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Computer-Aided Design AND APPLICATIONS

Fractal Art Graphic Generation Based on Deep Learning Driven Intelligence

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Abstract. Science and technology have greatly promoted social progress and development, and their impact in the field of art and design is also enormous. Driven by AI (Artificial intelligence), this article proposes a fractal art graphic generation model based on DL (Deep learning). By minimizing the total loss function of content information and style information, the model iteratively optimizes a random noise image, so that the random image finally retains both the content information of the content map and the texture information of the style map. Moreover, by designing loss functions with different fusion degrees to meet the requirements of different feature extraction, the random gradient descent method is used to iteratively update the pattern generation effect to realize the fusion generation of fractal art graphics. The results show that the F1 value of the model can reach 96.21%, which is about 12% better than that of the AlexNet model. It is about 7% better than ResNet model. Compared with other classic DL models, the proposed model has better performance, certain reliability and practicability. It provides more basis for CAD fractal art graphic generation based on DL.

Keywords: Artificial Intelligence; Deep Learning; CAD; Art Design
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1 INTRODUCTION

Art design can add color to people's lives, create a beautiful living environment and bring warmth and comfort to the tense modern life. Science and technology have greatly promoted the progress and growth of society, and its influence in the field of art design is also enormous. The performance analysis of classroom digital analog mixing in electronic products has played an important role in art creation teaching. Due to the different analysis of digital signal environments in electronic courses, they often have different results in custom compiled array designs. Abugharbieh and Marar [1] conducted a complete design of computer microcircuits and integrated

transistor resources. Its modern technology has been optimized to assist in engineering practice. With the growth of the times, AI has been widely used in art design, which can better interpret the designer's interpretation of works and design concepts in an artistic way and present them to people, which plays a very important role in people's appreciation of works of art and other designers' artistic design. CAD has been widely valued and applied because of its advantages of accuracy, authenticity, convenience for preservation and modification, and ability to stimulate designers' creative inspiration. Art graphic design is a modeling activity for the purpose of plane decoration. Amirovna [2] analyzed the independent role of fractal composition in art creation and its appearance treatment methods on natural energy products. The results indicate that fractal composition is an algorithm that can generate complex and fine patterns in art application teaching among students. CAD software can create various complex patterns by using fractal algorithms. CAD assisted fractal composition plays an important role in fine arts and Applied arts. It can help creators create complex patterns, improve work efficiency, provide accuracy and repeatability, and provide a safe and reliable environment for creators to explore and innovate. Fractal pattern is a special pattern generated by combining fractal theory with computer image technology. At present, fractal art graphic, as a new art form, has attracted people's attention and love. Is being more and more applied in art design practice. Judging from the practical effect of CAD, its development prospect is considerable. Computer-aided fractal art design provides designers with efficient, full and all-round new technical means, creates visual effects that traditional art design can't match, and realizes the perfect combination of "technology" and "art". Bai et al. [3] conducted a transformation of random noise signal encryption schemes for image information security. It constructs the visual significance scheme parameters of the image encryption system. At the same time, different fractal images are hidden and encrypted for spatial information, ensuring a uniform distribution of pixel values in visual image encryption. This scheme has high security and reduces the computational complexity of graphic sharing.

Fractal pattern is a graphic form different from traditional European geometry. Although it is obtained by mathematical methods and computer programs, it has a new art that conforms to the tradition and transcends it, which is shocking from both scientific and artistic perspectives. Chao [4] conducted an aesthetic design analysis of traditional art works that intersect mathematics. Explored the directionality of images through the use of computer fractal design. In the automated parameter design process, it more efficiently solves the impact of user feedback and image function fitness analysis. It better defines user needs through specific parameter direction design. IFractal patterns have both scientific rigor and artistic charm. At present, the use frequency of AI in the art field is increasing, and its greatest advantage is that AI can present artistic creation in many ways. From the aspect of art design, AI plays an important role in promoting it. The artistic design completed by AI can effectively convey the design intention that designers want to express and truly show the connotation of artistic works. This article mainly studies the CAD fractal art graphic generation method based on DL. Its innovations are as follows:

① In this article, a random noise image is iteratively optimized by minimizing the total loss function of content information and style information, so that the random image finally retains both the content information of the content map and the texture information of the style map. It provides more basis for CAD fractal art graphic generation based on DL.

② This article adopts a new method, that is, the negative gradient method, which constantly adjusts the input value of the objective function and makes the objective function converge to the local minimum; Finally, the weights and offsets of the network are adjusted by the backward algorithm, and a network with the minimum objective function is obtained. On this basis, the global average pool technology is used to reduce the network parameters.

