Research Article

A Double Random Matrix Design Model for Fractal Art Patterns Based on Visual Characteristics

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This paper adopts the method of visual characteristics of the double random matrix to conduct in-depth research and analysis on the design of fractal art patterns. For the practical application needs in fractal graphic design, a method is proposed to automatically extract the core base pattern based on fractal graphic content and generate a four-sided continuous pattern. The method first uses the Canny operator for edge detection to analyze the area of the main pattern. Then, it uses a grayscale cogeneration matrix to extract and analyze the graphic texture features, based on which the best splicing method is selected to splice the extracted pattern, and then, it achieves two splicing methods of flat row and staggered four-sided continuous pattern. The method has good practicality with low complexity and high versatility under the premise of ensuring the beauty of the generated four-sided continuous pattern. It can assist designers to design patterns, improve efficiency, and save design costs. In this paper, we improve the existing image segmentation methods, adopt two segmentation methods, namely quadratic tree segmentation and HV segmentation, propose a new local codebook selection strategy, and study the degree of self-adaptation of different methods to images in terms of segmentation methods and local codebook selection strategies. It makes the network unable to train efficiently on long text prediction problems. Finally, the improved algorithm of this paper is tested on the standard and living image libraries, and the experimental results show that the use of local codebooks makes the image coding speed significantly improved compared with the fixed fractal. In the face of the image to be retrieved, it is only necessary to perform the coding operation to obtain the fractal code to perform similarity matching, which can meet the requirement of real-time retrieval. Applying the improved distance formula, the search accuracy obtained on the test gallery is significantly better than that of the grayscale histogram algorithm.

1. Introduction

In recent years, the fractal theory has gradually emerged and gained popularity in the field of mathematics. In addition, fractals have also been studied from a mathematical perspective in many aspects of the art field, such as architectural ceramic patterns, packaging material design, illustration decoration, and modern clothing applications. The previous techniques for image and video classification and retrieval with the help of manual labor can no longer meet the needs of today’s society, and the research of more efficient and real-time image processing algorithms is a pressing problem for researchers [1]. The retrieval of these image data is a relatively complex process, and the extraction scheme of image features and the extraction speed of feature codes have become the focus of researchers’ consideration. How to enable users to quickly locate the information of interest from the huge amount of image data has become an urgent problem for image retrieval technology. Because of the subjective nature of image similarity judgment, the development direction of image retrieval technology is diversified, and algorithms based on color, contour, structure, etc., analyze and extract features from images in different directions. The innate advantage of images over text is obvious,
as images can give visual intuition and make it easier for users to perceive and digest the information, thus providing a better way to understand the information content [2]. It is used to enrich the types of transformation functions to realize more graphic transformations, and it has strong expansibility. On the other hand, the structure of image information is more complex than that of textual information, which poses a great challenge for image information retrieval. Although many algorithms for image retrieval have been proposed, several aspects, such as the individual needs of users, the timeliness of data volume processing, and the extraction of advanced semantic features of images, have prevented these algorithms from reaching a consistent level of satisfaction. Therefore, researchers are now required to development and synthesize the features and advantages of image retrieval techniques from all aspects.

The creation of fractal geometry gave another perspective to describe physical and natural phenomena, provided a new approach to studying the shape and structure of different entities, and likewise gave a theoretical basis for the creation of fractal art [3]. The development of computer graphics became a bridge between fractal theory and fractal art. Fractal geometry is displayed visually with graphics, which provides technical support for the development of fractal art. This thesis will start with image structure and feature extraction by studying the similarity of image structure. The content-based image retrieval algorithm reflects the semantic information of the image to a certain extent, eliminates the influence of color on the image, and is particularly advantageous for grayscale image retrieval. It provides users with more diverse ways of image classification and retrieval. The current society is an information society, and computer image-related technology, especially image retrieval technology, is being used in all aspects [4]. Whether it is the corporate sector or the general home users, image classification and retrieval systems play an increasingly important role and are closely related to human life, becoming an important part of the current society. Therefore, the research on image retrieval, especially content-based image retrieval algorithms, has become one of the current hot directions.

