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Computer-Aided Design AND APPLICATIONS

Computer Aided Art Modeling Design Method Based on Improved Genetic Algorithm

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Abstract. Combining with the needs of art design, the growth of art design CAD system is not only conducive to improving the efficiency of art design, but also to further improve the level of art design. Art CAD creation based on CAD systems plays an important role in neural network systems. Compared with traditional design methods, it has more efficiency advantages in system design efficiency. In the traditional process of artistic expression analysis, this article constructs a convolutional network feature extraction optimization model for computer art model design. This model optimizes some of the shortcomings of traditional methods. Corresponding weights are set according to the different obtained feature information in multiple convolution layers of the network, and a label set with multi-category labels is created, which can be classified many times in one transmission, thus expanding the differences between fine-grained images.

Keywords: Deep Learning; CAD; Art Modeling Design; Feature Extraction
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1 INTRODUCTION

The popularization and application of computer technology have brought broader development space and innovation in content and form to the design industry. Art designers can not only directly use paper and pen for design, but also use CAD software for design. Product design is a creative activity that interweaves sensibility and rationality. Individual designers complete the final product design plan by analyzing, synthesizing, creating, and expressing their own design knowledge. Multilayer neural networks can abstract and classify data. Under the framework of deep learning, multi-layer network structure is an important form of art design, which constructs different deep learning models through different neurons and layers. In art and design, the use of color and shape is also a factor that needs to be considered. For example, different colors can be used to represent different types of neurons or network layers, and different shapes can be used to distinguish different model components. The design of multi-layer network structures under

deep learning needs to consider multiple factors, including the shape, order, structure, complexity, and color of neurons and layers in art and design elements. The reasonable use of these elements can make deep learning models more expressive and effective in recognition. The computer-aided art modeling design method based on deep learning can be realized through the following steps: first, a large amount of art modeling design data needs to be collected, and the collected data needs to be preprocessed, such as image enhancement, Data cleansing, etc. Use deep learning model to extract data features, such as Convolutional neural network (CNN). The extracted features are used to train the deep learning model, such as Generative adversarial network (GAN). Evaluate the trained model, such as using cross validation methods. Finally, carry out artistic form design: use the trained model for computer-aided artistic form design, such as generating new artistic form designs, optimizing existing designs, etc. In the above steps, feature extraction and model training are key steps that can be achieved using various deep learning models. Generative adversarial network (GAN) can be used to generate new artistic modeling design. At the same time, it can also combine traditional artistic modeling design methods, such as composition, color, line, and computer graphics technology, such as rendering, animation, to achieve more realistic and vivid artistic modeling design effects.

Image classification refers to the image processing method of classifying the input original image through feature extraction. Traditional image classification is based on feature encoding, while emerging image classification is based on DL. In the process of product design decision-making, decision-makers need to consider many factors such as user needs, product experience, aesthetic design, and cost. Design decision-making and design evaluation are inherently a fuzzy, uncertain, subjective, multitasking, and complex selection process. Feature extraction and model training are key steps that can be achieved using various deep learning models. For example, use classifiers to train models, etc. At the same time, traditional image processing methods, such as color and texture, and computer graphics technologies, such as rendering and animation, can also be combined to achieve more accurate and refined art image classification effects. This article proposes a DL based computer-aided artistic design method. And a feature extraction and optimization model for art modeling images based on GA improved CNN was constructed, providing a guarantee for the artistic creation of art designers.

The distribution differences of some features extracted by CNN between different categories are very small, which makes little contribution to classification and even reduces the performance of the classifier. In addition, the features extracted by CNN often have high dimensionality, occupy a large amount of storage space, and easily lead to overfitting of the classifier during the training process. Because many artistic expressions have strong visual impact and cultural connotations. If computers can simulate the style of artists, they will have stronger learning ability and intelligence, which can generate a large number of non-realistic images with stronger artistic expression ability and psychological impact.

(1) In this article, GA is used to improve the traditional CNN, and a neural network system with pre-input is established and trained, which is more in line with human emotional cognition, so as to obtain the nonlinear relationship between modeling elements and perceptual images.

(2) The model sets corresponding weights in different convolution layers of the network according to the obtained feature information, and creates a label set with multi-category labels, which can be classified many times in one propagation, thus expanding the differences between fine-grained image classes.

This study first introduces the basic theory of CNN, and constructs an analysis model of artistic modeling characteristics based on CNN, and then improves the model by using GA to establish and train a neural network system with pre-input that is more in line with human emotional cognition. The performance of this method is tested by experiments, which proves the effectiveness of its application in art modeling design optimization.

