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Computer-Aided Design AND APPLICATIONS

Computer Aided Style Transfer and Creation Algorithm of Chinese Painting Based on Artificial Intelligence

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Abstract. Through long-term practice and learning, artists continuously improve their painting skills and artistic cultivation, injecting a continuous stream of vitality into the growth of Chinese painting. Based artistic creation, artificial intelligence (AI) technology provides new solutions for artistic style transfer, creative assistance, and more. This article explores the unique characteristics of Chinese painting and develops a transfer and creation algorithm specifically targeting the artistic style of Chinese painting. Through emotion analysis technology, algorithms can identify and transfer emotional elements from the original work, and apply them during the creative process, enabling the transferred work to better convey emotions. After experimental verification, this method has achieved good results in image processing errors and audience visual experience assessment, proving its effectiveness and superiority in the transfer of Chinese painting art style. These results provide broader creative space and possibilities for the creation of Chinese painting art, promoting This algorithm can help artists quickly transform and transfer artistic styles, thereby creating new artistic forms and expressions. Applying artistic style transfer algorithms in Chinese painting can help artists better master traditional Chinese painting techniques and artistic styles, while also enhancing their artistic style.

Keywords: Artificial Intelligence; Computer Aided Design; Chinese Painting; Artistic Style
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1 INTRODUCTION

In the long historical process, Chinese painting has absorbed various cultural elements and integrated various artistic skills, forming a variety of artistic expressions. The embroidery industry is also deeply influenced by it. By utilizing robot technology and AI, the efficiency and quality of embroidery have been significantly improved, while also bringing some new challenges. Chen et al. [1] explored the advantages and challenges of assembly automation. The traditional embroidery

process mainly relies on manual operation, which is inefficient and difficult to ensure accuracy. By introducing robot technology, automated embroidery can be achieved, greatly improving production efficiency. In addition, the image recognition and learning capabilities of AI can enable robots to exhibit higher intelligence in simulating and predicting pin layouts. By utilizing AI algorithms and big data technology, an intelligent design system can be developed that automatically generates diverse embroidery patterns and color combinations based on customer needs. This not only shortens the design cycle, but also meets personalized consumer needs. AI technology can achieve automatic quality detection of embroidery products, identifying and correcting potential defects through image recognition and comparison. AI can also be used for real-time monitoring of the production process to ensure consistency in product quality. This makes Chinese painting unique in the world art stage. Chinese painting gives priority to the use of pen and ink, emphasizing the artistic effect of both form and spirit and profound artistic conception. The creation of Chinese painting requires artists to have solid painting basic skills, profound artistic accomplishment and sensitive creative inspiration. Chen et al. [2] discussed how to use CycleGAN to enable Xizang's painting style to integrate the creation of works and open up a new path for art education. Circular consistency network is a special generative adversarial network (GAN), whose core idea is to learn how to transform images between different styles. CycleGAN achieves the transition from one style to another through two mutually transforming processes. For example, an image of Xizang painting style can be converted to other painting styles, and vice versa. This powerful image conversion ability provides artists with more creative possibilities. By using AI technology, it is possible to quickly and accurately convert painting styles and improve creative efficiency. Students can choose different painting styles to transform and integrate according to their interests and needs, achieving personalized learning.

This model can not only be applied to the field of painting, but also be extended to other art fields such as sculpture, architecture, etc., promoting interdisciplinary integration and development. Through long-term practice and study, artists constantly improve their painting skills and artistic accomplishment, and inject a steady stream of vitality into the growth of Chinese painting. Chinese ink painting is a unique art form, with its concise lines and rich white space, making the picture full of poetry and imagination. However, due to its unique painting methods and materials, there are certain limitations to the preservation and display of ink painting. With the development of technology, it has become possible to use deep learning technology to transform and enhance ink paintings. Chung and Huang [3] proposed a method of using boundary enhanced generation of adversarial networks (BE GAN) to interactively convert Chinese ink painting into real images. The generator is responsible for converting the original ink painting into a real image, while the discriminator evaluates and improves the output of the generator. Specifically, the generator first extracts features from ink wash paintings, and then uses adversarial networks to convert them into real images. The discriminator uses boundary enhancement technology to improve the details and clarity of the generated image by detecting and enhancing image edges. Through repeated generation and evaluation, BE-GAN can gradually improve its image conversion ability. By combining adversarial networks and boundary enhancement technology, BE-GAN can improve the clarity and detail representation of converted realistic images while preserving the style of ink painting. However, with the growth of modern society and the change of people's lifestyle, fewer and fewer people can devote a lot of time and energy to learning and practicing Chinese painting creation. This has led to the dilemma of the inheritance and growth of Chinese painting. Among them, wallpaper texture generation and style conversion have become a highly concerned direction. Gao et al. [4] aiming to achieve more natural and realistic texture generation and transformation effects, and experimental results of this method. Wallpaper texture generation is an important research direction in the fields of computer graphics and computer vision. Methods are usually based on random processes or image-based methods. However, these methods often find it difficult to generate complex and semantically meaningful textures. To address this issue, Firstly, we use deep learning techniques to train a large number of wallpaper images to obtain a pre trained convolutional neural network (CNN). Then, based on the input semantic label, we generate a texture corresponding to the label by adjusting the parameters and activation functions in the network. In this process, we used a Conditional Random Field (CRF) method to further optimize and adjust the generated texture. In this process, we should not only

respect the traditional spirit of Chinese painting, but also dare to innovate and promote the organic integration of tradition and modernity.