According to the needs of content and structure, the article is divided into six sections: the first section: introduction, which mainly introduces the background and significance of the topic, and explains the research innovation and structural arrangement of this article. Section II: Based on the literature review, the main research contents of this article are put forward. Section III: The basic theory of computer aided design of fractal graphics is expounded. Section IV: Using CNN

(Convolutional Neural Network) technology, a fractal art graphics generation model is established, and the concrete implementation steps of the model are given. Section V, empirical analysis. Through the analysis of the established mathematical model, it is proved that the established mathematical model is scientific and reasonable. The sixth section summarizes the main achievements and contributions of this article.

2 RELATED WORK

Gdawiec and Adewinbi [5] explored the model generation of artistic patterns. It uses a symmetrical wallpaper pattern to expand the Euclidean and dimensional orbits. The proposed scheme can obtain various interesting patterns. Therefore, the trajectory trap under this method can obtain patterns with fractal structures. He and Sun [6] have developed an emerging intelligent teaching assistance model. This model has played a professional role in the online teaching platform of art creation education theory. Based on modern art education theory, it greatly stimulates students' personalized collaboration potential in the art field. At the same time, this model provides students with a virtual environment for physical and mental experience, which provides great advantages for the computer-based art teaching mode. Jin and Yang [7] utilized the advantages of color design in computer environments to help enhance the concept of 3D simulation in innovative design of university cultural and art teaching environments. It adopts the method of object investigation to conduct information art design on the environmental art color design of computer-aided software. At the same time, it analyzed the significant improvement effect of computers on environmental art design. Kulnazarov and Bekmurodov [8] carried out a scheme improvement on Computer graphics format program. Computer graphics is a very important field in architecture and design teaching, which covers many applications. Computer graphics technology can help designers quickly verify the implementation possibility of design ideas in three-dimensional space. Designers can use CAD software for rapid modeling to explore surface modeling. Through digital models, designers can observe and compare different design schemes in a virtual environment, thereby better adjusting and improving design schemes. Kumari et al. [9] analyzed the application of viscosity approximation iterative methods in Mandelbrot and Julia Fractals generation. It analyzed different integrated visualization images using a linear approximation method. We have derived an escape criterion method that can solve different fixed points. In addition, it also provides examples of different fractal shapes.

Liu and Yang [10] have designed an open computer-aided art teaching model. Its aim is to explore a modular and optimized learning mode. There is a certain issue of teaching coherence in the creation of information services in the current art architecture. It uses computer CAD technology to develop web pages for server information teaching. This improves the collaborative performance of the art classroom task group, allowing all debugging deployments to actively participate in artistic creation. Nakamura [11] analyzed a fractal structured visualization algorithm population effect model. It proposes an image rendering application algorithm based on mathematical transformation. This algorithm solves the mathematical problem of artistic extension in drawing 2D and 3D fractal graphics, and provides fractal clues for different art groups. Ouyang et al. [12] implemented a graphic system for printmaking classification similarity. He created a graphic structure based on isosceles Right triangle, and derived a Graphics library similar to Escher. Popa et al. [13] improved the model accuracy of the software structure in terms of real-time generation of image processing software. It introduces a computer-assisted fractal optimization variant and compares it with practical differentiation time at the processor level. The results showed that the developed parallelized image program shortened the computational time of image processing, and the study analyzed the resources of mathematical images from the perspective of image differentiation technology.

Wang et al. [14] simulated the sub parameter deformation animation effect under the fractal image and continued to smooth the collage of Iterated function. After drawing the fractal variation parameters of plants, it adds simulation conversion of physical deformation parameters. The research results indicate that it constructs the image rendering time and limitations of the

