Research Article

Application of Intelligent Image Color Technology in Teaching Chinese Painting Color

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1.Introduction

Chinese painting is referred to as “Guohua.” Chinese painting is a traditional form of painting in China. The concept of Chinese painting originated in the Han Dynasty and refers mainly to scrolls painted on rice paper or silk and framed. As one of the most common forms of transmission of traditional Chinese culture, Chinese painting has gradually become one of the main ways for people to learn and promote traditional culture. Chinese painting is a traditional Chinese painting art with a history of thousands of years [1]. It is the wisdom of the Chinese nation and stands in the world of painting with distinctive national characteristics and a unique southeastern flavor. Chinese painting has different themes and connotations in different periods. During the Sui and Tang dynasties, Chinese painting entered full prosperity and influenced Europe and other regions. Chinese painting has a rich variety of subjects and methods of expression that have been widely circulated throughout the country, and each region has formed a unique regional painting art based on the original brush and ink combined with local characteristics, which is loved by the public for its unique artistic charm and rich cultural connotation [2]. In the twenty-first century, when the economy is developing rapidly, China’s influence and cultural soft power are increasing. To rebuild the national cultural pride and cultural confidence in the modern society of economic globalization, the development and inheritance of Chinese traditional culture have been emphasized. As one of the representative traditional cultures, the development of Chinese painting has important significance and value for the development of traditional culture. Chinese painting is a traditional art...
language, representing the oldest and most wonderful cultural connotation of the Chinese nation, and has a profound cultural heritage [3]. Based on the current social environment, Chinese painting has changed over time, breaking through existing constraints, constantly sorting out the trajectory of its evolution, and looking for a direction of development.

Contemporary young people grew up in the first year of the Internet and prefer trendy new culture. Meanwhile, with the change of lifestyle, the space for traditional culture to intervene in life is narrower, and the connection between the public and traditional culture and art is no longer close, traditional Chinese painting art is gradually forgotten by the public, and Chinese painting art begins to gradually decline. In the era of new media, combining traditional culture with new technology can enrich the art form of traditional culture, which is important for creating artworks with local style [4]. At the same time, the addition of traditional culture can provide rich materials and resources to enrich the technical works in terms of content and visual presentation, thus outputting culturally valuable artworks. The arrival of new technology brings life to the traditional art field. Combining elements of Chinese painting with AR technology can extend the visual experience, promote the development of Chinese painting style artworks, and provide new development directions for other works in the traditional art field [5]. It promotes the efficient combination of strategy and cultural industry, exports and promotes excellent Chinese culture to the outside world, and improves national soft power and international influence. In the process of art education reform, the development of information technology has profoundly changed its basic face. The appropriate introduction of information technology in the teaching of Chinese painting is conducive to the cultivation of students’ core art literacy and the enhancement of the fun of the teaching process [6]. Applying intelligent image color technology to the teaching of Chinese painting color can give students intuitive visual impact and reduce the tediousness of traditional teaching methods.

Painting is the act of adding points, lines, and colors to a plane by human beings to produce a certain visual effect. Humans often convey their own cognition or esthetic feelings about the objective world through painting. Because painting can bring visual impact and creativity, it is widely regarded as an esthetic art. Painting in human history can be divided into many types according to the tools and techniques of painting, such as oil painting, watercolor painting, ink painting, mural, and so on. It can also be classified according to the style of painting, such as classicism, abstract art, impressionism, and modernism. Painting has a high degree of abstraction and generality. It is an abstract generalization of real things by painters, and highlights and exaggerates its characteristics. So, every painter has his own style. This has also created a variety of paintings in the history of human painting. Therefore, how to distinguish various painting styles has become a very meaningful study. For images in the computer, it can be divided into real images and nonreal images. Real images express real images. Real-world things, not real images, are computer-generated images with a unique style. We hope to use the computer to extract the style features in the artistic image, let the computer learn this style description, and assign the style to a specific real image to generate a nonreal image with a specific style.

2. Related Works

Multispectral imaging technology emerged in the 1980s, which is short for multichannel spectral imaging technology. This technique combines spectral analysis technology and imaging technology to obtain spectral information and image information of samples, realizing the “unification of map and spectrum”; moreover, multispectral expands the number of spectral imaging bands, covering visible light, infrared light, and other bands, and the spectral reflectance of samples can be accurately recorded in each band so that the spectral information and spatial information of samples can be obtained as well as the physical and chemical properties of samples [7]. In 1969, Delgado et al. used near-infrared spectroscopy to successfully detect the invisible deep information on frescoes, which was the first time to use nonvisible band imaging technology to detect frescoes at home and abroad, and laid the foundation for the application of multispectral imaging technology on cultural relics [8]. In 1999, multispectral technology was used to obtain ancient Mayan murals, and image processing techniques were used to enhance image information and improve the visibility of mural information. 2015, Yang used multispectral technology and spectral matching methods to nondestructively identify the mural pigments of the Dazhao Monastery in Lhasa, Tibet [9].