In recent years, AI technology has made rapid progress and demonstrated strong application potential in various fields. In the field of computer-aided artistic creation, AI technology provides a new solution for artistic style transfer and creative assistance. In the field of art, especially in painting, the potential of the metaverse is remarkable. Guo et al. [5] explored the paradigm of parallel and analyzed its impact and value on artistic creation. The metaverse is a network of countless interconnected virtual worlds, each with unique rules and environments. In this universe, humans and artificial intelligence (AI) can collaborate and create together. This new creative method is called parallel human-machine collaborative painting. Parallel human-machine collaborative painting is an innovative art creation mode that allows humans and AI to create together in the same virtual environment. Human artists can draw through tools such as gestures, brushes, and mice, while AI can automatically generate works that meet the requirements of human artists by learning human painting styles and techniques. This collaborative creation approach can enable human artists to focus more on creativity and inspiration, while leaving tedious calculations and repetitive work to AI to complete. As one of the important technologies, the artistic style migration algorithm can automatically apply an artistic style to other images to realize the migration and integration of styles. The application of Generative Adversarial Networks (GAN) in the field of image processing has indeed brought significant progress to art image style conversion technology. GAN can learn and generate images through training, and its structure consists of two parts: a generator and a discriminator. The generator is responsible for generating the image, while the discriminator is responsible for determining whether the image was generated by the generator. These two will undergo adversarial training to continuously improve the generator's generation ability and the discriminator's judgment ability. The main purpose of artistic image style conversion technology is to fuse the content of the source image with the style of the target image, and generate a brand-new image with the target style. This technology utilizes the characteristics of GAN, treating the source image as a content image and the target image as a style image. Then, through the learning and generation process of GAN, the content of the source image is fused with the style of the target image. Han et al. [6] proposed a method for artistic image style conversion based on deep extraction to generate adversarial networks, aiming to improve conversion efficiency and effectiveness. The main task of this stage is to extract features from the source image, including key features such as texture and color, and transfer these features to the generated adversarial network. In order to achieve effective feature extraction, we used Convolutional Neural Networks (CNN) to preprocess the source image, and extracted and integrated key features of the source image through Self Attention Mechanism. Specifically, the generator first receives guidance information on the source image and target style, and then uses a generative adversarial network to convert the source image into an image with the target style. The discriminator evaluates and improves the output of the generator to achieve more realistic style transitions. The growth of this technology provides more possibilities and sources of inspiration for artists' creation. In this article, an AI-based computer-aided artistic style transfer and creation algorithm of Chinese painting is proposed. By studying the core elements of Chinese painting, such as brushwork, composition and color, and combining with deep learning (DL) technology, this article aims to develop an algorithm that can automatically migrate and create the artistic style of Chinese painting. This study combines Chinese painting art with AI technology to explore the fusion point and potential between them. Through the realization of the algorithm, the threshold of Chinese painting creation can be lowered, and more people can contact, learn and create Chinese painting. In this article, the AI-based computer-aided Chinese painting artistic style transfer and creation algorithm is studied, and its innovations are as follows:

(a) By studying the unique characteristics of Chinese painting, this article develops a migration and creation algorithm specifically for the artistic style of Chinese painting, thus realizing the accurate capture and simulation of Chinese painting style.

(b) Through computer simulation technology, this study successfully realized the high-precision simulation and conversion of complex strokes and brushwork of Chinese painting. This simulation

technology can truly restore the creative process of Chinese painting artists and make the generated works show the unique charm of Chinese painting more realistically.

(c) Through the emotion analysis technology, the algorithm can identify and transfer the emotional elements in the original works, and use them in the creative process, so that the transferred works can better convey emotions.

(d) The algorithm has the ability to deal with many different Chinese painting styles at the same time. This feature makes the algorithm more flexible and efficient, and artists can freely choose different styles to migrate and merge according to their own creative needs, and create rich and diverse Chinese paintings.

Firstly, this article expounds the research background of this article, introduces the status of artistic style transfer of Chinese painting, and summarizes the research purpose and method of this article; Then, it introduces the artistic style transfer, including the key technical links such as artistic feature detection, style transfer network design, loss function definition and so on. The experiment shows the results of the algorithm in terms of artistic style transfer, image processing error and audience visual experience. Finally, the research are summarized, and the contribution and value of this algorithm in the artistic style transfer of Chinese painting are emphasized.