2 RELATED WORK

Bhatt et al. [1] conducted an analysis of deep learning representation techniques for image automation processing. Functional compensation for surface defects in images has been achieved through machine learning technology for automated image detection. Deng and Chen [2] conducted computer mature art expansion in arts and crafts design. Its construction analyzes the current art requirements and methods. By optimizing the art of artificial intelligence, it analyzes the new development and auxiliary applications of art design. Ghosh et al. [3] devoted themselves to the application of deep learning technology in the network model of image segmentation based on machine learning. And in the object detection area, image recognition was performed using segmentation algorithms, which analyzed the encoding impact of visual image segmentation dynamics using logical algorithms. Guo and Li [4] proposed an information processing perspective scenario analysis based on information media compressed video. It discusses and analyzes the theoretical tools of digital network Information design, and combines the artistic information category design of the contribution network. Currently, the combination of computer technology and three-dimensional modeling of artistic images is rapidly developing. Guo and Wang [5] have conducted computer-aided simulation generation of digital carving technology processes. Through the processing of the observable digital image of the focused image, a model building system of Polygonal modeling is developed. The computer-aided modeling process of this sculpture has certain design innovation. He and Sun [6] conducted an analysis of the art teaching mode auxiliary system model for artificial intelligence auxiliary information systems. By collaborating with artificial intelligence for personalized teaching, the teaching mode and information technology development of online teaching platforms have been improved. Hu [7] constructed and analyzed the geometric information of the plastic parts database based on 3D CAD technology. It uses 3D feature construction technology to construct geometric information for digital projection of physical models. Orthogonal analysis of digital model objects based on digital information projection compares the physical construction of technical data in CAD. Jang et al. [8] conducted a comparative analysis method for artificial image processing based on computer vision. Through the function recognition of image computer, it analyzes the operation analysis strategy of Railway track based on computer area recognition. Through a broadband line scan of the area, it detected defects in the location of the facility. Jing and Song [9] conducted a morphological analysis of three-dimensional scenes on the development of computer software technology. It uses computer automated character simulation for the artistic construction of model animation. Based on the development of motion trajectories of different character models and the micro characteristics of other animation parameters, create images of lighting. Lu et al. [10] conducted high-quality processing analysis for large-scale image information retrieval. It conducted a label accuracy analysis on the network accuracy of image information processing for key issues of discrete discrimination. The results show that compared with advanced hash algorithms, it maintains the network information integrity of the image. Minaee et al. [11] conducted intelligent processing of computer vision images. It constructs and analyzes a multi-scale decoding architecture for deep learning. This includes the construction of a visual attention adversarial environment model based on convolutional pixel labeling, which optimizes the image processing capabilities of the dataset. Monga et al. [12] conducted an analysis of the emerging technology system linking problem of image processing technology for deep learning network signals. The sustainable development of high-performance network architecture has been achieved by applying deep neural networks to image processing and analysis in sparse encoding. Wan et al. [13] conducted a similarity function feature matching analysis of stripe example images. Through experimental matching verification of the image landscape of the search algorithm, it analyzed the geometric algorithm change matching problem in multimodal images. Wang et al. [14] conducted a domain specific analysis of visual image video resolution. It conducts Unsupervised learning on the published image benchmark data set and performance indicators, and optimizes the visual performance of image super-resolution. Zhao et al. [15] conducted artistic processing on the art packaging material technology of today's agricultural products. By using computer color assistance for ecological concept groups, a product information model design framework for packaging design images was constructed. By using

different combinations of product information, saturation testing, analysis, and verification of structural dynamics have been achieved.

3 COMPUTER AIDED ART DESIGN OPTIMIZATION BASED ON DL

In this era of extremely rich products, people's consumption concepts are constantly changing, and the change of consumption concepts makes products no longer simply exist as carriers of use functions. Many consumers regard the original feelings and spiritual satisfaction as the focus of choosing and buying products. With the great change of this consumption concept, consumers put forward new requirements for product design. For designers, how to find and master the spiritual needs of consumers, how to experience and understand the individual needs of consumers, how to shape the individual characteristics of products, and how to give emotional modeling to products are all very important topics. Data preprocessing: preprocess the collected data, such as image enhancement, Data cleansing, etc. Use deep learning model to extract data features, such as Convolutional neural network (CNN). The extracted features are used to train the deep learning model, such as Generative adversarial network (GAN). Evaluate the trained model, such as using cross validation methods. Computer Aided Art Design (CAID) is a method of using computers and their graphic devices to assist designers in their design work. CAID can integrate the principles of art design and integrate computer graphics software with the comprehensive application of art design. For example, designers can use computer software such as Adobe Photoshop, Illustrator, SketchUp, Rhino, etc. to draw, render, model, and modify artworks. In CAID, computers can assist designers in conducting extensive calculations, analyses, and comparisons to determine the optimal solution. Designers can convert sketches into working drawings and use computers to edit, zoom in, zoom out, translate, and rotate graphic data. Computers can also compare different schemes to help designers evaluate the advantages and disadvantages of different schemes. In short, CAID is a method of utilizing computer technology to assist design work, which can improve design efficiency and quality.