The use of disciplinary structures advocated by Jerome Bruner was the prototype for the emergence of “big ideas” in education, and in 1964, Izozaki et al. also pointed out the importance of “disciplinary representational concepts” in the design of curriculum. In 1964, the National Core Arts Standards in the United States recognized that big ideas “refer to the ability of people to organize and organize their thinking around ‘big ideas’ as they organize information into conceptual frameworks that create a larger ‘shift’ in their thinking” [10]. It is one of the things that distinguish ‘expert learners’ from ‘beginners’.” The concept of “concept-based curriculum and instruction” introduced in 2018 by American education experts Sumi et al. “emphasizes the need to move beyond knowledge and skills toward learning with conceptual understanding through deeper, transferable understanding [11].” In 2005, Kotera et al. argued that “the understanding and application of the Big Idea reflects the essential requirements of core literacy, provides a detailed analysis of the meaning and origin of the big concept, and discusses the big concept in art, providing a procedural structure for children’s art teachers to refer to about art appreciation teaching [12]. The work of other researchers and the differences between this study and other studies are shown in Table 1.

Foreign research results on big concepts in the field of education and teaching are abundant, especially in the field of science education, and scholars have conducted in-depth
research on them and designed curriculum models around them [13]. For example, the pyramid, system, and linear chain models have been very mature and can be applied to teaching practice, which provides a reference for domestic research on big concepts. However, foreign research on big concept teaching is mainly focused on science and science and technology fields, while humanities are relatively weak and there are gaps [14]. Combined with the current situation of education in the era of core literacy, domestic research on big concept teaching is mainly from the perspectives of teaching implementation dilemmas, curriculum design models, and teaching programs. The research results are in the upper level of theory, mainly focusing on teaching methods, and the implementation of educational contents and activities in concrete practice is still in the initial stage [15]. The research on how to use the subject big concepts to organize specific course contents carries out teaching design, and teaching evaluation is still lacking.

Combined with the current education situation in the era of core literacy, the research on intelligent image color technology teaching in Chinese painting color teaching is mainly from the perspectives of teaching implementation dilemma, curriculum design mode, teaching plan, etc. The educational content and activities of specific practice are still in their infancy. There is still a lack of research on how to use intelligent image color technology to organize specific course content and conduct teaching design and teaching evaluation.

3. Building a Model for Teaching Chinese Painting Color Based on Intelligent Image Color Technology

3.1. Intelligent Image Color Technology Model Design. The ancient pigments in China are divided into 6 kinds in terms of color, namely, red, green, yellow, cyan, white, and black. Each color contains several different pigments with different compositions, corresponding to different reflectance curves, as shown in Figure 1. There are obvious differences in the spectral reflectance curves of each pigment, and the variability of spectral reflectance is precisely the basis for spectral matching, so the Chinese painting pigments can be analyzed using spectral matching technology [16]. The principle of pigment information identification based on multispectral imaging technology is to spectrally match the spectral reflectance of an unknown pigment with that of a sample pigment. This paper analyzes the composition of fresco pigments and the spectral reflectance characteristics of pigments and introduces the spectral matching technique, whose matching rate directly affects the accuracy of recognition and is the core technology in pigment recognition; finally, it studies the commonly used spectral matching algorithms, such as spectral angle matching method, spectral similarity matching method, and spectral information scattering method, and summarizes the advantages and disadvantages of the commonly used spectral matching algorithms in pigment recognition.

Spectral matching is a technique to find the similarity or difference between two curves by comparing the measured spectral reflectance with the data already available in the spectral reflectance database, which can accurately identify the image elements on the image. For example, in pigment identification, the spectral reflectance of an unknown pigment in a multispectral image of a mural is matched with the spectral reflectance of each sample pigment in the database to obtain the spectral reflectance curve that is most like the reflectance of the unknown pigment. The characteristics of this unknown pigment can thus be considered to be consistent with the best matching pigment given in the spectral database; that is, the sample pigment corresponding to the most similar reflectance curve is the identification result of the unknown pigment, and thus, a more accurate identification of the unknown pigment in the image is made. Since imaging spectral data have a large degree of

| Years | Person’s name | Main contribution | The main contribution of this research |
|-------|---------------|-------------------|---------------------------------------|
| 1964  | Isozaki et al. | Pointed out the importance of “disciplinary representational concepts” in the design of curriculum | The feature matrix in the network is generated by feature recombination and matching, and finally the decoder is used to generate the migration image, which realizes the automatic classification of different color areas in Chinese paintings, and finally can make judgments on the most likely pigments for each type of color. |
| 1969  | Delgado       | Used near-infrared spectroscopy to successfully detect the invisible deep information on frescoes | |
| 2017  | Liu           | Argued that “the understanding and application of the big idea reflects the essential requirements of core literacy | |
| 2018  | Sumi et al.   | Proposed the concept of “concept-based curriculum and instruction” | |

Table 1: Summary of the contributions of previous researchers and the main results of this study.