2 RELATED THEORETICAL BASIS

In art and design education in universities, computer-aided technology design methods and processes, but also provides new possibilities for innovative educational models. Jin et al. [7] combine online learning with face-to-face classroom teaching. Teachers can use online platforms for theoretical teaching, while face-to-face classroom teaching can be used for practical operations and project development. This approach can better meet students' learning needs and improve their learning efficiency. By collaborating with industries, students can have direct exposure to the actual work environment and needs, which is very beneficial for their career development. At the same time, the industry can also communicate its needs and feedback directly to students and teachers through cooperation with schools. Students can use computer-aided design software for modeling, rendering, image processing, and interactive design to improve design efficiency and accuracy. In addition, computer-aided technology can also simulate phenomena such as physics, optics, and acoustics in the real world, helping students better understand and master design knowledge. Combining online and offline teaching, utilizing computer-aided technology to provide rich online resources, such as video tutorials, design software, and practical projects, to support students' autonomous and collaborative learning. Offline classrooms focus on cultivating students' practical operations and problem-solving abilities. Through computer-aided technology, students can easily collaborate and communicate in teams. Teachers can organize students to group projects and work together to complete complex design tasks, cultivating students' teamwork and coordination abilities. Environmental art design is a multidisciplinary field that requires processing. The introduction of CAD software enables designers to process this information more efficiently, improving design efficiency and quality. CAD software can help students more intuitively understand and analyze design concepts. Jin and Yang [8] help them better master design techniques and methods by drawing and modifying design schemes. In addition, CAD software can also help students better collaborate with teams and improve work efficiency. However, using CAD software alone cannot meet all the requirements of environmental art design. Environmental art design requires the comprehensive application of various knowledge and skills, including architecture, landscape design, interior design, etc. Therefore, in teaching, teachers not only need to teach students how to use CAD software, but also need to guide them to understand and apply other relevant knowledge and skills. Greatly reducing the time required for traditional manual drawing and improving design efficiency. CAD software can accurately draw graphics, reduce errors, and improve design quality. By using CAD software, students can better understand and master design principles and methods, and enhance practical abilities. CAD software provides more design possibilities, which can stimulate students' innovative thinking and improve their design innovation ability. To fully leverage the advantages of

CAD software, teachers and students must be proficient in the basic operations of CAD software. The use of CAD software in environmental art design teaching should focus on cultivating students' practical abilities and innovative thinking. Teachers should arrange the course time and teaching content reasonably based on the course content. With the rapid development of technology, especially in the field of contemporary art, computer-aided design is not only a technical means, but also an important medium for stimulating innovative thinking and expressing artistic concepts. However, how to effectively utilize computer-aided design for teaching and improve students' innovative and practical abilities is still a problem worth exploring. Liu and Yang [9] focus on the teaching philosophy of innovation as the core, teachers should encourage students to use computer-aided design for experiments and innovation. Rather than just mastering technical tools. For example, students can be guided to use computer-aided design for artistic creation and design, master skills through practice, and stimulate innovative thinking. In contemporary art computer-aided design teaching, teachers should adopt diverse teaching methods to adapt to the learning styles and needs of different students. Especially through the use of a neural network technology called style transfer. Park et al. [10] explored the principle of semantic perception neural style transfer and its application in the fields of image and visual computing. Semantic perception neural style transfer is a technology that combines deep learning and style transfer. It first performs semantic segmentation on the source image, identifies various objects and scenes in the image, and then converts them into a style that is closer to the target image style. This process requires the use of a deep learning model called Convolutional Neural Networks (CNN). Semantic perception neural style transfer first uses a CNN model called U-Net to perform semantic segmentation on the source image, obtaining the category information of each pixel. Then, this information is used to adjust the style of the source image to be closer to the style of the target image. This process can be optimized through a loss function that takes into account the results of semantic segmentation.

With the rapid development of information technology, especially, generative adversarial networks (GANs) have become an important tool in the fields of image processing and computer vision. The characteristics of GAN enable it to learn complex patterns from a large amount of training data and generate highly realistic images. In many applications, GAN has been used for tasks such as image generation, repair, and style transformation. In collaborative creative drawing systems, GAN can also leverage its powerful capabilities to help users create efficiently. In the system, GAN is used as a primary image generation tool. Users can generate new image parts by inputting text instructions or directly drawing on the image, while GAN is responsible for converting the user's input into specific image pixels. Due to GAN's learning ability, it can generate images that meet user expectations based on user instructions and historical painting records [11]. In image style conversion, the source image usually contains a content image, while the target image contains a style image. By fusing the content of the source image with the style of the target image, we can obtain a new image that includes both the content of the source image and the style of the target image. Generating a brand-new image with the target style. In recent years, the application of reversible networks in image style conversion has received increasing attention. Wang et al. [12] proposed aimed at achieving a more natural and realistic style conversion effect. A reversible input data to two or more different but interrelated output data. The characteristics of this network make it have broad application prospects in the fields of image processing and computer vision. In terms of artistic painting style conversion, reversible networks can simultaneously learn, and fuse them together to generate a new type of artistic work. Once the reversible network model is trained, we can use it for artistic painting style transformation. Specifically, we transfer the source image as input data to the reversible network model, and then use the output of the model as a new artwork. Due to the characteristics of reversible networks, we can obtain a brand-new image with a target style.