Use trained models for computer-aided art design, such as generating new art design solutions, optimizing existing designs, etc. In the above steps, feature extraction and model training are key steps that can be achieved using various deep learning models. For example, Convolutional neural network (CNN) can be used to extract image features, and Generative adversarial network (GAN) can be used to generate new artistic design schemes. At the same time, it can also combine traditional art design methods, such as composition, color, line, etc., as well as computer graphics technology. For example, rendering, animation, etc. to achieve more realistic and vivid artistic design effects. The computer-aided art design image features of deep learning include geometric features, texture features, and contextual features. Among them, geometric features include corners, lines, and curves, which can be extracted from prominent points, lines, and regions in the image to achieve the composition and shape of artistic design. Texture features include color, texture, and shape, which can be extracted from images to achieve texture and detail in artistic design. Context features include semantic and contextual information of the image, which can be used to achieve the theme and background of art design by identifying objects and scenes in the image. By combining these features, deep learning models can automatically generate new artistic design schemes or optimize existing design schemes, thereby achieving more realistic and vivid artistic effects.

3.1 Art Product Development and Application of 3D Modeling

With the progress of sci & tech, material products have been greatly enriched, and the phenomenon of product homogenization in the market is becoming more and more obvious. The user's demand for products has risen from material satisfaction to spiritual satisfaction, thus, art modeling design is increasingly recognized by the public. At the same time, in the field of graphics research, computer-aided 3D creative modeling technology has attracted more and more attention. 3D modeling is the most basic and widely used computer-aided technology, and it is also

a necessary prerequisite for implementing other CAD, CAM and CAE technologies. It is widely used in almost all product design and manufacturing fields. Through the analysis of modeling software technology, it is known that they are created by professional artists by combining the theories of computer iconography and fine arts. In the development process of art products, 3D modeling is not only an important means and expression of product design and mold design, but also the basis for subsequent model analysis and manufacturing stage. Professional artists in modeling software technology, combined with computer graphics and art, can create stunning works of art. This combination can use various modeling software and knowledge of computer graphics and art to realize the complete creation process from sketch to final work. First, artists can use modeling software to create basic models. This process can control Urelement such as points, lines, and faces through the tool set of the software. Then, artists can use the software's material and texture functions to add details and texture to the model, making the work more realistic. Finally, artists can use the software's lighting and rendering tools to enhance the effect and atmosphere of their works. Through this combination, artists can more accurately control the shape, scale and details of the model with the help of computer graphics. Meanwhile, through the knowledge of art, artists can better grasp elements such as color, light and shadow, and composition, creating more beautiful and realistic works. In short, modeling software technology professionals can combine computer graphics and art to create stunning works of art, which have broad application prospects and enormous potential.

3.2 CNN and its Application in Feature Extraction of Art Modeling Images

Computer image 3D modeling technology is a method of using computer technology to establish 3D models. These technologies include 3D laser scanners, 3D modeling software, etc. The process of 3D modeling involves obtaining 3D information from initial data, such as point cloud data, and then processing the data, such as removing noise points, simplifying, etc. Then organize the 3D data in different ways, and ultimately achieve the drawing of a model with 3D features in a computer. In 3D modeling, there are various methods that can improve modeling accuracy, such as using shadow information, using lighting information, and mixing multiple types of information. At present, Polygon mesh rendering technology has been mature, and popular 3D production software, such as OPENGIL, can realize the mesh modeling and rendering of 3D objects. In computer graphics, developing easy-to-use and powerful 3D modeling technology has always been a key basic research problem. Based on 2D image data, the 3D space is restored and the 3D model of the target in the image is reconstructed, which has low cost and convenient acquisition of image data. Therefore, the image-based 3D reconstruction technology has great research value, and its realization process is mainly classified based on depth map, stereo vision and plane. RGB images, which are mainly represented by 2D pixel arrays, are different. At present, there is no unified data expression form for 3D geometric data. The expression of 3D geometric data is related to the data structure that the algorithm depends on, and also to the format obtained during data acquisition. Geometric data are expressed in different ways, and the corresponding feature extraction models are also different. This article attempts to optimize the computer-aided art modeling design technology with the help of CNN method in DL, so as to provide technical support for art designers' artistic creation. The basic model of CNN is shown in Figure 1.

Feature modeling is closely related to entity modeling. On the basis of solid modeling, product feature descriptions are added to the entire product production process to make product expression more specific. Subdivision modeling technology is a very practical and intuitive modeling method. The stitching method of image blocks matches the original texture with the existing texture, that is, finding the texture mapping between the source image and the target image, and then cutting redundant boundaries. Feature oriented texture combination method generates feature domain, which can be obtained by various feature extractors or Radial basis function. Finally, in order to achieve perceptual similarity between the output image and the input image, the norm of the feature domain and style image of the input image should be as small as possible.