![Figure 1: Spectral reflectance of different colors.](image-url)
redundancy, the data can be encoded before spectral matching between image spectra and database spectra, thus simplifying the data before matching and improving the matching efficiency. The main encoding methods are binary encoding, multithreshold encoding, segmented encoding, etc.

$$T_d = y_{\text{max}} + \sum_{\delta|T} (y_{\text{max}} - y_{\text{min}}),$$

$$r(i, j) = \begin{cases} \text{mean}(i, j) & i, j \geq 1 \\ 1, y(i, j) & 0 \end{cases}.$$  \hspace{1cm} (1)

The mean Huber loss function proposed in this paper is an improvement of the Huber loss function. In the Huber loss, the threshold is fixed, while in the mean Huber loss, the threshold is changed according to the error between the predicted value and the true value of each batch, and it can also be said that the threshold in the mean Huber loss function does not need to be set manually, but is obtained adaptively according to the formula calculation. For the mean Huber loss function, when the error between the true and predicted values is less than the adaptive threshold $\delta_{\text{mb}}$, the loss function is calculated as a linear function of the mean squared error. When the error between the true value and the predicted value is greater than the $\delta_{\text{mb}}$ adaptive threshold, the loss function is calculated as a linear function of the mean absolute error. The total loss function of the SSN network is the sum of the RGB (red-green-blue, RGB) loss function and the significant loss function. The formula for calculating the total loss function of the SSN network is expressed as follows:

$$L_{\text{ssn}} = \lambda_1 L_{\text{sa}} + \lambda_2 (\alpha + L_{\text{rgb}}), |a| \leq \delta,$$

$$\delta_{\text{mb}} = (N + 1) \sum_{i=1}^{N} N(g_i + p_i).$$  \hspace{1cm} (2)

The SSN (structured segment network, SSN) model will have two loss functions after adding the significant graph network. During the training process, these two loss functions use the same loss function, but these two loss functions have different loss weights, and during the experiment, $\lambda_1$ and $\lambda_2$ take different values, which will produce different results. In the AADB dataset, taking 1 and 0.3 for $\lambda_1$ and $\lambda_2$, respectively, can make the model obtain the optimal performance. In the MCUHK dataset, taking 1 and 0.001 for $\lambda_1$ and $\lambda_2$, respectively, can make the model obtain the optimal performance. In practice, the default initial value of $\lambda_1$ and $\lambda_2$ is 1 for different databases, and during the training process, two values of parameters need to be adjusted according to the actual training results: firstly, $\lambda_1$ the value is fixed and the value is adjusted $\lambda_2$; secondly, the value is fixed $\lambda_2$ and the value is adjusted $\lambda_1$ until the optimal training results are achieved. The results of mean square error (MSE), mean absolute error (MAE), and median absolute deviation (MED) in the AADB dataset are shown in Figure 2.

There are two problems before the classification of Chinese paintings: a. in large-format Chinese paintings, the artistic targets painted by the paintings only account for part of the proportion, and there exists a large block of information invalid for classification; b. there are various forms of paintings, such as long scrolls and horizontal drapes, banners, and folding fans, and then, the irregular forms of paintings cause some difficulties in the extraction of digital Chinese painting image features [17]. To solve the above two problems, this paper introduces image block rejection based on image contrast. The images are preprocessed to eliminate invalid image block information and retain valid image block information. The effective information in the frame is chunked for image normalization, which provides standard input for the subsequent network and reduces the number of network operations. For image contrast, it not only shows the clarity of the image but also reflects the amount of information represented in the image. Therefore, the image contrast can be used to reflect the information size of the
image block, and the image block rejection method based on the image contrast is proposed. The contrast of the image block is calculated as following equation:

\[
C_m = \sum_{i,j} \frac{\delta_m(i,j)}{P_{\delta_m}(i,j)}
\] (3)

\[
g(x, y) = k_{mn} + g(x + a, y + b).
\] (4)

The distinctive feature of Chinese painting is that it is based on the movement of the brush, which is unique to different painters. The unique technique of brushwork, that is, the strength of the line, the lightness and weight, and the strength of the brushstroke, is an important feature in identifying the artistic style of a painting. When Qi Baishi painted birds, the brush is full of ink, the force is healthy and sharp, and there is virtual and real, brief, and appropriate; when painting shrimp, it seems to be soft and rigid, like a break, and there is a curve in the straight; the lines painted by painter Zhang Daqian are beautiful and vigorous, with clear arcs and sharp edges and corners [18]. The extraction of brushstroke features in paintings mainly adopts an edge detection algorithm. The commonly used edge detection operators include the Sobel operator, Canny operator, and Laplacian operator. The Sobel operator is inaccurate in locating the edges and cannot accurately detect the edges of the artist’s strokes when the brushwork is light, and the Laplacian operator is sensitive to the noise in the painting. Therefore, this paper adopts the Canny operator to detect the edge characteristics of brush strokes.