This technology has important application value in fields such as literary creation, advertising design, and natural language processing. Wang et al. [13] will review the latest methods and datasets of ATST, with the aim of providing reference for researchers in related fields. This type of method learns the relationship between the source text and the target text through training models, thereby achieving text style conversion. Although this method reduces manual intervention to some extent, its effectiveness is often not as good as deep learning methods. Transformers, and Variational

Autoencoders (VAEs). This method can automatically learn text features, with higher conversion efficiency and better results. The ability to convert modern Chinese into classical Chinese (or vice versa) has important practical value in the fields of literature and history. This not only helps us better understand ancient culture and language, but also provides new possibilities for modern literary creation. However, due to the significant differences in grammar, vocabulary, and expression between ancient Chinese and modern Chinese, achieving accurate conversion between these two languages is not an easy task. In recent years, natural language processing technology based on deep learning has provided new ideas to solve this problem. Xu et al. [14] proposed a hint-based reinforcement learning method for achieving stylistic transformation between modern Chinese and classical Chinese. After the prompt-based reinforcement learning stage, we used the trained model to convert modern Chinese and classical Chinese. In terms of application, image style conversion technology can bring innovation to many fields. For example, in the field of digital entertainment, the content of the source image can be fused with the style of the target image to generate novel works of art; In the field of advertising design, advertising materials can be converted into different styles through image style conversion to attract more consumers; In the field of cultural heritage protection, images of cultural heritage can be transformed into different styles through image style conversion to protect and inherit cultural heritage. This technology is widely used in fields such as painting, photography, and advertising design. Zhong and Huang [15] explored its implementation of intelligent processing and computation. Traditional CNN algorithms usually only focus on low-level features of the image, such as edges and textures, while ignoring high-level features such as color and shape when processing images. To address this issue, we propose an improved CNN algorithm. This algorithm adds two key components to the traditional CNN model: capture advanced features of the image, while the fully connected layer can map these features to the space of the target style.

3 DETECTION OF ARTISTIC CHARACTERISTICS AND STYLE TRANSFER OF CHINESE PAINTING

In the field of AI, DL has become one of the most influential and promising research directions. Based on a large quantity of data drivers, it learns the feature representation of data through multi-layer neural network structure, and then realizes the intelligent processing of various complex tasks. The DL theory provides the core technical support for the artistic style transfer and creation algorithm of Chinese painting studied in this article. By training the deep neural network model, we can learn and transfer the style characteristics of Chinese painting and generate works of art with Chinese painting style. Therefore, DL has played a vital role in guiding the research of this article. Computer vision is a scientific field that studies how to make computers get information from images or videos, understand the content and make decisions. In this study, the application of computer vision theory is mainly reflected in the processing and analysis of Chinese painting images. Through computer vision technology, we can extract the key features of Chinese painting, such as strokes, colors, composition, etc., and provide an important basis for the subsequent style transfer. In addition, computer vision theory can also help to study and realize the quality assessment of the generated works, and judge whether the Chinese painting works generated by the algorithm meet the artistic requirements through comparison and analysis with the original works. The theory of art and aesthetics is a theory and viewpoint to study artistic creation, aesthetic experience and artistic assessment. In-depth study of the core elements of Chinese painting, such as pen and ink techniques, composition rules and aesthetic pursuit, can help researchers grasp the unique charm of Chinese painting more accurately. Moreover, aesthetic theory also guides us to assess the aesthetic value of the generated works and ensure that the results of algorithm creation are of artistic significance. Based on these theories and principles, this article will assess the effectiveness of the algorithm and ensure that the generated works are aesthetically consistent with the original works. The theory of image processing and computer graphics studies the acquisition, processing, analysis, understanding and generation of images. Through image processing technology, Chinese paintings can be preprocessed and enhanced, and the input quality of the algorithm can be improved.

Computer graphics theory can be used to simulate and render strokes and textures of Chinese paintings, making the generated works more realistic.

For Chinese painting, a traditional painting form with profound historical background and artistic characteristics, how to realize the accurate detection of its artistic characteristics and the effective transfer of its style has always been the focus of academic attention. This section will introduce in detail the research methods and achievements of this article in the detection of artistic characteristics and style transfer of Chinese painting. The brushwork of Chinese painting is an important part of its unique charm. This study uses CNN in DL to automatically detect strokes and textures of Chinese paintings. By training the model to identify the characteristics of different strokes and textures, the accurate extraction and classification of strokes and textures can be realized. This section will introduce how to use CNN to detect the artistic characteristics of Chinese painting, and its structure is shown in Figure 1.