The design of fractal art graphics can be divided into two parts: graphics generation and graphics rendering. The generation phase iteratively generated different fractal algorithms to generate graphics. The rendering part requires the designer to render the generated fractal graphics according to different design rules, guided by the design rules so that the fractal art graphics meet the conventional aesthetic standards. The basic nature of fractal theory as the theoretical basis of this paper determines the design principle of fractal graphics. The exploration of the aesthetic and geometric properties of fractal graphics facilitates the establishment of similar characteristics between them and cloud shoulders and advances the process of the fractal analysis of cloud shoulders. Hence, this section requires an understanding of the foundations of fractal theory, the laws of artistic creation, and artistic aesthetics. Fractal graphics extended from the fractal theory are an important reference for this paper to study and compare the cloud-shoulder planar graphics, and a basic analysis of the visual characteristics and application status of fractal graphics is needed.

2. Related Work

Beirami et al. proposed a method for generating image descriptions that combine the visual features of the image to be described, textual information, and lexical statistics of the corpus [5]. Firstly, a pool of similar images is constructed based on the global feature similarity of images. Subsequently, a language model is trained to generate phrases related to similar images. Finally, a syntactic model is trained to select appropriate phrases to generate image descriptions. It reduces the requirements for mathematical skills and provides a graphical interface to facilitate designers and developers to debug in order to solve the problem of noise influence of a single query image [6]. Padhy et al. designed a word-frequency-based image description generation model to retrieve several similar images in the data and use the common content of these image descriptions to generate text descriptions of query images [7]. Padhy et al. used convolutional neural networks (CNNs) to extract image features and use the K-nearest neighbor (KNN) algorithm to calculate feature similarity to construct a pool of candidate images, and the same word-frequency-based description generation method is used to generate the text descriptions of the specified images [8]. The retrieval-based image description generation method directly references the description text of similar images, which ensures the linguistic fluency and grammatical correctness of the generated descriptions. However, the descriptions obtained by the retrieval-based method may not be consistent with the image content [9]. If there is information in the image to be described that is not included in the database, a completely wrong description will be obtained. Based on the collage theorem, Liao et al. adopted a flexible variant to deepen the application of fractals on graphics to applications in images, and a new iterative system was created, called the local iterative system, which led to the proposal of a local iterative fractal coding scheme (PIFS) based on image feature extraction, and PIFS extracts image through cross-scale redundancy between different regions of a pair of images [10]. The unsupervised process lays the foundation for the computer to automatically extract fractal codes through algorithms. This local iterative fractal coding scheme, unlike the previous overall local similarity, cleverly encodes images by the local and local similarity between images and gives researchers more options in terms of segmentation methods.

People also gradually pay attention to the inverse eigenvalue problem of reconstruction matrices, as well as the inverse eigenvalue problem of some special structure matrices [11]. The relevant theory has given sufficient and necessary conditions for matrices in a subspace, some closed convex cone, or bounded closed set constraints. The study of the inverse eigenvalue problem for non-negative matrices has been developed, however, there are many in-depth problems worth studying, and the research on this problem has been expanded a lot, including the real-valued inverse...
eigenvalue problem, the symmetric non-negative inverse eigenvalue problem, the random inverse eigenvalue problem, and so on [12]. Among them, random matrices are a special and widely used class of non-negative matrices. Hence, the inverse eigenvalue problem of random matrices has also received increasing attention from the mathematical community. In this paper, we take the theoretical properties related to the inverse eigenvalue problem as the basic knowledge and some concluding properties summarized by previous authors as the auxiliary materials to study the inverse eigenvalue problem of symmetric double random matrices in-depth and innovatively propose the sufficient conditions and construction firms for the solution of the inverse eigenvalue problem of low-order symmetric double random matrices, as well as the new algorithm for the inverse eigenvalue problem of high-order symmetric double random matrices [13].