3.2. Chinese Painting Color Teaching Model Construction. The eye is an important organ for cognition of the outside world, through which we can perceive changes in color, light, shadow, and the environment, thus completing the input of visual information. Visual “seeing” is a complex process, and the selection and processing of information in this process is a subjective and independent choice, which is influenced by personal cognitive ability, life experience, cultural literacy, etc. The visual perception of external things and the psychological judgment and analysis of perception together shape the result of visual experience [19]. There is no clear academic definition of visual experience, but from the perspective of psychological cognition, visual experience is composed of visual psychology and visual perception. “Seeing” is a practical activity that involves rational decision making. “Seeing” is not a simple presentation or reduction of the visual field, but feedback of the body to stimulate the light patterns deep in the eyes under the combined effect of perception and thought. Gestalt psychology has proposed a variety of principles of the perceptual organization through numerous experiments, explaining how to organize perceptual activities and experiential materials into a meaningful whole. According to Gestalt psychologists, “Any perception of the knowledge environment is the result of the active organization of perceptions in a certain form. Dr. Yu Riji of Wuhan University proposed to use digital modern technology to create digital products of intangible cultural heritage and proposed the theoretical framework of CDIM (Cultural Digitized Implantation Model) (shown in Figure 3) for the preservation and development of intangible cultural heritage digitalization” [20]. The theoretical framework is proposed to confirm the feasibility and necessity of digital development of ICH (Input/Output Controller Hub, ICH) and augmented reality, to guide the direction of digital product development of ICH and augmented reality by constructing a theoretical model, and to provide a way for the modern development of ICH material cultural heritage.

Chinese painting and augmented reality technology with 3D animation, video, audio, and other digital technology means an organic combination so that augmented reality Chinese painting works that have the traditional digital media art characteristics while being given the characteristics of augmented reality interactive technology. Augmented reality animation is widely used in the creation of augmented reality, augmented reality technology is detached from spatial reality, and the spatial performance supports the presentation of two-dimensional animation, while meeting the design and development of three-dimensional scenes, and can carry out a series of interactions with the audience. Two-dimensional space can exist simultaneously with three-dimensional space, when the object is given a longitudinal perspective, it can realize the three-dimensional transformation of two-dimensional objects [21]. The Chinese painting style augmented reality art creation uses augmented reality technology to realize the virtual superimposition of 2D and 3D animation and the real world, and the design analysis focuses on the characteristics and interaction of 2D and 3D space animation.

The two parameters that control the degree of image smoothing are the smoothing degree coefficient \(\gamma\) and the spatial scale parameter \(\delta\). The filtering results of the algorithm after different iterations are found to reach convergence in 4 iterations. For some small-sized image stains, the smoothing effect is more significant when \(\delta\) increasing to 2~3, and the noise is eliminated. However \(\delta = 3\), the details of the pattern are lost to some extent, so the spatial scale parameter \(\delta\) is chosen to be 2. The white part of the knife in the shadow image is smoothed out with \(\gamma\) the increase of the value, but \(\gamma\) the smear part of the image will be preserved if the value of the smoothing degree is too small, so the smoothing degree coefficient \(\gamma\) is chosen to be 0.01~0.02 when processing the shadow image. The accuracy of the superpixel segmentation has a great impact on the subsequent GrabCut segmentation, which determines the final target segmentation to a certain extent. Therefore, to objectively analyze the influence of the number of superpixel segmentation on the image segmentation accuracy and time, and to obtain the optimal number of superpixels, this paper designs the evaluation index—boundary tightness for superpixel segmentation accuracy evaluation, and the segmentation results with the different number of super pixels are shown in Figure 4.
The appreciation of art is primarily based on visual senses, while other senses, such as hearing and smell, can be used as secondary means to enhance students’ visual perceptions. Learners use simple words to express their feelings courageously, which is a major component of the appreciation activity. This activity is also a process in which learners use their own words to express their feelings and perceptions, and through which they can get closer to the artwork again, and further deepen their understanding of it [22]. In teaching, we should pay attention to the “fun of perception.” Furthermore, the importance of the teaching process and teaching methods is one of the most important aspects of the reform of the Art Curriculum Standards. Therefore, knowing the art-related standards of each learning area of each school period and the learning characteristics of learners will give them more initiative in the selection of teaching process and teaching methods, which will be more conducive to mobilizing students’ interest in learning Chinese painting and developing their learning ability.

The learning objectives of the “Modeling and Expression” area in the first period focus on the development of students’ perception and emotion, and learning experience. For example, “several pieces of works that can show their level” has a certain amount, but it is not clear how much, if there is and can reflect their own if they are available and reflect your level of ability, it is fine. The learning objectives of the second level of “modeling and expression” have transitioned from the learning objectives of grades 1~2, which focus on learning experiences, to the learning of art subject knowledge and skills, whether they have a strong interest in modeling activities, and whether they can use more than three methods [23]. These evaluation recommendations provide important indicators for testing the achievement of the standards. The minimum requirements for the technical skills of art include recognizing a variety of modeling elements, experiencing the effects of different media, expressing characteristics and feelings about things through a variety of methods, and creating three-dimensional works with intention. The third level of the Art Curriculum Standards has more requirements for the first area of study “Modeling and Expression,” which gradually
requires students to actively participate from interest to a strong interest in learning, to the conscious use of principles and forms of modeling activities; to learn how to compose, how to arrange the picture, and how to notice the relationship of space; and to use language or words to evaluate themselves and their classmates. By analyzing the objectives of the third period, it can be analyzed that the third period of modeling expression still focuses on the expression of emotions and strengthens the learning of knowledge and skills of art disciplines to meet the esthetic needs of students who are increasingly enriched in their learning.