algorithm. Compared with traditional methods, it reduces the time required for rendering and overcomes the problem of interactive image control parameter deformation. Artistic expression is another emotional language of humanity. High quality art design can interact with human emotions, express ideas and viewpoints, especially in art design with obvious visual characteristics such as painting. Xu and Cai [15] analyzed the emotional interaction of artificial intelligence art innovation in handicraft art. In the process of interactive and intelligent artistic digital evolution and creation, adopting computer-aided intelligent applications to improve artistic intelligent teaching design has become a key decision. Xiang et al. [16] conducted traditional fractal visual object analysis with extensive object function control. It uses the pattern fractal generator of Affine transformation to improve the hybrid modeling of visual objects. During the training process of this generator, the proposed model does not require professional mathematical knowledge for 3D training, and it can also perform high-resolution visual object validity analysis. Yu et al. [17] conducted an analysis of the application of surface parameterized design in environmental landscape simulation. It constructs a dynamic optimization method for environmental landscapes through linear analysis of computer model parameterization criteria. In the design of functional parameter changes in the algorithm, it explored the amplitude of interference changes in optimized parameters, and the research results showed that the plotted points have a dynamic correlation with the curve generated by the function. Zhang and Rui [18] conducted digital image assistance for computer-aided art design. Currently, there is a lack of aesthetic judgment in the digital core content of existing online teaching resources. To solve this problem, he proposed a program to improve computer graphics and aesthetic design of spatial composition. Simulated the display effect of artistic product design methods centered on digital content. In order to improve the learning level of computer assisted platform, it uses perceptual interactive teaching methods to make an intuitive judgment on the art teaching of computer Digital art. Zhao and Zhang [19] conducted a research and analysis on automatic generation of abstraction painting style. It is based on sketching and combines computer image analysis to analyze the color composition of different paintings and randomly adjust the color palette effect of parameters. Its research contributes to the development of extended cases of abstract images.

Driven by AI, through CAD fractal art graphic design, patterns can be easily created, modified and saved. Fractal patterns can be realized by computer programs. Through the setting of various parameters of the software, the fineness and generation mode of graphics can be controlled; Change the color, depth and angle of the figure, and enlarge and decorate the part conveniently; Copy, paste and save quickly. In this article, driven by AI, the problem of CAD fractal art graphic generation is deeply discussed based on DL algorithm, and a fractal art graphic generation model is constructed based on CNN.

3 GENERATION MODEL OF FRACTAL ART GRAPHIC BASED ON CNN

Fractal art is a graphic art form with unique aesthetics and artistic value. In order to generate fractal art graphics, we can use Convolutional neural network (CNN) to build a Generative model. The following is how to build a Generative model of fractal art graphics based on CNN: First, we need to collect a large number of fractal art graphics data, which can be from public data sets on the network or generated by ourselves. Next, we need to preprocess the data, including steps such as size normalization and image enhancement, in order to provide high-quality training data for CNN. Next, we need to design a suitable CNN model. Considering the characteristics of fractal art graphics, we can use deep learning frameworks such as TensorFlow or PyTorch to construct models. The design of the model should include convolution layer, pooling layer, Activation function and other components to achieve layer by layer abstraction and feature extraction of images. After the model design is completed, we need to provide training data for the model and optimize the model parameters through the Backpropagation. In the training process, Loss function such as Cross entropy can be used to evaluate the performance of the model, and super parameters such as Learning rate and iterations can be adjusted according to the actual situation. After the training is completed, we need to evaluate and tune the model. The evaluation process

can use a test set, and evaluation indicators can include accuracy, recall rate, etc. We can fine-tune or improve the model based on the evaluation results. Finally, we can use the trained model to generate new fractal art graphics. We can use the input image as the input of the model, and then generate the corresponding fractal art graphics through the predicted output of the model. In addition, we can also improve the complexity and artistry of the generated graphics by modifying the parameters of the model or adding additional layers. In general, the fractal art graphics Generative model based on CNN needs to rely on a series of steps such as data collection, preprocessing, model design, model training, model evaluation and optimization, and graphics generation. Through this model, we can achieve the conversion from input ordinary images to output fractal art graphics, providing a new possibility for artistic creation and graphic design.

CNN is a feed-forward neural network with sparse connection, which imitates the biological vision mechanism. CNN can perform parallel computing, has the ability to process information at high speed, and can accumulate experience through repeated learning processes, just like the human brain, which can continuously improve the effect of image classification. CNN is composed of layers of network stacks, and the whole network can be regarded as a function, and many neurons are regarded as parameters of this function. We input this network and expect to get a good output. The function of parameters is self-evident. CNN can learn rasterized features, such as pixels and audio, with less computation. A large quantity of experiments show that the characteristics of CNN extracting image features are: the bottom layer captures the image texture, and the top layer retains the image content. After many convolutions, the characteristics of learning become more and more global. The CNN function is defined as:

$$x_j^l = f\left(\sum_{i \in M_j} x_i^{l-1} \times k_{ij}^l + b_j^l\right) \tag{1}$$

Where x_i is the input feature map, k represents the convolution kernel, b is the deviation term, and the output after convolution is the feature map x_j.

Commonly used activation functions are Sigmoid, Tanh and Relu. Sigmoid function is a kind of S-type function. Compared with Sigmoid function, Tanh function is symmetric about the origin of coordinates. Moreover, around 0, the curve changes more steeply, so in the training stage, the step size of each update of the weights is larger, and it can quickly converge to the optimal value. The graphs of Sigmoid function and Tanh function are shown in Figure 1.