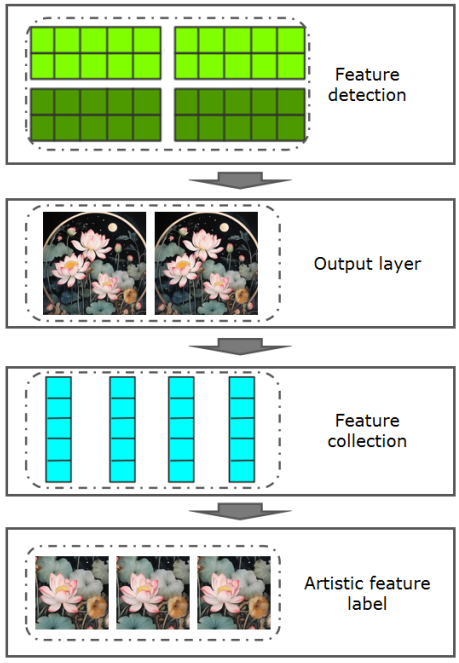

Figure 1: Chinese painting art feature detection model.

The use of color in Chinese painting is rich and varied, and the color matching is exquisite and delicate. In this article, the methods of color histogram and color clustering are used to detect and analyze the colors in Chinese painting. Through these methods, we can accurately extract the information of the main color, color distribution and color matching in the paintings. Composition is an important part of Chinese painting and plays a vital role in the vividness of works. This article studies the composition and layout of Chinese painting by using the technology of object detection and edge detection in computer vision.

It is necessary to convert the patterns of Chinese painting into digital images, as computers cannot directly understand non digital forms of images. Chinese painting, as a traditional art form, usually contains complex textures and structures, so special attention needs to be paid to the selection of image resolution and color space during the conversion process. A suitable resolution can ensure the clarity of image details, while the correct color space can ensure the color accuracy of the image. Figure 2 shows the operation flow of the model.

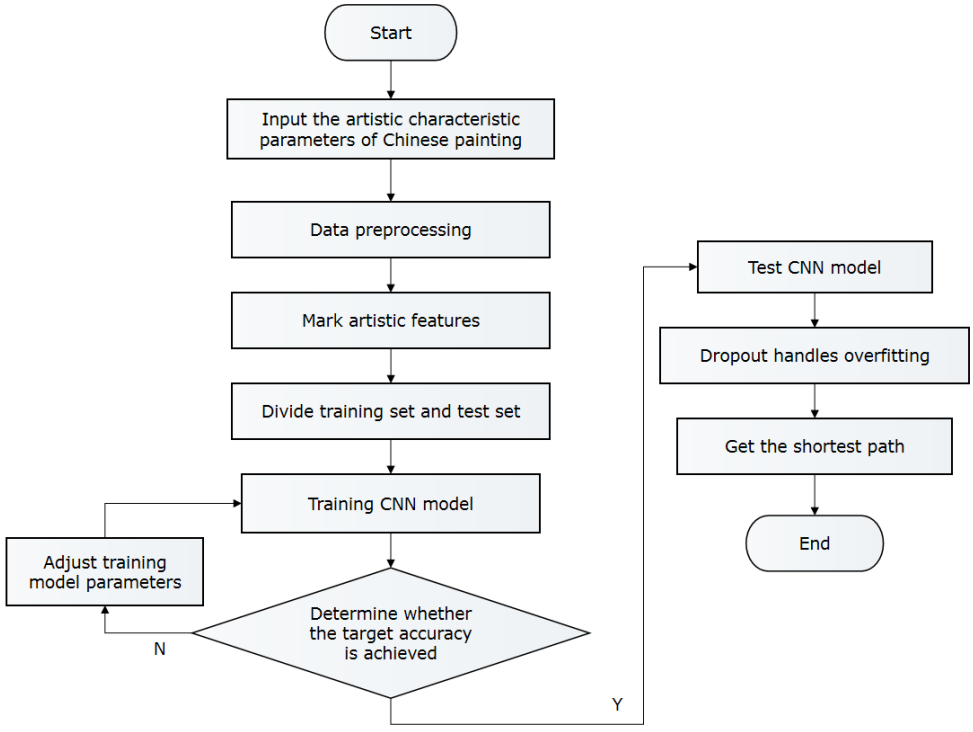

Figure 2: Operation flow of the model.

By learning the feature representation of source style and target style through training model, it is possible to transfer the source style to the target image and generate Chinese painting works with source style characteristics. In order to achieve better style transfer effect, this article designs a loss function specifically for Chinese painting. This function should comprehensively consider artistic features such as brush strokes, colors, composition, etc., and add perceptual loss and content loss to ensure that the generated works are consistent in style and try to retain the content information of the original image. By optimizing the loss function, we can achieve better style transfer effect and make the generated works closer to the artistic style of the original. The pixel with $a_{ij}=0$ corresponds to the background point. Set the background point set:

$$B=\{(x,y)\mid a_{xy}=0\} \tag{1}$$

$$d_{ij}=\min\{D[(i,j),(x,y)],(x,y)\in \mathrm{B}\} \tag{2}$$

Among them:

$$D[(i,j),(x,y)]=\sqrt{(i-x)^2+(j-y)^2} \tag{3}$$

In the process of image acquisition and digitization, it is first needed to acquire the images of Chinese paintings and digitize them by scanning or shooting. Ensure that the resolution and quality of the image are high enough to preserve the details and features of the original work. Before the subsequent processing, it is usually needed to preprocess the image. This includes operations such as removing noise, adjusting brightness, contrast and color balance to enhance the overall quality and clarity of the image. Using computer vision and DL technology, the features of Chinese painting images are extracted. These features can include brush strokes, colors, textures and composition. After the artistic features are extracted, the style transfer algorithm can be applied to transfer the

source style to the target image. In the process of style transfer, it is needed to comprehensively consider the characteristics of brush strokes, colors, composition and so on, and design the corresponding loss function to retain the essence and characteristics of the original.