4. Analysis of Results

4.1. Intelligent Image Color Technology Model Results.

Since different kinds of pigments have their unique spectral reflectance, this paper constructs a pigment sample library for this system using 15 kinds of pigments collected in the early stage and designs a pigment analysis system for ancient wall paintings based on multispectral imaging technology on this basis [24]. The system consists of three major functional modules: color classification, pigment analysis, and output storage; these three functional modules realize six specific functions: color space conversion and color segmentation in the color classification module; reflectance data preprocessing and spectral matching in the pigment analysis module; and query retrieval and output display in the output storage module. The system can interactively divide the color image of a mural into different areas according to the different colors in the mural picture and complete the color classification work. The system will then classify the multispectral images of the mural according to this classification result. The classified multispectral images are then reconstructed into reflectance curves. The reconstructed reflectance curve is then fed into the spectral matching module for spectral matching and identification of specific pigments. After the identification is completed, the system will return the pigment with the closest spectral reflectance curve to the color and the matching rate and will archive the results of color classification and pigment analysis for easy viewing later.

Since convolutional neural network models have solved various problems in computer vision and achieved good results, it has become common for many researchers to use convolutional neural networks to extract image features. Many of the ideas for the design of the convolutional neural network model originated from AlexNet, which first obtained state-of-the-art results in the ImageNet competition [25]. Therefore, in the experiments in this chapter, priority was also given to the AlexNet network. The AlexNet network was considered first. In addition to the AlexNet network, the GoogleNet, ResNet50, and SENet networks are also networks that perform well on the target detection task, so these networks were also included in the experiments. To validate the performance of these networks in predicting image esthetic scores, these four CNN models were fine-tuned on the datasets AADB and AVA. Fine-tuning means that no significant modifications were made to the network structure of these models, and only, the output of the last fully connected layer was modified by changing the dimension of its output to 1. The performance of the different benchmark networks on the AADB dataset, using this output as the automatically predicted esthetic scores, is shown in Figure 5.

SEResNet-50 achieves an average binary classification accuracy of 75.1% and an average binary classification accuracy of 80.155% on the AADB dataset. The average binary classification accuracy of SEResNet-50 is 3.494% better than that of ResNet-50, 3.47% better than that of GoogleNet, and 13.99% better than that of AlexNet by 13.99% on average. Therefore, SEResNet-50 was selected as the benchmark network for extracting depth features in the subsequent experiments [26].

The core of AR (augmented reality, AR) interaction is the control of virtual superimposed objects, and the way virtual objects are superimposed is through the computer phone screen, to achieve control of virtual objects superimposed on the screen, which can be translated into the way to achieve by touching the screen, the core of touch is to touch the action and touch the location, through the touch of this action to trigger the play command. The common virtual overlay display in AR includes animation, video, and audio playback in which animation is displayed in the form of a 3D model overlay, and the interaction can move the 3D display model backward and forward, left, and right. The designed interaction logic is shown in Figure 6. The image will be grayed out and filtered to remove noise points to achieve the target information feature extraction, further screening the extracted information special town points, screening out excellent feature points, matching to the corresponding feature points, capturing the location and direction of the recorded image in real-time, and finally achieving to make 3D objects stored in the data platform and real scene stack.

Among virtual reality paintings, immersive creation is the most direct form of creation. The immersive painting emphasizes the visual experience of the picture, weakens the narrative of the story, and highlights the immersive quality of virtual reality [27]. The picture of virtual reality painting is a 360-degree free view, each object in the picture can be changed in real-time according to the switching of viewpoints, and the viewer can enjoy the picture in a way like a "tour," freely controlling the presentation of the picture. This kind of panoramic composition gives viewers a certain sense of experience and novelty, but some problems will inevitably arise. In the panoramic picture environment, the amount of information in the picture is very large, so in the process of composition, it is necessary to have a focus, pay attention to the content of the trade-offs, and divide the main and secondary relations and rhythm changes of each part.

Vuforia image recognition mechanism is accomplished by detecting, extracting, screening, and matching natural feature points, saving the feature points detected by the image in Target Manager in the database, and then placing the feature points in the detected real image in the database, and the feature points in the database will be matched with the feature point data of the model graphics when the AR recognition function is turned on [28]. The feature points in the database will be matched with the feature point data of the model graphics when the AR
recognition function is turned on, to complete the image recognition, and the recognition process is shown in the figure. The environmental factors when scanning the object will also have some influence on the recognition speed. The image target should be in a moderately bright environment with diffuse light irradiation, and the surface of the image should be evenly irradiated so that the information of the image will be more effectively cell phone
4.2. Experimental Results of Chinese Painting Color Teaching Model. Deep CNN networks are needed to extract the depth features of images. First, two more popular CNN networks are selected to extract the depth features of images and the experimental results are compared, and the optimal benchmark network is selected based on the results. Second, many experiments are applied to verify the effectiveness of the proposed learning rate reduction strategy. Finally, depth features of different dimensions are fed into the reinforcement learning network and the best performing features are selected as the result of depth feature extraction in the cropping algorithm [29]. Since CDRL-IC proposes to use the VGG16 model to extract depth features before feeding them into the reinforcement learning model, the algorithm crops the image with the best performance. However, given that EfficientNet performs optimally in the target classification task, this section compares VGG16 and EfficientNet-BO to fine-tune the structure of these two networks.