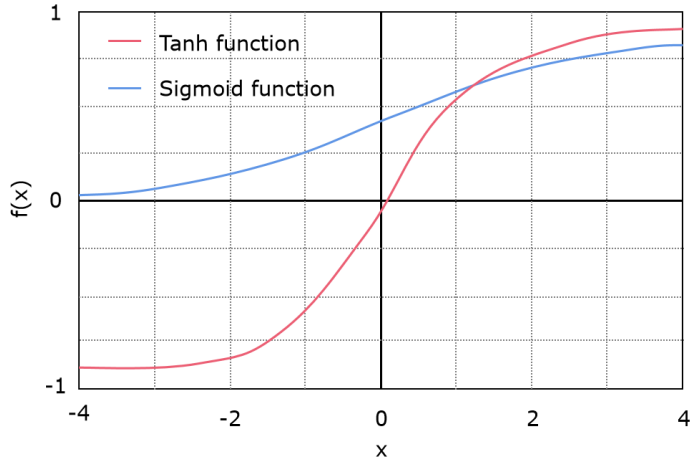

Figure 1: Graphs of Sigmoid function and Tanh function.

The transmission of neuron parameters between network layers can be expressed by matrix. Generally, the values of all neuron parameters in a certain layer are expressed as a column of vectors, and then all the weights between it and the next layer are put into a matrix. The i row of the matrix is the transfer weight between all neurons in this layer and the i neuron in the next layer.

In fractal art graphics, composition mainly refers to the layout and organizational form of fractal patterns. Fractal distribution composition distributes patterns on the calculated scattered points according to some recursive model, forming a pattern with randomness in layout and obeying statistical self-similarity. Therefore, the fractal distribution composition is more artistic and creative, and its works are more appreciative. Fractal patterns can be realized by computer programs. Iteration algorithm is shape-based iteration, and escape time algorithm is point-based iteration. After iterating several steps for the displayed points, it is judged whether the distance from the point to the origin is greater than a certain value. The points that escape after different iterations are colored with different colors to get colorful graphics. By designing loss functions with different fusion degrees to meet the requirements of different feature extraction, the random gradient descent method is used to iteratively update the pattern generation effect to realize the fusion generation of fractal art graphics. In order to adjust the weight parameters of each neuron, a cost function is often designed according to different training purposes. The purpose of training the network is to minimize the value of the cost function in essence. Because the objective functions in the training stage of network model are all non-convex, the optimization of the objective function depends heavily on the selection of initial values, so it is necessary to initialize the parameters of network model to avoid the solved model parameters reaching local optimum prematurely. The training sample of CNN consists of two parts:

$$X = \left[x_1, x_2, x_3, \ldots, x_{n1}\right]^T \tag{2}$$

For the expected output vector:

$$T = \left[t_1, t_2, t_3, \ldots, t_{N3}\right]^T \tag{3}$$

The output of the hidden layer node h and the output of the output layer node s are:

$$y_h^k = f\left(\sum_{i=1}^{N1} w_{ih} x_i^k + \theta_h\right) \quad k = 1,2,3,\ldots,N \tag{4}$$

$$o_s^k = g\left(\sum_{h=1}^{N2} w_{hs} y_h^k + \theta_s\right) \quad k = 1,2,3,\ldots,N \tag{5}$$

In this model, the pooling operation can be regarded as transforming a picture with high resolution into a picture with relatively low resolution, which is beneficial to sampling and selecting excellent features, making the model have anti-noise ability, reducing the feature dimension and reducing the calculation amount by half. By using the pool layer, the calculation speed can be effectively accelerated, and the over-fitting problem can be prevented. In addition to the initialization of parameters, the selection of super parameters in the training stage of network model is also very important. These super parameters include convolution kernel size, moving step size and learning rate. Only by setting parameters and super parameters can the accuracy of the network be improved as a whole.

Each layer of CNN network is connected by neurons, and each neuron contains a weight parameter. During the training stage, the parameter is continuously transmitted to the deeper level and finally reaches the output layer. The quantity of nodes in the input and output layers is fixed. The schematic diagram of CNN construction process in this article is as follows (Figure 2).