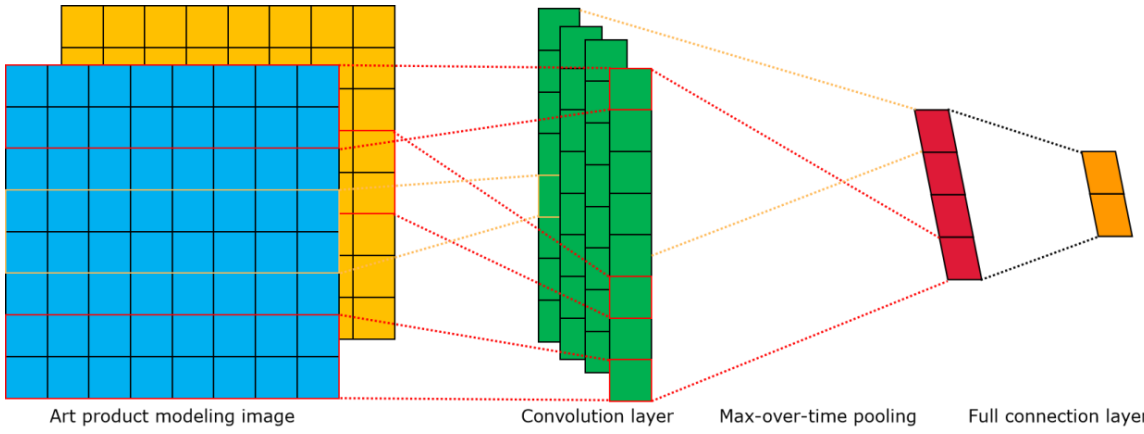

Figure 1: CNN basic model.

Feature oriented texture combination methods can generate feature domains with similar repetitive patterns. The principle of this method is to use similar repeated texture regions in the image to concatenate them into a larger image. When implementing, the small image can be randomly cut into multiple small patches, and then similar patches in the large image can be found to concatenate them into a larger image. The advantage of this method is that it can generate feature domains with similar repeating patterns, while the disadvantage is that there may be texture distortion and blurring.

Subdivision modeling technology can almost complete any desired model, no matter how complex the model is, it can be used to complete it. A computer-aided 3D modeling technique focuses on recommending available components. This technology is based on geometric or semantic compatibility, extracting component prompts from pre segmented Wang Wei model databases for users to use. The image recognition process of computer-aided artistic design based on CNN is shown in Figure 2.

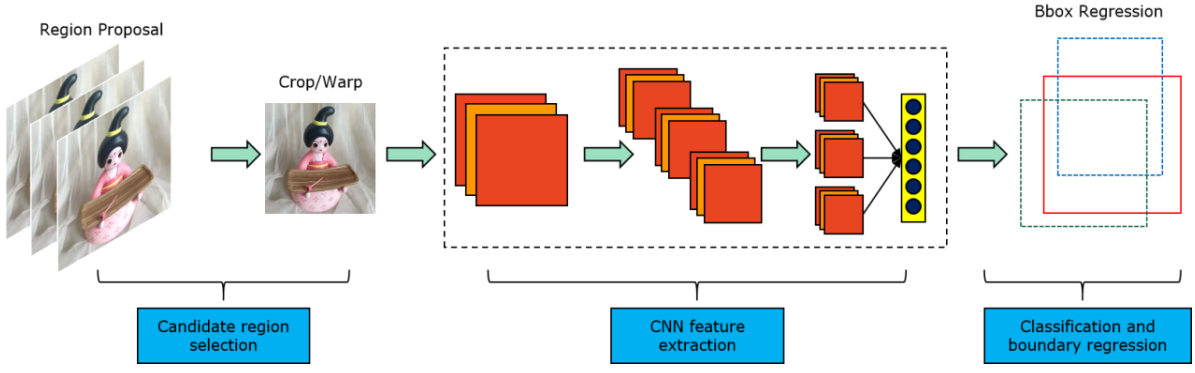

Figure 2: CNN model.

At present, the theory and technology of artificial intelligence represented by DL has become the core and key supporting technology of the new generation of computer science. DL is a series of various neural networks. The quantity of these neural networks is huge and complex, and the hierarchical structure is very complicated. Due to the shortcomings of traditional methods, such as too complicated calculation process, low efficiency, backward derivation of camera parameters,

and low similarity between reconstruction results and real 3D stereo, it has become the mainstream way to construct end-to-end neural network to complete image 3D reconstruction. DL is a network composed of simple neurons with self-adaptation, which can simulate any function in theory. It can build a multi-layer neural network structure, and then rely on massive data training to learn more deep-seated features, thus improving the accuracy of classification.