The focus of this paper is on the construction of sufficient conditions and solutions for the inverse eigenvalue problem of low-order symmetric doubly random matrices and new algorithms for the inverse eigenvalue problem of high-order doubly random matrices. The output layer dimension is 1024. In the test phase, the beam search strategy is used to generate texts, the beam width is 3, and the text combination form of the top three probabilities at each moment is always retained until the final description is obtained. The fixed block segmentation approach does not have the adaptive capacity to the structure of the image itself because of its fixed segmentation scheme and produces different coding effects for different images. Therefore, this paper adopts the quadtree approach to segment the image, so that the segmented R-blocks are more consistent with the structural features of the image. Meanwhile, a new D-pool selection scheme proposed for R-block matching, in which three D blocks adjacent to R-blocks horizontally are selected as the D-pool selection scheme, since the structure of the segmented blocks tends to be arranged horizontally for most images. Therefore, the selection of horizontally adjacent D blocks as the selection scheme of the D pool can effectively improve the matching speed, and at the same time, as the D blocks in the D-pool only have a certain offset in the horizontal coordinates, it makes the image in the process of retrieval to propose a more effective distance formula, and this distance judgment will not produce duality, i.e., it meets the condition of distance definition.

3. Analysis of Double Random Matrix Model of Fractal Art Pattern with Visual Characteristics

3.1. Double Random Matrix Design. The inverse eigenvalue problem of the asymmetric doubly random matrix is the problem of determining that a real array of elements is an eigenvalue of a doubly random matrix of an order dependent on a diagonal matrix and nonsingular matrix, on which the conditions for being asymmetric doubly random matrix are studied. For the problem of the inverse eigenvalue of a symmetric doubly random matrix, to determine whether a set of data can be used as the eigenvalue of a symmetric doubly random matrix, sufficient conditions are given in this paper, however, in the process of proving the corresponding theorem, some conclusions are needed as a basis, and firstly, several relevant lemmas are presented to provide a basis for the subsequent proof process [14].

\[ \sum_{i=1, j \in [I]} x_{ij} \geq |R(I)| \geq \sum_{i=1, j \in [R]} x_{ij}^2. \] (1)

We consider, in turn, symmetric, Hankel symmetric, and centrally symmetric, as well as symmetric and Hankel symmetric double subrandom matrices with minimal double random completeness. Then, we use the definition and properties of the subrandom flaw to make some variants, so that the symmetric structure can be maintained even after turning the doubly subrandom matrix into a doubly random matrix. Also, we extend the definition of the subrandom flaw from the square matrix to the non-square matrix. The image-text cross-modal fusion module calculates fusion features without introducing too many parameters, which can fully exploit the potential correlation of image-text features, thereby improving the performance of image description generation methods. In addition, we also give a new way of changing from a doubly subrandom matrix into a doubly random matrix, i.e., the doubly random cover of a doubly subrandom matrix, where each element of a doubly random matrix is greater than or equal to the corresponding element of a given doubly subrandom matrix, and the doubly random cover still maintains the original symmetric structure.

\[ \overline{B} = \begin{pmatrix} B & B_{12} \\ B_{12} & B_{22} \end{pmatrix}. \] (2)

Since \( n = 3 \), \( sd(A) = 1 \) is an odd number, and according to theorem (2), there exists a \( 5 \times 5 \) centrosymmetric doubly random matrix \( B \) containing \( A \) as the principal submatrix. To find \( B \), one can first construct a matrix \( D \), a \( 4 \times 4 \) doubly random matrix containing \( A \), as the principal submatrix.

\[ A = \begin{pmatrix} 0.45 & 0.05 & 0.48 \\ 0.08 & 0.58 & 0.14 \\ 0.42 & 0.04 & 0.58 \end{pmatrix}. \] (3)

Let \( w_{m,n} \) be the set of all matrices of order \( m \times n \) with row sum and column sum less than or equal to 1. Let \( D \in w_{m,n} \), then \( D \) can be a submatrix of a doubly random matrix. Therefore, we can extend the definition of the subrandom flaw to matrices.

\[ sd(D) = \min|m,n| + \sigma(D). \] (4)

Double random matrices, as a special case of random matrices, are very closely related to many disciplines, especially many branches of mathematics, such as number theory, combinations, etc., which are very valuable to study. Double random matrices have made very great progress in recent years in physics, bioengineering, and wireless communications, such as satellite switching and time division multiple access systems, which use double random matrices...
to replace the capacity of antenna channels. If the length of a graph is a measurable value and the area is 0, the graph belongs to a one-dimensional graph. In other words, a one-dimensional graph is a shape that can be measured by length. The double subrandom matrix, as a submatrix of the double random matrix, has many similar properties to the double random matrix, as shown in Figure 1.