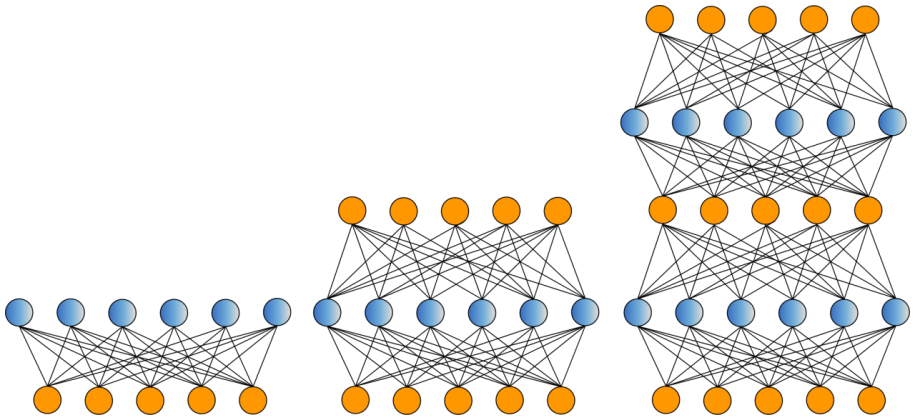

Figure 2: Schematic diagram of CNN construction process.

The preprocessing of data will seriously affect the network's feature extraction. This processing method is often used for data sets with simple structure, and the trained model is also very effective.

Firstly, the original image is filtered by low-pass filter, and then a low-frequency image is obtained by down-sampling according to the sampling matrix, which is a coarse-scale approximate image of the original image. The reason why CNN can effectively extract the deep features of the image is mainly due to the convolution operation of the image. In a computer, a picture can be regarded as a two-dimensional matrix, and convolution operation is to calculate and process each two-dimensional matrix accordingly. During network training, each filter convolves the input layer to extract higher-level image features. The formula of the activation layer after the convolution layer is as follows:

$$F_j^{(n+1)} = f\left(F_j^n\right) \tag{6}$$

Where: f is a point-by-point activation function. Convert each data item x_i in a small batch $B = \{x_1, x_2, x_3, \ldots, x_m\}$ with the size of m into y_i:

$$y_i = \gamma \hat{x}_i + \beta \tag{7}$$

$$\hat{x}_i = \frac{x_i - E_M(x_i)}{\sqrt{Var_M(x_i) + \varepsilon}} \tag{8}$$

Using the hole convolution kernel can expand the receptive field of convolution operation without losing information and introducing additional parameters, so that it can collect feature information in a large range. If m holes are inserted between every two elements in the convolution kernel with the size of l×l, the effective area of convolution operation can be expanded to (l+4m)× (l+4m). The training of CNN model is closely related to the amount of data. The data can be obtained from natural images, generated by cropping or rotation, and obtained by generative countermeasure network. When these data are insufficient, the generalization ability of the model will be seriously affected and over-fitting will occur.

4 SIMULATION EXPERIMENT ANALYSIS

In order to verify the validity and accuracy of computer aided fractal art graphics Generative model based on AI driven deep learning, we can conduct simulation verification. Model input and

output comparison can take a fractal art graphic as the input of the model, and then compare the predicted output of the model with the original graphic. By comparing the differences between the two, the accuracy of the model can be evaluated and its generalization ability can be tested, that is, whether the model can generate corresponding fractal art graphics for different input images. The generalization ability of the model can be evaluated by testing its performance in different scenarios. Evaluate the quality of the model by comparing its performance indicators such as accuracy and recall. By comparing with other methods, we can further prove the advantages of computer-assisted fractal art graphics Generative model based on AI driven deep learning. Finally, we can evaluate the practicality and value of the model through user surveys and feedback. We can understand the performance of the model in practical applications by showcasing the fractal art graphics generated by the model to users and collecting user feedback and evaluations. Through the above simulation verification, we can further prove the validity and reliability of computer-assisted fractal art graphics Generative model based on artificial intelligence driven deep learning. At the same time, we can also continuously improve and optimize the model based on user feedback and evaluation to meet the application needs of different scenarios and needs.

As the input of CNN structure, the quantity of images directly affects the final effect of the model. In the training stage, CNN uses the input sample images to extract and learn effective classification features, and finally generates a classification model. If the quantity of samples is too small, then the network can extract less feature information from it. Therefore, the quantity of samples of images should be as large as possible, and images of the same type should be collected in many different scenes. In the experimental image set, the image size is 1920×1080. Model construction and algorithm implementation TensorFlow, a DL framework based on Google open source. The convolution kernel size is 3*3, and the moving step is 1. Depending on the image size, sometimes there will be a zero-filling operation. Proper size parameter setting can ensure the accuracy in the network training stage. Figure 3 is a schematic diagram of the loss function descent process of the constructed network.