Assuming that the image is $I(x,y)$, take the window W_i of $N \times N$ on the image, and its local gradient matrix can be expressed as:

$$G = \begin{bmatrix} \vdots & \vdots \\ I_X(k) & Iy(k) \\ \vdots & \vdots \end{bmatrix} \tag{4}$$

Here $[I_x(k), I_y(k)]^T$ represents the gradient value of the image at the point (X_k, Y_k), and the important information of the image window W_i can be reflected by the gradient matrix G, whose singular value decomposition is:

$$G = USV^T = U \begin{bmatrix} S_1 & 0 \\ 0 & S_2 \end{bmatrix} [V_1 \ V_2]^T \tag{5}$$

Where U, V is an orthogonal matrix. Column vector V_1 is the main direction of local gradient, column vector V_2 represents the "boundary direction" of the selected window, and singular value $S_1 \geq S_2$ represents the energy of column vector V_1, V_2 respectively.

The local gradient direction of the image can be expressed by vector V_1. If vector $V_1 = [V_1(1), V_2(1)]$ is set, the local gradient direction of the image can be expressed as:

$$\theta_0 = \arctan\left(\frac{V_1(2)}{V_1(1)}\right) \quad \theta_0 \in [-\pi, \pi] \tag{6}$$

Before realizing the artistic style transfer and creation of Chinese painting, it is needed to detect the artistic characteristics of Chinese painting images first. This step is of great significance, which can help researchers accurately grasp the unique elements and characteristics of Chinese painting and provide key guidance for subsequent style transfer and creation. Through the detection of artistic features, we can extract the core features of Chinese painting, such as strokes, colors, composition and so on. These characteristics are the cornerstone of the artistic style of Chinese painting, which is very important for migration and creation. Only by accurately capturing these characteristics can we ensure that the essence of the original work is preserved in the style transfer and the unique charm of Chinese painting is displayed in the creation.

Fitting the point (X_i, Y_i) of the number to $y = b + ax$, and finding a and b makes:

$$J(b,a) = \sum_{i=1}^{n} \left[y_1 - (b + ax_i) \right]^2 \tag{7}$$

It can be known from the above formula:

$$nd + a\sum_{i=1}^{n} X_i = \sum_{i=1}^{n} Y_i \tag{8}$$

$$b\sum_{i=1}^{n} X_i = a\sum_{i=1}^{n} X_i^2 = \sum_{i=1}^{n} X_i Y_i \tag{9}$$

$$H(X) = -\sum_{i=1}^{n} p(X_i) \log p(X_i) \tag{10}$$

$$R = -\sum p(i)\log p(i) \tag{11}$$

The results of artistic feature detection can provide inspiration for creativity. By analyzing the detected features, artists can gain a deep understanding of the original work's style, composition, and color, thereby stimulating creative inspiration. These inspirations can serve as the starting point for new work creation, combining the artist's personal style and creativity to create unique works with Chinese painting charm. By analyzing the characteristics of reference detection results, artists can better grasp the artistic elements of Chinese painting and enhance the expressive power and connotation of their works. Moreover, these results can also serve as feedback mechanisms in the creative process, helping artists adjust and improve their works, making them more in line with the artistic norms and aesthetic requirements of Chinese painting.

4 RESULT ANALYSIS AND DISCUSSION

The experiment aims to innovate the design of cultural souvenirs by combining consumer demand prediction, in order to improve the visual effect and artistic expression of the product, thereby increasing consumer willingness and satisfaction to purchase. Through innovative design of cultural souvenirs that combines consumer needs, it is expected to achieve significant improvements in visual effects, artistic expression, and consumer satisfaction, verifying the guiding role of demand prediction in innovative design. The results shown in Figure 3 are comparative data from precision experiments conducted on various art style transfer algorithms. From these data, it can be clearly seen that the Chinese painting art style transfer algorithm proposed in this article has significantly improved in performance.

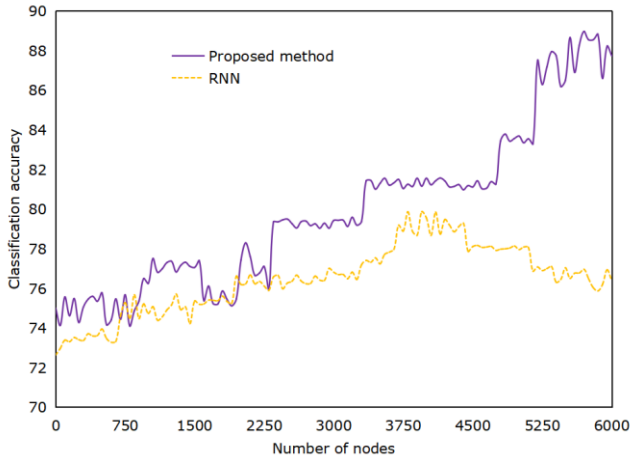

Figure 3: Accuracy test of different artistic style migration algorithms.