In recent years, the concept of subrandom flaw has further deepened the connection between double subrandom matrices and double random matrices, which also makes the research of double subrandom matrices develop rapidly, and the application of double subrandom matrices is an emerging field. It is believed that with further in-depth research on double subrandom matrices, its application value will surely be reflected gradually in mathematics and physics.

$$\alpha_{ij} = \frac{1}{2} (\alpha_{ij} - \alpha_{ji}),$$

$$\alpha_{ij} = \alpha_{ji} \geq b_{ji}.$$  

In this paper, the theorem of forming an asymmetric double random matrix of higher-order from two low-order symmetric double random matrices is given [15]. Theoretically, the application of the lower-order symmetric double random matrix and the theorem leads to the construction form of a matrix of arbitrary order. The feasibility and correctness of using the theorem to construct symmetric doubly random matrices from a given set of numbers are also demonstrated by specific example applications. For the problem of the inverse eigenvalue of the higher-order symmetric doubly random matrix theorem, a sufficient condition to determine whether an asymmetric doubly random matrix can be constructed from a set of numbers is proposed.

The feasibility of the conclusion and the advantage of not needing to discuss parity is also illustrated by example analysis. The fine self-similarity of the fractal graphics itself is added, which endows the continuous pattern with another aesthetic sense, and it is very suitable for application. The construction theorem of a higher-order symmetric doubly random matrix is proposed based on the method of merging from lower-order matrices into higher-order matrices. It is shown by concrete examples that this matrix construction theorem can also be applied to the construction of the corresponding matrix from a given set of numbers.

In this paper, the specific construction form of the solution matrix is given from the inverse eigenvalue problem of low-order and high-order symmetric doubly random matrices for the inverse eigenvalue problem of low-order symmetric doubly random matrices. With the help of the idea of constructing new symmetric doubly random matrices using smaller matrices with known spectra. Judgment theorems and matrix construction theorems are presented for the higher-order symmetric doubly random matrix inverse eigenvalue problem.

3.2. Processing the Visual Characteristics of Fractal Art Patterns. In principle, the fractal iteration system is not complicated, if the graphics have self-similarity, it is possible to analyze and study its corresponding fractal iteration code and set the final generated graphics as immobile points. From any point, the affine transformation is performed. Based on the collocation theorem, when there are enough affine transformations, all the affine transformed points tend to be stable, along with their composed graphs from the original image (immovable points). In this way, we can start from any point and iterate many times through the iteration law obtained by the collocation theorem, and each iteration will generate several points, and through the repeated iteration process of these points, the original image is finally generated [16].

For the existence of an arbitrary graph, its main work is to find its overall and local affine transformation relationship, i.e., its similarity law. It is possible to record the graph with few parameters, without recording the position relationship of each point on the graph. It should account for the main proportion in the comprehensive analysis. The key here is to find the similar characteristics of the image as a whole and locally, and the collage theorem accomplishes this process by utilizing human discovery. The semisupervised approach is quite labor-intensive for the study of many graphics.

The aesthetic criteria of graphics is usually evaluated in three aspects: shape, color, and layout. The shape requires the structural integrity of the graphic (flower pattern), not missing petals, internal structural imbalance, and visual feedback to the user aesthetically caused by the abrupt shape [17]. Uniform color matching is required, because the primary and secondary color matching, the gradual change of color fusion, and the obvious color difference will affect the structure of the flower itself, as shown in figure 2. The shape and color of the graphics are mostly directed at the flower pattern itself, and the layout of the graphics refers to the distribution of the flower pattern as much as possible in line with the conventional design requirements, such as centering and symmetry. When designing fractal flower shapes, the artistry of the fractal shapes themselves should be shown based on the traditional aesthetic design rules. It is a common design rule for designers.

If a figure has no edge of length 0, the dimension of the figure is 0 dimension, such as a collection of several points. If the length of a figure is a measurable value and the area is 0, the figure is a one-dimensional figure. In other words, a one-dimensional figure is a shape that can be measured in length.