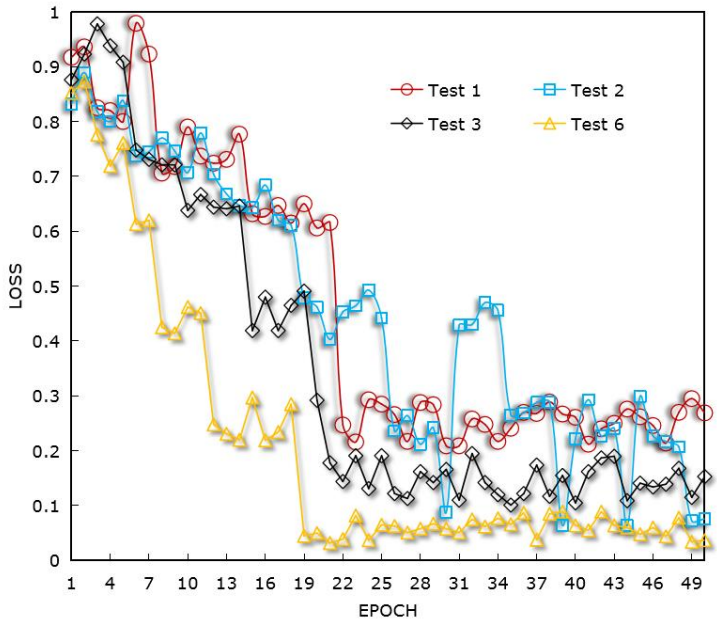

Figure 3: Decline process of loss function of network.

In this experiment, because the training set, verification set and verification set have all been converted to TFRecord format, the images are loaded according to TFRecord file instead of JPEG

file. Load the training image by matching all TFRecord files found in the directory where the training set is located. In addition, the input image is enhanced, repaired or denoised. These operations can essentially improve the quality of data, thus preparing for subsequent feature extraction. In the execution stage, given any picture, input it into the trained generating network, and the generating network will calculate the result of fractal art graphic generation according to fixed weights. Because the weights of the generating network have been determined during training, the speed of generating pictures will be very fast.

In order to compare the difference of test results between algorithms and the accuracy of positioning, the accuracy of the algorithms is reflected by calculating the F1 value in the experiment, and the calculation method is as follows:

$$F1 = 2 \cdot \frac{\text{Precision} \cdot \text{Recall}}{\text{Precision} + \text{Recall}} \tag{9}$$

In this article, AlexNet model, ResNet model and the test results of F1 value of this model are selected to draw a data graph. Specific experiments are shown in Table 1 and Figure 4.

Iterations	*This article model*	*Iterations*	*This article model*
5	89.01	100	93.93
10	92.88	105	94.82
15	91.12	110	93.81
20	90.47	115	93.83
25	92.09	120	92.45
30	91.03	125	94.77
35	91.38	130	95.00
40	92.78	135	93.09
45	92.46	140	94.16
50	89.63	145	93.75

Table 1: Trend of F1 value change.

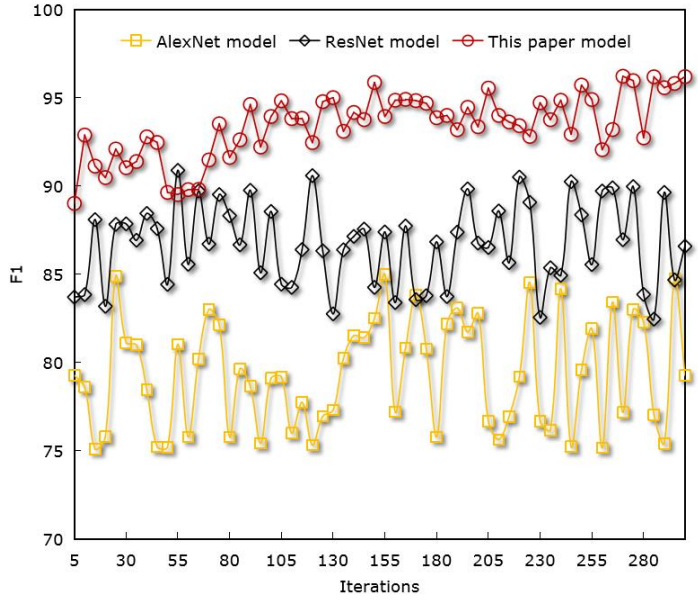

Figure 4: Comparison results of F1 values of each model.

The test results in Table 1 and Figure 4 show that the F1 value of the constructed model can reach 96.21%, which is about 12% better than that of AlexNet model. It is about 7% better than ResNet model.

