support for the three-dimensional reconstruction art of traditional Chinese sculpture. It also allows the sculpture designer to make modifications during the design process, which is also a more intuitive and time-saving way to paint. It also provides a lot of materials for the reference of sculpture designers.

Through the introduction of the scheme in Section 3.2, we can understand that the processing of data sets related to traditional Chinese sculpture is an important process for artificial intelligence related theoretical skills. This is because the algorithms in artificial intelligence theoretical skills not only require the format of the data, but also the accuracy of the weight distribution. This will involve the processing of outliers in the data and the processing of missing values in the data. The missing value of the data mainly solves the data format requirements of the intelligent algorithm. The intelligent algorithm performs the calculation of the convolution matrix, which does not allow the data to be missing in the matrix. If the data is missing, the data matrix operation and calculation cannot be performed. Iterative process of the algorithm.

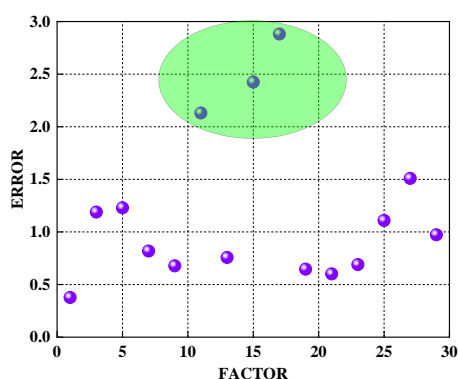
#### 4 RESULTS AND DISCUSSION SECTION

This study mainly explores the effect of artificial intelligence-related techniques in evaluating factors related to traditional Chinese sculpture. If intelligent skills can accurately evaluate the relevant characteristics of traditional Chinese sculptures, CAD technology in computer-aided systems can more accurately paint and reconstruct traditional Chinese sculptures. It mainly analyzes the pattern factors, shape factors and cultural factors designed by Chinese traditional sculpture technology. Figure 3 shows the performance of artificial intelligence-related theories in evaluating the pattern factors of traditional Chinese sculptures. It can be seen that the values of the evaluated sculpture pattern factors are in good agreement with the actual sculpture pattern values. The error here is relatively large for sculptural patterns with small eigenvalues, but it is also a reliable evaluation effect. For the larger eigenvalues of the sculptural pattern factor, the value and trend of the pattern are in good agreement with the actual pattern factor. This proves that MPCNN-LSTM technology can more accurately evaluate the pattern factors of traditional Chinese sculptures, which can provide more feature references for CAD drawing technology and computer-aided systems. Judging from the evaluation results shown in Figure 3, this also shows that artificial intelligence theory can better assist computer-aided systems and CAD technology to complete the pattern reconstruction function of traditional Chinese sculptures.



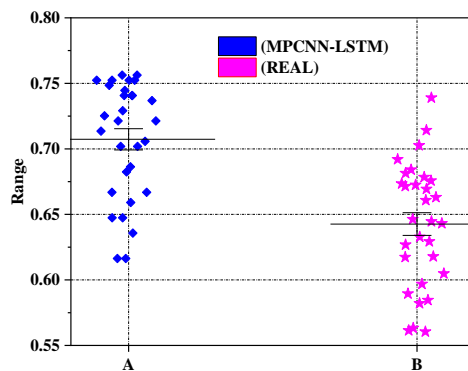
**Figure 3:** Eigenvalues of Chinese traditional sculpture pattern factors obtained by MPCNN-LSTM technology.

The shape of traditional Chinese sculpture is a three-dimensional feature, which is a feature that is difficult to achieve in traditional sculpture design methods. It can complete the task of three-dimensional reconstruction of traditional Chinese sculpture with the help of computer-aided technology and CAD technology. If the artificial intelligence method can efficiently evaluate the shape information in the traditional Chinese sculpture technology, it can assist the computer-aided system to complete the reconstruction task of the three-dimensional sculpture. Figure 4 shows the effect of MPCNN-LSTM technology in evaluating the shape information of traditional Chinese sculptures in the form of evaluation scatter plots. Through Figure 4, it can be more intuitively found that most of the errors in the shape information of traditional Chinese sculptures are distributed in the range of 0.5%-1.5%. There are only a few error margins above 2%, which have been marked with green areas in the figure. Through the error distribution of the sculpture shape information, it can be shown that MPCNN-LSTM technology can complete the evaluation of the shape information of traditional Chinese sculptures. It also shows that artificial intelligence theory can assist CAD technology and computer-aided systems to complete the task of 3D reconstruction of sculpture shapes.



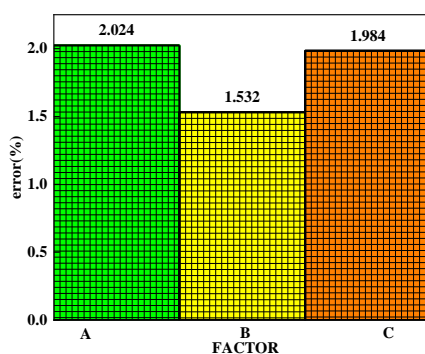
**Figure 4:** Error of shape information of traditional Chinese sculpture obtained by MPCNN-LSTM technology.