The model proposed in this paper needs to realize its own reconstruction as well as CycleGAN. The first column is an input image, a natural landscape photo and a Chinese painting, the second column is a photograph with a Chinese painting style and a Chinese painting image with a realistic style generated by the transfer, and the third column is the reconstruction of the migrated image [30]. Post-reconstruction images. In the image generated by the migration, the generated Chinese painting retains the content of the original landscape photograph and, at the same time, changes the style of the photograph to the style of Chinese painting; the ordinary photograph generated by the Chinese painting also modifies the picture to a more realistic landscape picture accordingly; And the image can also be reconstructed well by two generators that are opposite to each other, so the result shows that our model can indeed transfer the style of the image, which proves the feasibility of the method.

As a comparative experiment, CycleGAN uses the default training parameters and configuration of the original method, and trains 200 epochs. To verify the feasibility of the method, the image data collected above are loaded into the original CycleGAN model and the model designed in this chapter, respectively. After a series of algorithms, a synthetic image is finally obtained. The first column is the input image, and the second column is the input image. The result of CycleGAN, the third column, is the result of the improved method in this paper. Through comparison, it is found that the migration images generated by the method in this paper are more line with the characteristics of Chinese paintings than the results of the original CycleGAN. The result generated by the original CycleGAN seems to only reduce the contrast of the original image, and the image style still looks like a natural landscape photograph closer to the input image. The images generated by the method in this paper are closer to the style of traditional Chinese painting. Due to the use of the average relativistic discriminator, the migration map generated by the method in this paper is closer to the average of all style maps. For example, some composite images will have text on them.

To verify the validity of the proposed three-part composition features, these features are sent to the intelligent body. The three-part composition features of the image are extracted according to the composition method, and these features are fed into the smart body [31]. In this section, the cropping performance of three different three-part composition feature dimensions is verified, and the three dimensions are $1 \times 1 \times 1280$, $1 \times 1 \times 2048$, and $1 \times 1 \times 4096$, respectively. Different dimensions of three-part composition features being fed into the reinforcement learning. Among them, "No" indicates that no three-part composition features are added, and only $1 \times 1 \times 1280$ depth features are used. "1 $1 \times 1 \times 1280$," "1 $1 \times 1 \times 2048$," and "1 $1 \times 1 \times 4096"$ represent the three-dimensional trichotomous features of the input, respectively. According to the experimental results, it can be found that the best cropping performance of the two datasets is $1 \times 1 \times 4096$ for the three-composition feature dimension in the four indicators, so we conclude that the image cropping algorithm performs best when the three-composition feature dimension is $1 \times 1 \times 4096$, and the image sharpness is an important indicator in the image evaluation task, and it is also a key factor in the evaluation of the image esthetic quality. To verify the correlation between image sharpness and esthetic quality, a statistical analysis of image sharpness quality and esthetic quality in the AADB dataset was conducted in this paper, and the results are shown in Figure 7.

There are various methods of expression in Chinese painting. No matter what method of expression is used, color is a basic element in Chinese painting. Ink painting, as an expressive method of traditional Chinese painting, has only black and white as its colors. In modern ink painting, the use of color has gradually diversified and the expression of color has gradually become more distinct. The color
characteristics of Chinese painting are an indispensable factor in both painting appreciation and painting recognition. Color features are not affected by image size and orientation and have strong robustness [23]. Therefore, due to the qualities of color features and their frequent use in paintings, color features are used as a basis for classification in this paper. Usually, color features are extracted using three main algorithms: color histogram, color set, and color moment. The color histogram lacks the spatial information of color; that is, it cannot describe the artistic target in the painting. The color set is only applicable to large-scale datasets. Color moments take advantage of the property that color information is mainly concentrated in the lower order moments and express the color distribution information in the painting by calculating the color first-order moments, second-order moments, and third-order moments of the image. This method not only expresses the color distribution information in the painting well but also has less computation. Therefore, this paper uses color moments to calculate the color characteristics of digital Chinese painting images. In the case where the vertices of the graph fail independently of each other with a constant probability, the reliability of the graph is defined as the probability that the graph obtained by deleting the failed vertices and the edges associated with them is connected. For a class of graphs with the best connectivity—Harari graphs, the bounds of reliability are obtained, and the asymptotic properties of reliability are analyzed.

High-quality images are trained to align images of different visions by a network model. A2-RL was the first to combine reinforcement learning with image visual crop splitting, and A3RL is an improved version of A2-RL that improves the crop speed of A2-RL. GAIC is a grid-anchored frame-based image crop algorithm that effectively reduces the number of crop candidate frames from the millions level to less than 100. CDRL-IC is an improved version of the I model, which mainly improves the computational efficiency, cropping speed, and performance of the model. ASM-Net is an image cropping model with image composition and significant perception of esthetic score maps. Lu2020 is a deep convolutional neural network model that automatically learns the relationship between image objects of interest and esthetic regions. SAIC-Net is an image significant perception SAIC-Net is an image cropping model for image saliency perception. The confidence analysis of their results on CUHK-ICD and FCD test datasets is shown in Figure 8.