3.3 GA Improved 3D Model Generation and Optimization Algorithm for Art Modeling

CAD algorithms can be used to generate various types of artistic design, including sculpture, painting, architecture, and more. Through continuous optimization, genetic algorithms can explore more design spaces and improve the diversity and innovation of artistic design. Genetic algorithm can generate artistic design that meets the requirements based on different design needs and aesthetic preferences. During the design process, flexibility and customizability of the design can be achieved by adjusting algorithm parameters and fitness functions. Genetic algorithms can generate artistic and aesthetic designs. During the design process, algorithms can evaluate the fitness of the design to find the optimal solution, making the design more in line with aesthetic standards. Genetic algorithms can be used to predict the effectiveness of artistic design and optimize it. During the design process, algorithms can predict the effectiveness of different design schemes, compare and optimize them, and select the optimal scheme for further design and production. Genetic algorithms can be used in various fields of artistic design, such as architectural design, product design, sculpture design, etc. Through continuous optimization, genetic algorithms can improve the practicality and application value of design, meeting the needs and challenges of different fields. In summary, the artistic effects of GA 3D model generation and optimization algorithms can be achieved through continuous optimization and exploration of more design space. Genetic algorithms can generate artistic and aesthetic designs that enhance diversity and innovation, achieve flexibility and customizability, and enhance the ability to predict and optimize design effects.

The GA improved 3D model generation and optimization algorithm for art modeling can use genetic algorithms to optimize computer-aided art design. The algorithm can be divided into two stages: 3D model generation and model optimization. In the 3D model generation phase, you can use the deep learning model, such as the Generative adversarial network, to generate the 3D model of artistic modeling. In the model optimization stage, genetic algorithms can be used to optimize the 3D model, such as optimizing the geometric features, texture features, and contextual features of the model, in order to achieve more realistic and vivid artistic effects. At the same time, other optimization algorithms, such as Simulated annealing algorithm. As a derivative of 2D engineering drawing, wireframe model is the earliest 3D space model. The wireframe model is based on the 2D engineering drawing, in which the depth coordinates are added, and the straight line in the original plane is represented as the boundary of the model, and the original arc is represented as the external outline. Solid modeling is based on many basic voxels, such as cube, cylinder, vertebral body and ring body, and generates the required geometric shape through Boolean operation. These bodies have complete geometric information and are real and unique 3D objects. The complete 3D solid structure is complex, which can be divided into several components and then spliced and merged after modeling separately. Sketch contains the outline information of art product model, extracts the position constraints between parts, and defines the connection and inclusion relationship between parts. The parameterization of straight-line contour is relatively simple, while the contour of curve needs to be expressed by curvature, curvature radius, curvature center and other parameters. The outline curve of fine arts modeling is shown in Figure 3.

The image channel is divided, and the structure Vector field obtained from the image brightness component is used to convolve the reference image according to the Vector field data, and then color simulation is carried out to obtain the final rendering result. The graph neural network model for node embedding and edge annotation achieves attribute definitions of node and edge features through feature encoding networks, and adaptively adjusts the weight of each meta task based on the loss of each meta task.

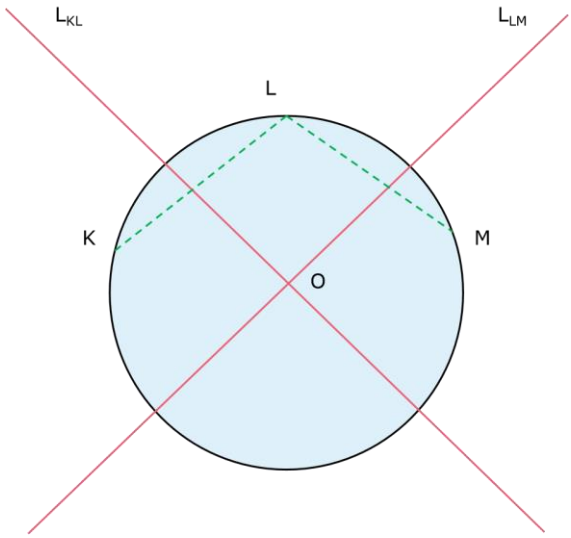

Figure 3: Curve diagram of fine arts modeling outline.

Usually, regularized data can be processed through convolution, which is similar to expressing multiple views and depth maps through 2D convolution and voxels through 3D convolution. However, for the expressions of point clouds and triangular patches, convolution is not used, and these expressions are not regularized. The basic idea is to use modeling components or modeling results to prompt users. Some of these components or results are unexpected to users, thereby motivating them and achieving innovative results.