The idea of calling a function inside a function itself in a computer program is called recursion. Fractal graphs possess the characteristics of self-similarity, structural nesting, and strong local association, which is also exactly in line with the idea of a recursive algorithm. Fractal graphs generated by the computer recursive algorithm amplify the strong local association in the characteristics of fractal graphs because of the single rule of a recursive algorithm, which makes the structure of generated graphical units simple with strong local similarity.

The brightness and texture features of the picture are extracted through the LAB space transformation and the grayscale co-occurrence matrix, and the brightness and texture features of the style picture are counted. Text
generation is an issue of great interest in the field of artificial intelligence, and text generation structures based on recurrent neural networks are the most widely used framework at present.

Recurrent neural networks emulate the visual property that a person can always retrace the text information at any position while reading and use a recursively connected structure to store historical text information to guide text generation. However, recurrent neural networks are highly susceptible to gradient disappearance or gradient explosion when the network is too deep, which leads to the inability of the network to be trained effectively for long text prediction problems. Previous image description generation methods usually use cascading or summation to accomplish the cross-modal fusion of graphical and textual features in the generation phase. However, these feature fusion approaches do not fully exploit the potential connections of the graphical features [18]. Because of the subjectivity of image similarity judgment, the development direction of the image retrieval technology shows a diversified trend. To this end, this chapter constructs a cross-modal image text fusion module to compute image text fusion features and exploit the intrinsic association of image-text features to improve the description generation performance of the network.
Figure 3 shows the generic flow of the attention module in the image description generation task. The attention module uses various pieces of information from the description generation task to assign reasonable weights to each visual region of the image, so that the model focuses on the region that can provide more information at the current moment to generate image descriptions. At present, the research on the attentional memory mechanism of image description generation tasks mainly focuses on the selection of weight assignment information and the design of a weight calculation model. In this chapter, we construct an attention module based on long- and short-term memory networks and use image text fusion features and generated text information to guide weight assignment.

In evaluating the quality of stereo images, this model first generates intermediate views by combining stereo visual perceptual features. It then extracts monocular visual information and binocular visual information based on the left and right views and intermediate views, respectively, and finally, it calculates monocular quality and binocular quality and fuses them into an overall quality score.

3.3. Experimental Design. To quickly implement the design of fractal graphics, there are many rendering tools for fractal graphics, and one of the more common ones is Apophysis, an open-source fractal graphics rendering tool based on the iterative function system (IFS). The dimension of the graph is 0, such as a set of points. The renderer code is open source, and based on its open-source function plug-ins, developers can design their function plug-ins, which are used to enrich the variety of transformation functions to achieve more graphical transformation, and they are scalable [19]. It reduces the mathematical skills required, while providing a graphical interface to facilitate the debugging of designers and developers.

The fractal tool provides a visual design interface to quickly add transformation condition rules and display the results to the user promptly. The view editor allows one to adjust the number and position of triangle transformations, the rectangular coordinates, or polar coordinates before and after the transformation, add the weights of the transformation, and the pointing and weights of the multi-triangle mapping. The tool provides not only editing design for fractal graphics but also the whole fractal image. Image processing controls, such as lens, gamma, luminance, background color, size, gradient, etc., can be adjusted through the adjustment window to make the iteratively generated fractal graphics more beautiful by design adjustments.

Adding nongreat suppression only eliminates a certain number of blurred edges, and there are effects because of other factors, such as noise and color that do not completely define the image edges. To better deal with these effects, a double-threshold method can be used, i.e., the filtering achieved setting two thresholds, namely high and low. The high and low double thresholds are limited, so that the image pixel gradient is divided into three intervals if the pixel gradient is greater than the high threshold. It is considered a strong edge pixel if the pixel gradient is less than the low threshold. It is suppressed and filtered, and the pixels between the high and low threshold intervals are considered weak edge pixels, which can be qualified by the neighborhood method, i.e., by checking whether the 8 neighborhood pixels are around the pixel. Based on algorithms, such as color, outline, and structure, images are analyzed, and feature extraction is done from different directions. Whether the pixel contains a strong edge pixel, it is determined whether it is an edge pixel or an interfering pixel because of noise or other reasons, as shown in Figure 4.