The artistic features of Chinese painting are the embodiment of its unique charm and value. Effectively retaining these features is a key task in style transfer. The results show that compared with RNN algorithm, the accuracy of this algorithm is improved by more than 15%. This is a very significant improvement, which proves that the algorithm in this article has higher accuracy and effect in the task of artistic style transfer. Some style transfer algorithms may lose the clarity of images in the process of processing, resulting in blurred works. The algorithm in this article realizes the transfer of artistic style on the premise of ensuring image clarity. This means that the algorithm in this article not only improves the accuracy of style transfer, but also maintains the original quality of the image, providing higher visual quality for the generated works.

Accuracy and recall are key performance metrics. As the harmonic average of the two, F1 value provides a single assessment index, which comprehensively considers the accuracy and integrity of the algorithm. According to the display in Figure 4, the algorithm in this article has achieved the highest score on F1 value, which shows that the algorithm in this article is excellent in both accuracy and recall.

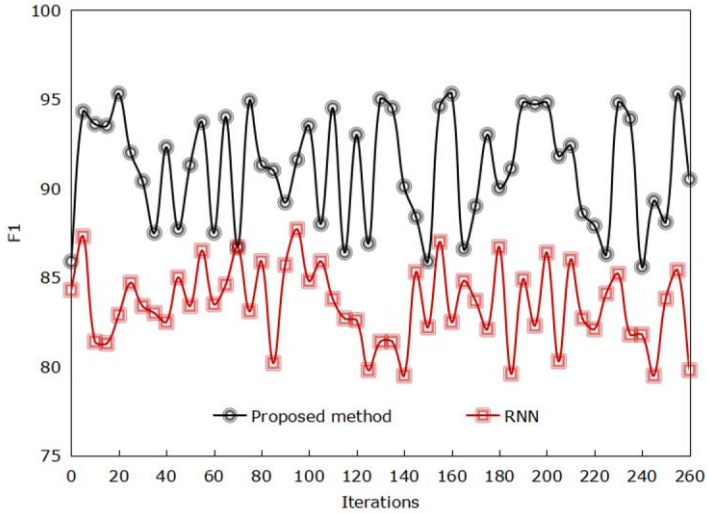

Figure 4: Comparison of F1 values of several algorithms.

In image processing, the error may come from many aspects, such as the calculation approximation of the algorithm, the simplified assumption of the model, the noise of the image and so on. These errors will accumulate and may affect the quality and accuracy of the final generated image. Therefore, an excellent algorithm should be able to minimize these errors and ensure that the difference between the processed image and the original image or the target style is minimized (Figure 5).

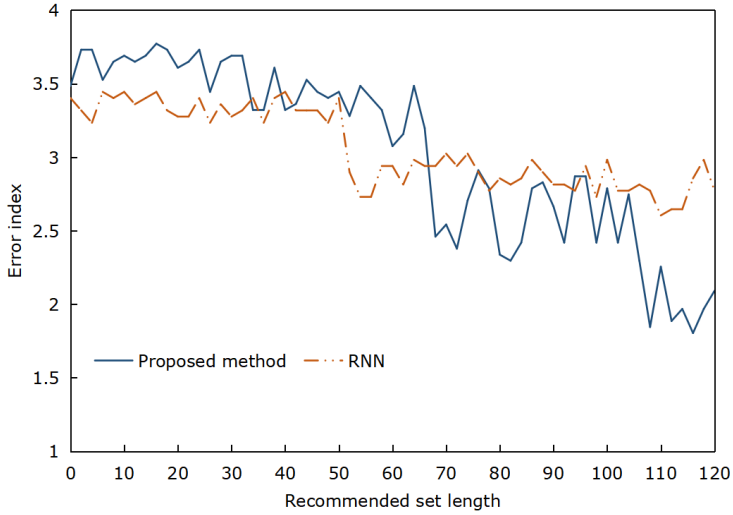

Figure 5: Image processing errors of different algorithms.

Because this method is especially aimed at Chinese painting, it has a deeper understanding of the characteristics, strokes and colors of Chinese painting. This understanding helps the algorithm to

process images more accurately and reduce errors. Although RNN algorithm also adopts advanced DL technology or other image processing strategies, their universality may lead to relatively high errors when dealing with Chinese painting, an image with unique artistic characteristics.

In Figure 6, we see the Chinese painting images before and after the optimization of this algorithm. It can be clearly observed that the optimized image has a certain improvement in quality and more outstanding artistic expression.

Figure 6: Artistic effect of Chinese painting.