Using three points to determine the radius of curvature of the curve, the principle is: take three points on the curve $K=(x_K, y_K)$, $L=(x_L, y_L)$, $M=(x_M, y_M)$. Let the Cartesian coordinates of n_i be $(n_{i,x}, n_{i,y}, n_{i,z})$, and represent it as spherical coordinates (r_i, θ_i, ϕ_i), and the relationship between them is:

$$n_{i,x} = r_i \sin\phi_i \cos\theta_i \tag{1}$$

$$n_{i,y} = r_i \sin\phi_i \sin\theta_i \tag{2}$$

$$n_{i,z} = r_i \cos\phi_i \tag{3}$$

Since n_i is a unit normal vector, there is $r_i = 1$. According to the above relational expression, the corresponding (θ_i, ϕ_i) is determined for the unit normal vector n_i of each triangular patch, which is used to represent the direction information of the normal. in:

$$\begin{cases} \phi_i \in \left[-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right] \\ \theta_i \in [0, 2\pi] \end{cases} \tag{4}$$

Next, the area weighted histogram of normal direction is calculated:

$$H(i,j) = \sum_{(\phi_k, \theta_k) \in R_{i,j}} S_k / S \tag{5}$$

When running 3D software to create artistic modeling, it is necessary to use the software effectively to speed up the creation of Solid modeling and save the creation time of modeling. The meta-baseline classification method trains classifiers in CNN and learns a nearest neighbor based small sample classification algorithm, making the model more portable and capable of classification in different images. After the completion of 3D solid modeling, 2D rendering can be generated using the 3D software's renderer or plugin renderer. In addition, 3D artistic design has also become a concern for people, and in order to achieve better visual effects and customer satisfaction, it is often necessary to design sketches. Therefore, sketching is also a Committed step of 3D model design. It can be said that the quality of sketch drawing determines the success or failure of 3D modeling design.

$$y = x * w \in R^{u \times v} \tag{6}$$

The size of the extracted features:

$$u = \left[\frac{n - s + 2 \cdot Zeropadding}{Stride} \right] + 1 \tag{7}$$

$$v = \left[\frac{m - k + 2 \cdot Zeropadding}{Stride} \right] + 1 \tag{8}$$

This method divides the image features of the training set extracted by CNN into labels, and then describes the distribution of image features by using the results of GA for each dimension feature in each category. For chromosome k with fitness f_k, its selection probability s_k is calculated as follows:

$$s_k = \frac{r_k}{\sum_{i=1}^{pop\_size} f_i} \tag{9}$$

Then sum the fitness values of all chromosomes in the population:

$$F = \sum_{i=1}^{pop\_size} f_i \tag{10}$$

For each chromosome, calculate the selection probability c_k:

$$s_k = \frac{r_k}{F} \tag{11}$$

For each chromosome, calculate the cumulative probability t_k:

$$t_k = \sum_{i=1}^{pop\_size} s_i \tag{12}$$

Collect the sample pictures of art modeling products as comprehensively as possible through websites, magazines and other channels, delete the samples with repeated or similar forms through expert interviews, and select the representative sample set of art modeling products:

$$X = \{X_1, X_2, X_3, \ldots, X_m\} \tag{13}$$

Quantitatively describe each representative art modeling product sample to obtain an art modeling design parameter set:

$$x = \{x_1, x_2, x_3, \ldots, x_n\} \tag{14}$$

The modeling design parameter matrix of representative art modeling product samples is:

$$X = \begin{bmatrix} x_1^1, x_2^1, x_3^1, \ldots, x_n^1 \\ x_1^2, x_2^2, x_3^2, \ldots, x_n^2 \\ \ldots \quad \ldots \quad \ldots \quad \ldots \\ x_1^m, x_2^m, x_3^m, \ldots, x_n^m \end{bmatrix} \quad m = 1,2,3,\ldots,m; \;\; n = 1,2,3,\ldots,n \tag{15}$$

Where, the quantity of m representative art modeling product samples; n stands for the dimension of art modeling design parameters. Based on this feature distribution description, the difference between classes will be more objective, which can effectively solve the problem of super-parameter selection such as the quantity of clusters in feature description, thus further improving the performance of image classification. At present, with the rapid growth of DL in image processing, the application of neural network in image 3D reconstruction technology has greatly improved the reconstruction accuracy and achieved higher efficiency than traditional algorithms. Neural network can get the parameters of feature extraction layer through training data learning, which avoids the tedious work of manual feature extraction.

4 RESULT ANALYSIS AND DISCUSSION

Different modeling methods also have their advantages and disadvantages. In many cases, multiple modeling methods can be used comprehensively. Effective image processing is the basis of subsequent feature extraction and classification, which directly affects the detection resolution and recognition accuracy of the whole system. In CNN, information such as images and audio are input into the network, and more abstract information is extracted layer by layer through convolution layer, pooling layer and full connection layer. Each layer needs to convolve other information such as input graphics or audio with a series of trained filters, and then add regularization terms and feature normalization, and then down-sample, which can make the network robust to objects in the image. On the platform of Matlab, the efficiency of different methods of art image feature classification model is tested, and the recognition efficiency is evaluated by running time. The statistics of calculation time experimental results of different feature dimensionality reduction are shown in Table 1.

Music type	*Training sample*		*Test sample*	
	LSTM	GA-CNN	LSTM	GA-CNN
Sculpture	7.72	6.35	8.55	6.69
Draw	7.33	6.29	6.63	4.52
Paper cutting	8.69	7.43	6.85	4.69

Table 1: Dimension reduction time of art image feature classification model.