The fractal tree image obtained by copying and rotating in Photoshop is deblurred to a certain extent, resulting in distortion and pixel reduction in the enlarged image [20]. The enlarged image after the combination of the rotated fractal tree generated by the VB program is still clear. Therefore, the required rotation of the fractal map in the VB source program can improve the image clarity, achieve fidelity, and prevent later changes from causing image distortion to the fractal map.

For training, the network parameters are updated using the adaptive moment estimation method (Adam), with an initial learning rate of $1 \times 10$ and a batch size of 10. The adaptive pooling output feature map size is $7 \times 7$. Objects contained in the image are detected using the Faster R-CNN network. The input layer dimension of the long and short-term memory network is 2048, and the output layer dimension is 1024. In the test phase, the text is generated using a cluster search strategy with a cluster width of 3 [21]. The top three forms of text combinations with probability at each moment are always retained until the final description is obtained. The length of each sentence does not exceed 16 words. It also provides a theoretical basis for the generation of fractal art.

4. Analysis of Results

4.1. Results of Visual Properties of Fractal Art Patterns with Double Random Matrix. The image features are extracted using ResNet101, and the image text cross-modal fusion algorithm is used to map both image-text features to the same space to guide text generation, and the network is trained using an improved cross-first loss function based on scene probability. The key here is to find the similarity features of the whole and part of the image, and the collage theorem completes this process by means of artificial discovery. It is also a manifestation of its limitations. From the results in Figure 5, the performance of the algorithm in this chapter is greatly improved in each evaluation index. Comparing the VTF_Only method with the m-RNN method, the image text cross-modal fusion module fully exploits the potential correlation between the two features by making all components of the image text features interact, and it improves the performance of the image description generation method. Comparing the Prob_Only method with the Up-Down method using the same features, the improved cross-full loss function based on scene probability improves the uneven training of the image description generation network caused by the different frequencies of descriptions,
and the training of uncommon scenes is enhanced by the penalty function based on scene probability.

Fixing the output dimension of the image text cross-modal fusion module to 4096, Figure 5 compares the effect of penalty terms, taking different powers on the performance of the image description generation algorithm. The loss function normalization factor $\alpha$ is fixed at 3, which is determined based on the average integral of the selected power function. When $y = 0$, the loss function degenerates to the form of a standard cross first function. The results in Figure 5 show that when $y = 0.5$, the improved cross first loss function based on scene probability strikes a balance between easy and difficult training samples, and the algorithm performs best. Currently, it has more obvious advantages in two indicators, namely ROUGE_L and CIDER, and their results are 55.9 and 109.5, respectively.

With the same fusion feature dimension, the performance of the description generation network with the addition of the image text cross-modal fusion module is significantly improved, especially for the three metrics, namely Bleu_N, ROUGE_L, and CIDER.
SIPCE, and CIDER. The development of computer graphics has become a bridge connecting the fractal theory and fractal art. In addition, it is observed that the network performance is relatively optimal when the output dimension of fused features is 4096. From the above, the number of computational parameters of one image text fusion operation is 0, which is positively correlated with the output dimension of fused features. In the same case, the computational complexity of one outer product operation is 0. When the input dimension is 1024, the computational complexity of the outer product operation is about 1 million, which is comparable to that of the image text cross-modal fusion module with an output dimension of $6 \times 10^4$. The image text cross-modal fusion module computes the fusion features without introducing too many parameters, and the features can fully exploit the potential correlation of the graphic features and thus improve the performance of the image description generation method.