Chinese painting is famous for its unique brushwork, color and composition, which together constitute its unique artistic expression. Through the optimization of this algorithm, these artistic features have been better presented. The optimized image is more vivid in color, and the color transition is more natural, which makes the overall color matching of the picture more harmonious and more visually impactful. After the optimization of the algorithm, the composition of the picture is more balanced and the theme elements are better highlighted. This makes it easier for the viewer to capture the artist's creative intention and theme when appreciating the painting. By deeply understanding the artistic characteristics of Chinese painting and combining with advanced DL technology, the algorithm can improve its visual expression while retaining the artistic charm of the original.

Figure 7 shows the audience's assessment of the visual experience of the Chinese painting art design works processed by this algorithm. The experimental results show that this method has achieved good results in simulation accuracy and appreciation, and can improve the interaction between art design.

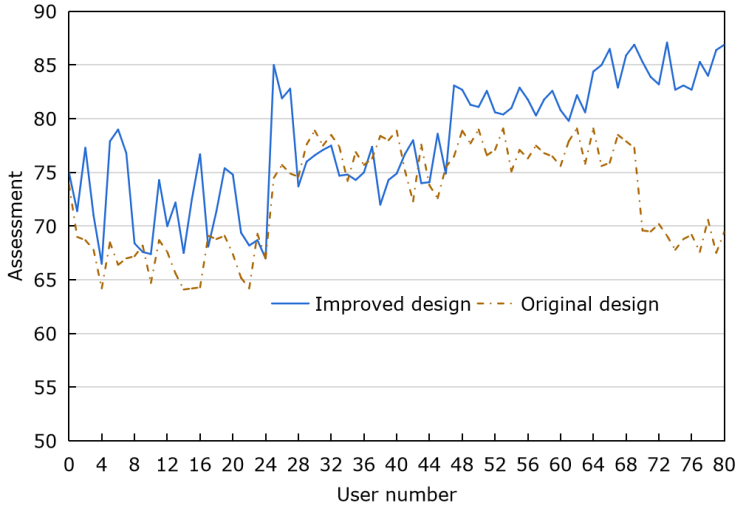

Figure 7: Viewer's assessment of visual experience of Chinese painting art design works.

The audience gave positive feedback on the works processed by the algorithm in this article, indicating that the method can accurately simulate and generate art works that meet the requirements. The achievement of this good effect can be attributed to the algorithm's accurate capture and transfer of artistic features of Chinese painting, as well as the reduction of image processing errors. These factors together ensure the similarity between the generated work and the original work in terms of strokes, colors, composition, etc., enabling the audience to achieve higher satisfaction in the visual experience. The audience gave positive feedback on the ornamental value of the Chinese painting works optimized by the algorithm in this article. This indicates that through the optimization of the method in this article, the image quality of the work has been improved, and the artistic expression is more prominent, enabling the audience to obtain better visual enjoyment during the appreciation process. The improvement of viewing quality not only enhances the charm of the work itself, but also provides the audience with a richer and deeper visual experience. By improving the audience's assessment of the visual experience of the work, it can be inferred that the Chinese painting works processed by the algorithm in this article enhance the interaction. The audience can actively participate in the appreciation and design process of the work, and form good interaction and communication with the designer.

The algorithm proposed in this article has achieved significant results in artistic style transfer, image processing errors, and audience visual experience assessment. By accurately capturing and transferring the artistic features of Chinese painting, this algorithm can help artists achieve style transfer and integration during the creative process, creating unique and charming new works. This helps to promote the innovation and growth of Chinese painting art, while preserving and inheriting the essence of traditional artistic styles. By reducing image processing errors, this algorithm improves the quality and accuracy of generated images. This is crucial for artistic creation, as preserving details and accuracy can better showcase the artist's creative intent and artistic expression. Artists can trust the accuracy of algorithms in processing images more, thereby better focusing their energy on the creation itself and enhancing the artistic and expressive power of their works. Finally, the improvement in the visual experience assessment of Chinese painting art and design works by the audience further validates the effectiveness and artistic value of the algorithm proposed in this article.

5 CONCLUSION

In the long historical process, Chinese painting has continuously absorbed various cultural elements and integrated diverse artistic skills, forming a variety of artistic expressions. The creation of Chinese painting requires artists to have solid painting basic skills, profound artistic accomplishment and sensitive creative inspiration. This study combines Chinese painting art with AI technology to explore the fusion point and potential between them. Through the realization of the algorithm, the threshold of Chinese painting creation can be lowered, and more people can contact, learn and create Chinese painting. The results show that the algorithm proposed in this article has achieved remarkable results in artistic style transfer, image processing error and audience visual experience assessment. These results are of great significance to the artistic creation of Chinese painting. By accurately capturing and transferring the artistic features of Chinese paintings, the algorithm can help artists to realize the transfer and integration of styles in the creative process and create new works with unique charm.

The current algorithm may need a certain amount of calculation time when processing large-size images. In the future, we can study how to improve the efficiency of the algorithm, realize real-time artistic style migration, and provide more convenient tools for artists and designers. Everyone's aesthetics and preferences are unique. In the future, we can study how to customize the artistic style migration in combination with the individual needs of users, so that the generated works are more in line with users' tastes.

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