DL can also make art intelligent while making the machine intelligent. Compared with the traditional algorithm of image artistry, neural art abandons the stacking of traditional algorithms, and can learn to imitate the essence of the original painter only through automatic learning on the network. The traditional art modeling can only be aimed at a certain style of a certain painter. After down sampling, it passes through the nonlinear activation function layer, which not only reduces the phenomenon of over-fitting, but also solves a large quantity of nonlinear problems in reality. By combining the above mapping layers, the relationship between layers can be obtained and redundant information can be filtered out, so as to extract the essential features of complex structural rules in signal graphics or audio information. The results of the feature classification model of art images based on GA-CNN are shown in Figure 4. The comparison between GA-CNN and LSTM's art image feature classification models is shown in Table 2.

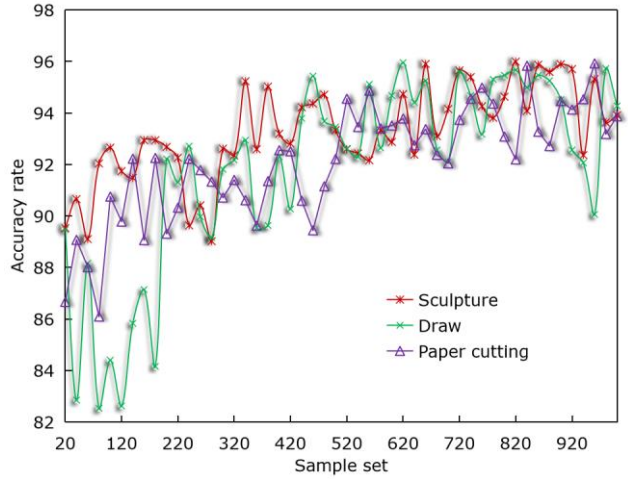

Figure 4: Comparison of accuracy of feature classification models of art images between GA-CNN and LSTM.

Music type	*Training sample*		*Test sample*	
	LSTM	*GA-CNN*	*LSTM*	*GA-CNN*
Sculpture	90.36%	93.52%	85.37%	93.68%
Draw	87.45%	96.25%	86.35%	94.44%
Paper cutting	87.42%	95.76%	87.75%	96.96%

Table 2: Correct rate of feature classification model of art images.

The use of space-time comprehensive modeling method is a common means of modern graphic design, which more and more expresses the unique art patterns and fashion humor. In the aesthetic process, both orderly combination and disorderly elements are the source of graphic creation, and the arrangement, division and construction of the whole and part all give more ideological connotation to the spirit of the picture. Figure 5 shows the running time comparison results calculated by GA-CNN and LSTM.

It can be seen that although GA-CNN has no obvious advantages in the initial stage, GA-CNN shows high operational efficiency when the complexity of artistic modeling images is increasing. Compared with LSTM algorithm, GA-CNN effectively improves the design efficiency because of its controllable execution parameters, clear objectives, less time consumption and lower similarity between structures. Different CNN have more or less the same properties, including: local perception, weight sharing and pooling. For local perception, focusing on local small blocks like human eyes, each hidden layer node will only be connected with its adjacent local area, while the hidden layer nodes in the common multi-layer perception machine will be connected with each pixel block in the image, thus greatly reducing the parameters of the neural network.

Compared with previous optimization algorithms, GA-CNN has the advantages of simple calculation process, strong flexibility, suitability for parallel processing, strong robustness and good performance, and can be used to solve complex nonlinear optimization problems. Check the recall and accuracy of the feature recognition algorithm for fine arts modeling images, as shown in Figure 6 and Figure 7.

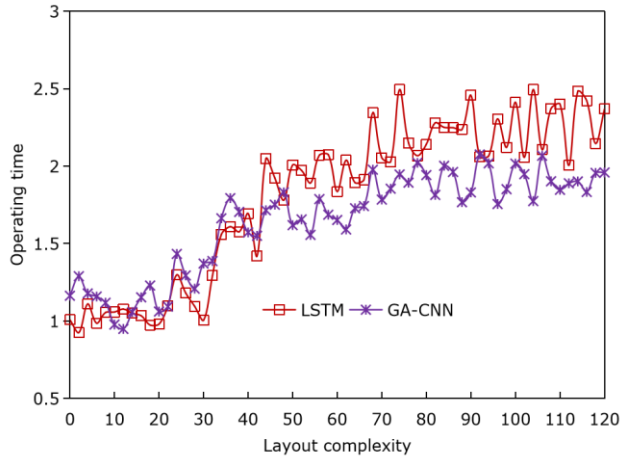

Figure 5: Comparison chart of algorithm calculation time.