The purpose of batch normalization is to avoid that with the deepening of the hierarchy, the input data of the later layer will change due to the updating of the parameters of the previous layer in the network training stage, which will cause the information transmission to decline layer by layer. In this article, the data with the quantity of batch images between 5 and 320 are selected to observe the change of accuracy of the model. Figure 5 shows the change of model accuracy when setting different batch images.

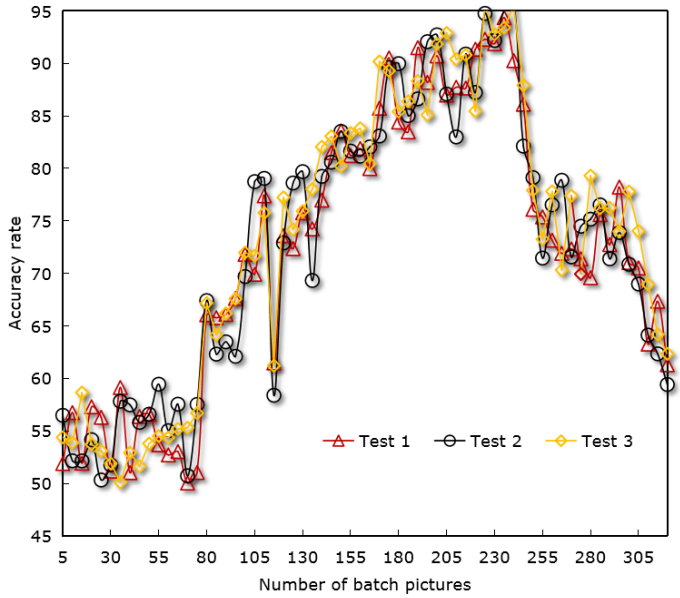

Figure 5: Model accuracy of different batch images.

When the quantity of batch images exceeds a threshold, the accuracy of the model gradually stabilizes. In this experiment, the threshold is 240, so this article chooses 240 as the number of batch pictures in this CNN model. Using multiple filters to convolution an image is a commonly used image processing method that can be used to extract more features of the image. In Convolutional neural network (CNN), multiple filters are usually used to convolve images to extract different features of images. Each filter can be seen as a specific feature extractor that can highlight certain features in the image, such as edges, corners, and so on. The advantage of using multiple filters for convolution is that images can be analyzed from different perspectives and dimensions, thereby extracting more features. These features can be combined and fused in subsequent layers to construct more complex feature representations, ultimately achieving tasks such as image recognition, classification, and segmentation. At the same time, using multiple filters for convolution also increases the complexity and computational complexity of the model. Each filter needs convolution operation, which will increase the time and Space complexity of calculation. Therefore, in practical applications, it is necessary to choose the appropriate number of filters and convolution methods based on specific tasks and data characteristics to achieve better performance and effectiveness. Overall, using multiple filters to convolution images is an effective feature extraction method that can be used for various tasks in image processing and computer vision.

Generally, color images are all three channels, corresponding to RGB. In order to extract more features of the image, this article uses multiple filters to convolution the image, and each filter

extracts the input layer and corresponds to one layer. After convolution extraction, multiple filters will generate multiple network layers. The content loss function and style loss function are defined respectively: the content loss function only calculates the high-level feature correlation of empty CNN; The style loss function fuses the feature correlation of all layers. Random initialization following Gaussian distribution is adopted. The weight parameter is set to a random value close to 0, and at the same time, the network is in a symmetrical state, which improves the effect of network training. The following experiment, in the experimental indicators, the calculation formula of $\mathrm{Precision}$ and Recall is as follows:

$$\mathrm{Precision} = \frac{T_p}{T_p + F_p} \tag{10}$$

$$\mathrm{Recall} = \frac{\mathrm{T_p}}{\mathrm{T_p} + \mathrm{F_N}} \tag{11}$$

Where $\mathrm{T_p}$ stands for the quantity of positive cases; $\mathrm{F_N}$ represents the quantity of negative cases identified; $\mathrm{F_p}$ stands for the quantity of recognition errors. The accuracy comparison of the algorithm is shown in Figure 6. The recall trend of the algorithm is shown in Figure 7.