The generative rules can be divided into two types: one is the addition and deletion rule, which is to add or delete (some/all) shapes to the existing shape set, and the other is the replacement rule, which is to replace the existing shape elements with new ones in the existing shape set. \( r_7 \sim r_{10} \) are the modifying rules, which directly transform the initial shape elements to make the initial shape elements change. After the initial shape elements are determined by the generative rules as the basic units of the pattern and inherit the original pattern style, the initial shape elements are transformed and adjusted within the appropriate range using the modifying rules so that they can achieve a differentiated and innovative design while retaining the outline factor of the existing shadow pattern. Taking the artistic style migration of images as the starting point, we first introduce a method of image style migration based on generative adversarial networks. Then, a technique called relativistic discriminator is introduced. This chapter analyzes the algorithmic process of CycleGAN from the mechanism of image style migration and improves it by changing the input of the generator to input texture features, a more obvious feature in traditional Chinese painting, into the generator as a priori knowledge, and then, based on the relativistic discriminator, it modifies the discriminator loss function and the adversarial loss function, collects the experimental data for qualitative experiments and shows the results, and finally proves the feasibility and effectiveness of the
improved method proposed in this chapter by analyzing the experimental results.

5. Conclusion

In this paper, traditional Chinese painting is integrated with the real world through the transformation of 3D models and video overlays so that the traditional one-dimensional visual experience is transformed to visual, auditory, and tactile dimensions. By applying intelligent image color technology to the teaching of Chinese painting color, traditional instruction is qualitatively transformed. Artworks with emotional interaction can establish an emotional connection with students, and this emotional involvement and interaction can evoke emotional cognition. We extend the interaction experience between people and artworks, form a design model applicable to the combination of traditional culture and new technology, and comprehensively analyze the uniqueness of augmented reality technology in the creation and design of Chinese painting from the communicator channel and emotional design, creatively integrate emotional design into the creation of new artworks through the communicator channel, and summarize the uniqueness of traditional culture in the use of new technology in the expression, and the unique expression and emotional interaction connotation of the use of new technology in traditional culture are summarized. Due to technical limitations and the author’s lack of comprehensive knowledge, there are still many areas where the application of intelligent image color technology in Chinese painting color teaching is not mature enough. The improvement effect of the style transfer method based on feature reorganization is not obvious enough, which makes us think about the objects that need to be transferred. Through many experiments, it is found that the original method is obvious for the subject, and the image transfer effect with regular texture is better, while for traditional Chinese painting, this shows that the existing style transfer algorithm cannot transfer from any image to any image, which is also a direction worthy of efforts in the future.

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 known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
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References