As shown in Figure 6, the OTSU binarization of the fractal map is performed using the maximum interclass variance obtained from the grayscale probability to count the number of pixel points within the rectangle. If the percentage of non-zero-pixel points inside the rectangle reaches 1/5, the rectangle size is appropriate, and the coordinates of the starting point of the rectangle containing edge pixels are recorded. If the percentage is less than 1/5, the rectangle is larger, and the rectangle length and width are reduced in turn. If the percentage of nonzero pixels is still less than 1/5 after the rectangle length and width are reduced to 1/8 of the image, it is decided that the flower pattern area is too small and not suitable for extraction. The smaller the rectangle, the more accurate the calculation of the image information share, however, with the increase of the number of rectangles, the amount of computation also increases, which may lead to the problem of low operational efficiency. The number of rectangles in the rectangle round-seeking mechanism is controlled below 2000, and it takes about 0.8–1.5 seconds to calculate a fractal map. Fractal geometry is visually displayed with graphics, which provides technical support for the development of fractal art. The number of rectangles is controlled below 2000, and it takes about 0.8–1.5 seconds to calculate a fractal map, which can meet the actual application requirements.

The organization of the pattern for fabric printing requires a consistent pixel distribution at the border of the stitching, and the translation stitching in the direct stitching requires the same pixels in the symmetric part, which can ensure the continuous pixels at the border of the pattern after stitching. Because it is flipped by a certain side, there is no problem of pixel inconsistency. Staggered splicing is easy to cause discontinuity because of the different offsets chosen for staggering. It is closely related to human life and has become an important part of the current society.

The continuous pattern of fractal pattern reflects the symmetry and regularity of traditional continuous patterns, and adding the fine self-similarity of the fractal pattern itself gives another aesthetic sensation to the continuous pattern, which is also very suitable for the application. Based on the above steps, we determine whether the fractal pattern needs to be extracted and whether the edges of the pattern meet the stitching requirements, determine the base pattern, and stitch it in a direct or staggered manner.

In addition, for the fractal map set, the grayscale co-generation matrix is used to determine the boundary texture information, and the boundary with uniform grayscale and low complexity can be spliced. The splicing results of multiple sets of quadratic continuous patterns are provided for designers’ reference. In terms of positioning, the number of windows determines the complexity of pixel calculation, and the window step and size are controlled to achieve the effect of low calculation complexity, which can be displayed in real time.

Fractal graphics, because of the difference in design, will make part of the rendered graphics pattern concentration. The before and after the background difference is obvious because the design is usually used for fabric printing. Local style migration leads to edge pixel blurring, before and after the style is very different, and local style migration is not suitable for fractal graphics. There is no need to record the positional relationship of every point on the graph. For the specificity of the fractal graph set, the perceptual loss-based style migration algorithm is compared and optimized by analyzing image iteration, model iteration, and different loss functions, setting reasonable initial style weights according to the brightness and texture differences of the style pictures and guaranteeing that the pictures rendered by the trained generative model incorporate the style texture features of the style pictures based on keeping the content intact.

4.2. Experimental Results. To test the impact of different content style parameters on the generated pictures, the time used to render a picture using the traditional gradient descent method is about 35 minutes, 7 in order to understand the influence of different optimization functions on loss convergence, the time taken by 1000 iterations of different optimization functions under the same learning rate was tested, as shown in Figure 7. The gradient descent method fluctuates more and converges slowly. Hence, a better optimization method can be used.

After the experimental test, the image iteration using the Adam optimization method takes about 15 minutes to migrate a picture, and it can be found that the ratio of content weight to style weight is the key to synthesizing the image. Therefore, the research on image retrieval, especially content-based image retrieval algorithms, has become one of the current hot topics. The model iteration method constructs the training generative network, extracts the feature reverse mapping using the trained VGG model, and saves the generative network model parameters to achieve fast style migration.

The image tendency after fast style migration is mainly influenced by the style initialization weights. When training the model, each style has an optimal interval for the value of the initial weights, however, this interval is unknown and needs to be manually debugged. Too large or too small initial weights can lead to overly biased style or content generated by the model, reducing the aesthetic value of the model-generated pictures. In the specific experimental process,
using an NVIDIA Tesla P-100 graphics card, it takes about 10 hours to train a generative model using the ImageNet dataset under the TensorFlow deep learning framework, which is costly in terms of time. By extracting features, such as the texture and luminance of style images to compare the effect of the generated images, we narrow down the range of style weights to find the appropriate style weight and generate a style migration model that meets the aesthetic standards.