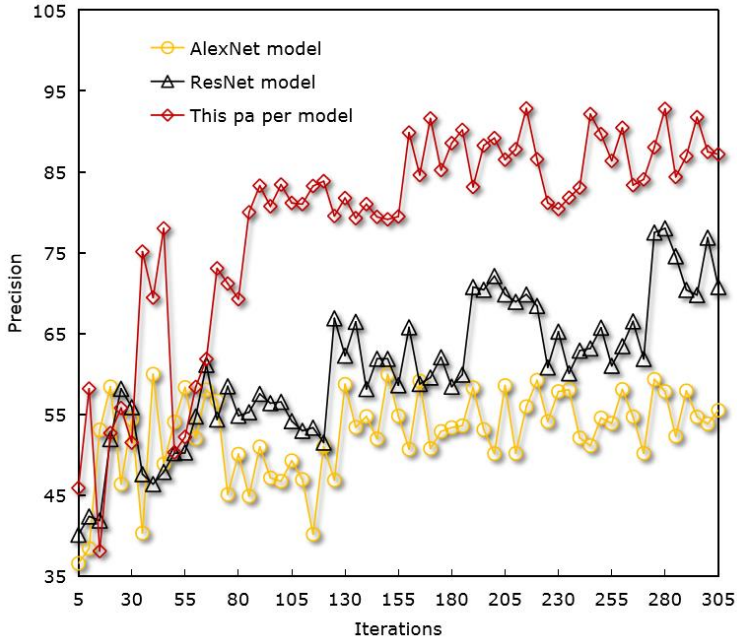

Figure 6: Accuracy comparison of algorithms.

The test results in Figure 6 and Figure 7 show that, compared with AlexNet model and ResNet model, the precision of the model constructed in this article is higher, which can reach more than 90%, and its recall rate is better.

In this article, the Dropout layer added to the model can greatly reduce the cost of fusion. The concrete realization is that in the process of forward propagation, in some hidden layers, each neuron outputs 0 with a certain probability, which is equivalent to training a new model in each training, and it effectively avoids the problem of over-fitting.

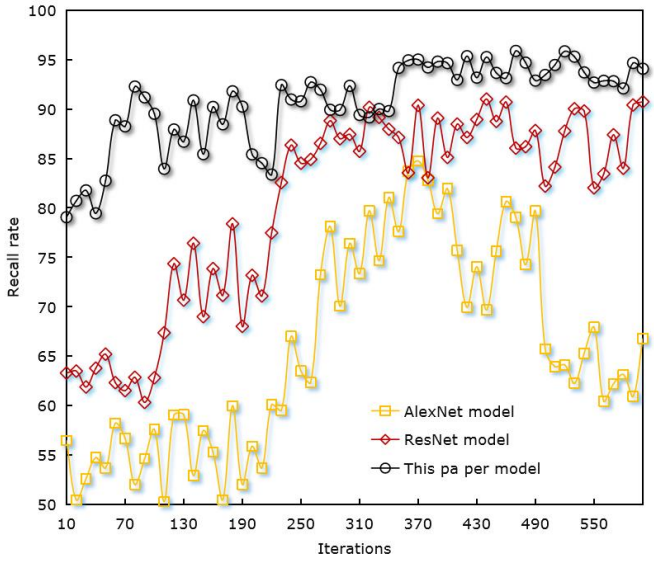

Figure 7: Algorithm recall trend.

In addition, in order to improve the practicability and feasibility of DL-based fractal art graphic generation model technology, aiming at its low generation efficiency and unnatural performance, this article uses hole convolution kernel instead of traditional convolution kernel to do convolution operation of image feature extraction, and obtains better and faster fractal art graphic generation effect. On the whole, compared with other classic DL models, the proposed model has better performance, certain reliability and practicability.

5 CONCLUSIONS

CAD provides an unprecedented artistic expression for art designers. AI can provide data support and technical support for art design. Art design broadens its coverage through AI, which promotes art design to a new level. Driven by AI, this article proposes a fractal art graphic generation model based on DL. In order to reduce the value of cost function, the input value of cost function is constantly adjusted in a certain step according to the direction of negative gradient, and finally the cost function converges to a local minimum. Finally, the weight and offset of the whole network are adjusted by back propagation, and the network with the minimum cost function value is obtained. In addition, the loss function with different fusion degrees is designed to meet the requirements of different feature extraction, and the pattern generation effect is iteratively updated by using random gradient descent method to realize the fusion generation of fractal art graphics. The results show that the F1 value of the model can reach 96.21%, which is about 12% better than that of the AlexNet model. It is about 7% better than ResNet model. Moreover, compared with AlexNet model and ResNet model, the precision of the model constructed in this article is higher, which can reach more than 90%, and its recall rate is better. On the whole, compared with other classic DL models, the proposed model has better performance, and compared with the method using common CNN fusion features, the proposed method has higher reliability and better performance. It provides a new method for CAD fractal art graphic generation based on DL, and also provides more basis for related research.

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