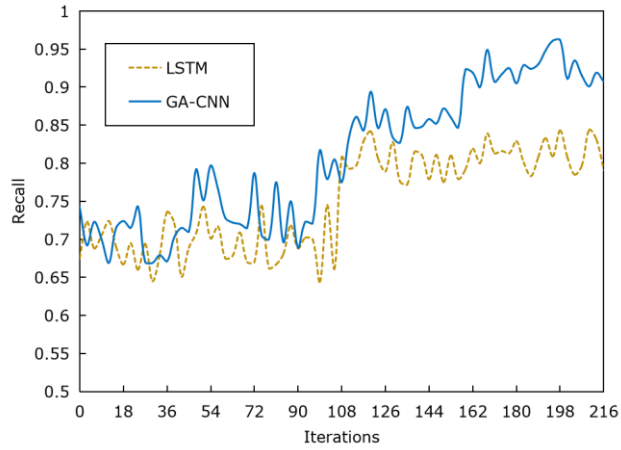

Figure 6: Comparison of recall of feature recognition of art modeling images.

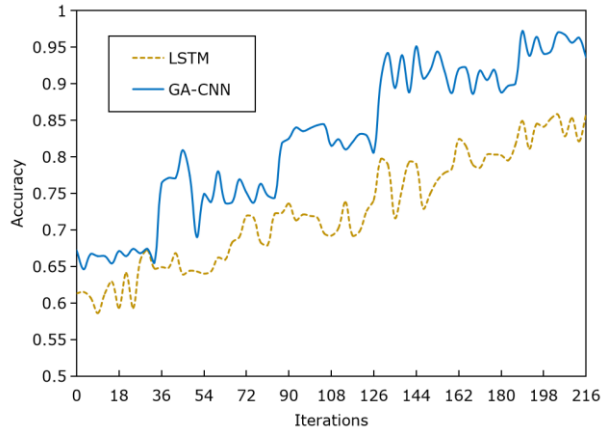

Figure 7: Comparison of feature recognition accuracy of fine arts modeling images.

Each layer convolves the whole picture with the same convolution kernel sliding, and the same convolution kernel reduces parameters, so CNN is more lightweight. There are quite a lot of redundant information in a large quantity of pixels. By down-sampling, the useful information is highlighted while reducing the quantity of pixels. GA-CNN is more accurate in identifying the characteristics of art modeling images, and the accuracy can reach more than 96%, which can accurately locate the edge contour of art modeling images.

Genetic algorithm has global search ability, which can search the entire solution space and find the optimal solution. In GA-CNN, genetic algorithm is used to search the optimal structure and parameters of Convolutional neural network, so as to improve the classification and recognition accuracy of the model. Genetic algorithm has the characteristic of fast convergence and can find the optimal solution in fewer iterations. In GA-CNN, genetic algorithm can quickly find the optimal structure and parameters of Convolutional neural network, thus reducing the training time and computing resource consumption of the model. At the same time, genetic algorithm has robustness and is not sensitive to initial solutions and parameter settings. It can find the optimal solution under different initialization and parameter settings. In GA-CNN, the robustness of genetic algorithms can improve the stability and generalizability of the model, thereby improving the classification and recognition accuracy of the model. Convolutional neural network has a strong feature extraction ability, which can automatically extract useful features from images. In GA-CNN, the Convolutional neural network can further improve its feature extraction ability by optimizing the genetic algorithm, so as to better recognize the features of artistic modeling images. GA-CNN can be used for various types of image recognition tasks, including artistic image classification, object detection, object tracking, and so on. In the field of art modeling image recognition, GA-CNN can be used for application scenarios such as classification, recognition, and annotation, and has high practical value. In summary, GA-CNN has the advantages of global search ability, fast convergence, robustness, feature extraction ability, and applicability in identifying features of art and sculpture images, making it an effective image recognition method.

5 CONCLUSION

This paper introduces a method of feature extraction and optimization of artistic modeling image based on Convolutional neural network (CNN) improved by genetic algorithm (GA). Art modeling images refer to images with unique style and aesthetic appeal, such as painting, photography, design, etc. This method aims to extract the features of artistic modeling images and optimize them to improve the accuracy of image classification and recognition. Genetic algorithm is an optimization algorithm that simulates the process of biological evolution, with the characteristics of global search and fast convergence. In this paper, we will use genetic algorithm to optimize the Convolutional neural network, so as to improve the accuracy of its classification and recognition. Compared with the traditional art design, the design efficiency of CAD software is higher. Computer-aided art design software takes advanced computer technology as a means to make technological innovation on the basis of traditional art design. In this article, a computer-aided art modeling design method based on DL is proposed, and an image feature extraction and optimization model of art modeling based on GA-improved CNN is constructed. The performance of this method is tested through experiments, which proves the effectiveness of its application in art modeling design optimization. Compared with the traditional LSTM algorithm, the proposed method has obviously higher precision for the design of fine arts modeling images. GA-CNN is more accurate in identifying the characteristics of art modeling images, and the accuracy can reach more than 96%, which can accurately locate the edge contour of art modeling images.

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