The texture features of style pictures as the main features of migration should take the main weight in the comprehensive analysis. The brightness and texture features of pictures are extracted by LAB space conversion and grayscale cogeneration matrix, respectively, and the brightness and texture features of style pictures are counted. The selected interval of initial style weights is limited regarding the training model results to avoid the influence of too large and too small weights. In this paper, the style weights are set to 3 intervals, namely 10–80, 80–150, and 150–230, and the suggested initial weight intervals are given by comparing the luminance and texture information of the images generated by the training model with the original style images with different weight ratios.

We can see that when the image has gone through the decoding process 7 times, the image changes insignificantly and is basically in a stable state, and the peak signal-to-noise ratio of the image does not change much in terms of technical indexes, and the iterative work can be ended at this time to get the final immobile image. Extend the definition of subrandom imperfections from square to nonsquare. The peak signal-to-noise ratio of the image is shown in Figure 8, and the R-block steps are 2 × 2, 4 × 4, and 8 × 8. The smaller the R-block step, the larger the final PSNR value, and when the R-block step is 2 × 2, the PSNR value of the image after iteration is about double that of the R-block step of 8 × 8. Therefore, the fractal algorithm based on fixed block segmentation cannot be used in real-time image retrieval.
Focusing on fractal graphics and the principle of fractal image coding and decoding, the focus of fractal coding is on the selection of image segmentation schemes and codebooks. When the minimum segmentation block is $2 \times 2$, the coding time is long, however, the decoding effect is good. When the minimum segmentation block is $8 \times 8$, the coding time is greatly reduced, however, the PSNR also decreases exponentially.

Therefore, in the process of the corresponding algorithm research, it is necessary to grasp the final effect one wants to get. In addition, we also give a new way to change from double subrandom matrix to double random matrix. If one wants to get a more accurate decoding effect, one can set the minimum segmentation block to the minimum pixel if one does not have strict requirements on time. If one wants to save time and have low requirements on the decoding effect, one can set the minimum segmentation block to a slightly larger pixel value. This chapter applies the fractal principle to the codec test for the living gallery, and the test result will be used as the comparison result for subsequent experiments.

The fixed segmentation fractal algorithm, which uses a single layer segmentation, so the number of segments is certain for any image. Double random matrices have made great progress in physics, bioengineering, wireless communication, etc., in recent years, such as satellite switching and time division multiple access systems, which use double random matrices to replace the capacity of antenna channels. Image Picture 3 has a relatively complex structure with an uneven grayscale distribution, and the number of segments is 4078, while images Picture 1 and Picture 4 have a more concentrated pixel distribution. Hence, the number of segments is 1500 and 1700. Image Picture 2 is of medium complexity. Hence, its segmentation block number is about 2600. Compared with the fixed segmentation fractal algorithm, the average number of segments is reduced by about 60%, and the storage space required for the fractal code file is relatively small.

5. Conclusion

The fractal technology is a promising technology for image coding. Since the images processed by fractal technology can better reflect the self-similarity of images, increasing number of researchers have used fractals in image retrieval algorithms in recent years. The HV segmentation scheme improved with the strategy of restricting the segmentation ratio, and the optimal segmentation points are not exactly used for segmentation. The position of segmentation points is restricted in the middle region of the block to be segmented to avoid the appearance of too narrow segmentation blocks, which, in turn, improves the self-adaptive property of the image. Finally, an image similarity matching algorithm based on area cross-weights is introduced to adjust the weights of the aspect ratio of the segmented R-blocks, and a new image distance comparison formula is proposed. The work in this paper investigates the application expansion of fractal geometry graphics in the field of art design from three aspects: automated modeling, automated pattern design, and style migration, and it provides some practical solutions for fractal geometry in intelligent art design. Through the analysis of examples, it shows the operability of the conclusion and the advantage of not needing to discuss parity. In fractal graphics modeling, the graphics generated in batch based on self-combining nonlinear transformation modeling have the special case of uneven distribution of patterns, which still needs to be judged by adding more precise artistic rules. The method of automatic generation of fractal quadratic continuous patterns is the first time to use image processing for pattern organization design, and the fineness of pattern extraction still needs to be improved. Finally, the artistic value of fractal art graphics is reflected not just in the graphics themselves. We hope that the next related researchers can further explore the artistic value of the graphics and combine technology and art perfectly.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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