Cultural information is a feature that Chinese traditional sculpture art will ultimately display. Each traditional Chinese sculpture art will contain different historical and cultural information. In contemporary times, sculpture art will also be designed according to the culture of residential areas or urban landscapes. However, it is difficult to quantitatively analyze the cultural information of Chinese traditional sculpture art by artificial means, which makes it difficult for computer-aided technology and CAD technology to grasp the cultural information contained in Chinese traditional sculpture art. This requires the use of artificial intelligence theory to analyze the cultural factor information contained in the sculpture. Figure 5 shows the effect of MPCNN-LSTM in predicting cultural factors of sculpture art in the form of an evaluation box map. It can be seen from Figure 5 that MPCNN-LSTM accurately evaluates the cultural information contained in traditional Chinese sculptures. Whether it is the box distribution shape of the sculpture cultural information or the specific value of the box, the characteristics of the estimated cultural information are in good agreement with the actual sculpture cultural characteristics. Once the MPCNN-LSTM technology can successfully evaluate the cultural information of Chinese traditional sculptures, it can carry out three-dimensional reconstruction of the cultural information of traditional sculptures through computer-aided technology and CAD technology.



**Figure 5:** Evaluating eigenvalues of traditional Chinese sculpture cultural information.

The above analysis only analyzes the evaluation effect of part of the sculpture test set, which can only represent the locality of the test set. This study also demonstrates the effectiveness of the MPCNN-LSTM technique in evaluating three factors of traditional Chinese sculpture in the form of a global error distribution. Figure 6 shows the effectiveness of artificial intelligence theory in testing the patterns, shapes, and cultures of traditional sculptures. It can be seen from Figure 6 that the errors of MPCNN-LSTM in evaluating the three characteristics of traditional Chinese sculpture have a good distribution. The largest global evaluation error comes from the pattern features of traditional Chinese sculptures, and this part of the effect error is 2.024%. The smallest global evaluation error comes from the shape factor of traditional Chinese sculpture, and the effect of this part of the factor is 1.532%. The global error of cultural evaluation of traditional Chinese sculpture is only 1.984%.

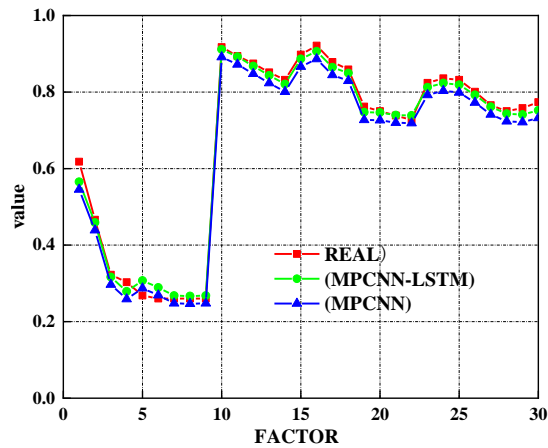


**Figure 6:** The MPCNN-LSTM technique evaluates the global error in terms of three characteristics of traditional Chinese sculpture.

It also explores the impact of LSTM technology on evaluating the performance of traditional Chinese sculpture, which is to compare the differences between MPCNN-LSTM technology and MPCNN technology in evaluating traditional sculpture. In this study, the sculpture pattern feature with the largest global evaluation error was selected as the research object. Figure 7 shows the effect curves of two artificial intelligence algorithms for predicting traditional sculpture factors.



From Figure 7, it can be found that the curve evaluated by the MPCNN-LSTM technology is closer to the effect value of the actual pattern feature.



**Figure 7:** Differences between MPCNN-LSTM and MPCNN in evaluating sculptural factors.

The eigenvalues of the sculpture pattern obtained by MPCNN are smaller than those obtained by the MPCNN-LSTM technique, and these distances are farther from the actual sculpture pattern information features. This shows that the pattern prediction of traditional Chinese sculpture needs to use LSTM technology to obtain more accurate results. This difference in effect can also guide the prediction and evaluation of artificial intelligence-related theories in evaluating the shape and cultural factors of traditional Chinese sculpture.

## 5 CONCLUSION

Chinese traditional sculpture is not only a kind of sculpture art, it also plays the role of inheritance of Chinese history and culture. Chinese traditional sculpture is also an important form of displaying culture in different historical eras. Compared with the form of painting, sculpture art will retain the corresponding historical, cultural and artistic characteristics for a longer time. However, traditional sculpture art is a display of three-dimensional effects, and traditional design methods often first use the form of two-dimensional painting to reflect it. This traditional sculpture art not only consumes too much time, it also limits the display and retention of Chinese sculpture art. With the emergence and development of computer-aided technology and corresponding drawing software, the sculpture of traditional Chinese sculpture art has ushered in a new development direction. Computer-aided technology can show the three-dimensional effect of traditional Chinese sculpture art, and it can also assist the sculptor to design the sculpture art quickly. The traditional sculpture art design scheme is difficult to grasp the shape information of the existence of the sculpture and the cultural information it reflects. It can only display the pattern information of the sculpture, which is an incomplete design scheme. Based on artificial intelligence theory technology, computer-aided technology, and CAD drawing technology, this research studies the pattern, shape and cultural information in traditional Chinese sculpture technology. This information can better assist in completing the three-dimensional reconstruction effect of sculpture. Through research, it can be found that the artificial intelligence theory MPCNN-LSTM technology can assist computer technology and CAD technology to evaluate the pattern information, shape information and cultural information of traditional sculptures.

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