[1] R. E. Harrist, “Chinese painting and its audiences by Craig clunas,” Harvard Journal of Asiatic Studies, vol. 79, no. 1-2, pp. 298–306, 2019.
[2] Z. H. U. Haishan and L. A. N. Shufeng, “Classroom teaching evaluation of Chinese painting as a form of fine arts in rural junior high schools,” Asian Agricultural Research, vol. 12, no. 1812-2021-687, pp. 69–72, 2020.
[3] D. A. Rovere, “Reducing plagiarism and improving writing: a lesson from Chinese painting,” Canadian Perspectives on Academic Integrity, vol. 3, no. 2, pp. 57–62, 2020.
[4] M. K. Ahsuwalia, S. I. Ayala, A. F. Locke, and T. Nadrich, “Mitigating the “powder keg”: the experiences of faculty of color teaching multicultural competence,” Teaching of Psychology, vol. 46, no. 3, pp. 187–196, 2019.
[5] D. J. Carter Andrews, E. Castro, C. L. Cho, E. Petchauer, G. Richmond, and R. Floden, “Changing the narrative on diversifying the teaching workforce: a look at historical and contemporary factors that inform recruitment and retention of teachers of color,” Journal of Teacher Education, vol. 70, no. 1, pp. 6–12, 2019.
[6] R. Burciaga and R. Kohli, “Disrupting whitestream measures of quality teaching: the community cultural wealth of teachers of color,” Multicultural Perspectives, vol. 20, no. 1, pp. 5–12, 2018.
[7] W. C. Fong, “Why Chinese painting is history,” Art Bulletin, vol. 85, no. 2, pp. 258–280, 2003.
[8] L. Delgado, K. Baese, and A. Hauptman, “A pathway to teaching for paraprofessionals of color,” Phi Delta Kappan, vol. 103, no. 3, pp. 17–21, 2021.
[9] G. Yang, “Temporal spirit, expressiveness and nationality of contemporary Chinese painting,” Linguistics and Culture Review, vol. 5, no. S2, pp. 472–486, 2021.
[10] A. Isoftaki, H. Mikami, K. Hiramatsu et al., “A practical guide to intelligent image-activated cell sorting,” Nature Protocols, vol. 14, no. 8, pp. 2370–2415, 2019.
[11] H. I. Sumi, H. Takehara, D. Shirahige et al., “Next-generation fundus camera with full color image acquisition with advanced NIR multi-spectral imaging system–high speed vision system and its impact on various intelligent applications,” ITE Technical Report, vol. 42, no. 30, pp. 13–16, 2018.
[12] P. Baranitharan, S. Kumanan, and S. Sudhagar, “An intelligent novel approach for diesel engine life monitoring using infrared image processing technique,” Environmental Progress & Sustainable Energy, vol. 41, no. 1, Article ID e13712, 2022.
[13] Q. Zou, “The role of sketching in figure creation of modern Chinese painting,” Journal of Frontiers in Art Research, vol. 1, no. 5, pp. 105–108, 2021.
[14] K. D. Brown, “Teaching in color: a critical race theory in education analysis of the literature on preservice teachers of color and teacher education in the US,” Race, Ethnicity and Education, vol. 17, no. 3, pp. 326–345, 2014.
[15] B. Zafar, R. Ashraf, N. Ali et al., “Intelligent image classification-based on spatial weighted histograms of concentric circles,” Computer Science and Information Systems, vol. 15, no. 3, pp. 615–633, 2018.
[16] E. Fanni and A. Khodayari, “Designing a new intelligent image processing algorithm for traffic sign detection and recognition based on fuzzy logic,” Amirkabir Journal of Mechanical Engineering, vol. 50, no. 1, pp. 207–218, 2018.
[17] A. A. Nawaz, M. Urbanska, M. Herbig et al., “Intelligent image-based deformation-assisted cell sorting with molecular specificity,” Nature Methods, vol. 17, no. 6, pp. 595–599, 2020.
[18] T. Huynh-The, C.-H. Hua, and D.-S. Kim, “Encoding pose features to images with data augmentation for 3-D action recognition,” IEEE Transactions on Industrial Informatics, vol. 16, no. 5, pp. 3100–3111, 2020.
[19] H. Tian, T. Wang, Y. Liu, X. Qiao, and Y. Li, “Computer vision technology in agricultural automation - A review,” Information Processing in Agriculture, vol. 7, no. 1, pp. 1–19, 2020.
[20] X. Zhang and M. Yang, “Color image knowledge model construction based on ontology,” Color Research & Application, vol. 44, no. 4, pp. 651–662, 2019.
[21] M. P. P. Kumar, B. Poornima, H. S. Nagendraswamy, and C. Manjunath, “A comprehensive survey on non-photorealistic rendering and benchmark developments for image abstraction and stylization,” Iran Journal of Computer Science, vol. 2, no. 3, pp. 131–165, 2019.
[22] B. Yong, X. Jiang, and J. Lin, “Online practical deep learning education,” Educational Technology & Society, vol. 25, no. 1, pp. 193–204, 2022.
[23] J. Qian, “Research on artificial intelligence technology of virtual reality teaching method in digital media art creation,” Journal of Internet Technology, vol. 23, no. 1, pp. 125–132, 2022.
[24] M. B. Siuty and A. Atwood, “Intersectional disruptor: a special educator of color living and teaching in the intersections,” Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, vol. 45, no. 1, pp. 61–76, 2022.
[25] T. Teacher of Color Collective and M. Souto-Manning, “On the mis-education of teachers of color: a letter to teacher educators,” Journal of Teacher Education, vol. 73, no. 1, pp. 66–80, 2022.
[26] S. S. Kulkarni, S. Bland, and J. M. Gaeta, “From support to verification of the teaching workforce: a look at historical and contemporary factors that inform recruitment and retention of teachers of color,” Journal of Teacher Education, vol. 73, no. 1, pp. 66–80, 2022.
[27] S. Rivera, “Navigating race in science teacher education: the counterstory of a woman faculty of color,” Journal of Science Teacher Education, vol. 33, no. 2, pp. 192–205, 2022.
[28] J. Zhang, W. Xie, H. Liu, W. Dang, A. Yu, and D. Liu, “Compressed dual-channel neural network with application to image-based smoke detection,” IET Image Processing, vol. 16, no. 4, pp. 1036–1043, 2022.
[29] N. A. Azlim, A. Mohammadi Nafchi, N. Oladzadabbasabadi et al., “Fabrication and characterization of a pH-sensitive intelligent film incorporating dragon fruit skin extract,” Food Sciences and Nutrition, vol. 10, no. 2, pp. 597–608, 2022.
[30] T. Jiang, X. Gan, Z. Liang, and G. Luo, “AIDM: artificial intelligence for digital museum autonomous system with mixed reality and software-driven data collection and analysis,” Automated Software Engineering, vol. 29, no. 1, pp. 1–22, 2022.
[31] F. F. Liu, S. C. Chu, X. Wang, and J. S. Pan, “A collaborative dragonfly algorithm with novel communication strategy and application for multi-thresholding color image segmentation,” Journal of Internet Technology, vol. 23, no. 1, pp. 45–62, 2022.