Art Image Color Sequence Data Processing Method Based on Artificial Intelligence Technology

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***Abstract*—With the traditional quality enhancement methods cannot control the best field density range resulting in too large threshold value of colour difference in art works. Therefore, a research on art works quality enhancement based on image processing technology is proposed. The CIE L* a* b* color space model is established to divide the color magnitude and then transform the color space by RGB space conversion model. On this basis, the quality of art works is enhanced according to the process of the quality enhancement of art works. As considering that the actual density is not within the control range, the image processing technology is used to separate targets to solve this problem. In the experiment, Adobe Illustrator CS6 software was used to make the experimental color target and six test samples were selected to test whether the distribution results of the two methods in different degree of color difference perception met the quality enhancement requirements. The experimental results show that the quality enhancement effect of the proposed method is better and more in line with the design requirements.**

Keywords*—Artworks; quality enhancement; image processing technology; color space model; target separation; experimental color target

I. Introduction

Graphic artworks mainly come from original works and reproductions. The materials of the original works are various. The most common ones are canvas, paper, wood board, stele, and murals [1]. The mid-term steles and murals are immovable, so the digitalization method is special. Scan with a camera or contactless. Photography or non-contact scanning are inseparable from the intervention of optical lenses, so certain physical deformation is inevitable [2]. Of course, modern optical lenses have developed to a high level of technology, so generally, only professional lens components can be used to avoid obvious deformation problems. Modern printing has completely adopted the digital technology process to handle each production link, and the rough division is input and output. The first is the digital input link. The reason for the different colors of the same set of prints is that different digital materials are used. Although the same technology and materials are used in printing, the image files used are not produced by a unified image digital standard [3]. So it is difficult to adjust to the same color effect in post-processing. For art professionals, the expressiveness of the color of the work is sometimes even more important than the accuracy of the graphics [4]. The sharpest criticism, I have heard in the digitization of art works is the overall tone of many digitized images and the original work. They are all reversed. For example, the overall tone of the original work is warmer, and the result obtained after scanning is cooler. Moreover, such pictures are obtained by professionals after repeatedly adjusting the color curve of the scanner [5]. The problem of color deviation between the digitized art image and the original is a problem that exists widely in the book digitization project but has not been significantly improved [6].

Today, with the rapid development of computer graphics and image processing technology, image processing technology is used for image beautification processing and applied to the field of art to improve the imaging quality and visual sense of the image [7]. The beautification processing of art images mainly includes image noise reduction, image information fusion, image enhancement and image white balance deviation compensation, etc. In the process of landscape image acquisition, due to the influence of the light intensity and the physical characteristics of the acquisition device itself, the original images usually collected need to be processed in post-processing [8]. Image beautification technology is the key to post-art image processing. Image understanding is a science that automatically extracts information through computer programs [9]. It is the process of recognizing image content and interpreting and expressing it in natural language. Specifically, image description can be understood as a special translation process from image to text, in which multi-party knowledge in the fields of CV, NLP and machine learning is used [10]. For humans, the process of "seeing pictures and talking" from images to texts is a very basic ability, but for machines, it is to build associations between completely different modeling systems. The process of automatic image understanding firstly obtains the cognition of the image content through the model, and secondly, the binary cognition needs to be converted into the form of natural language for output [11].

The traditional method of enhancing the quality of works of art is achieved by calculating the dot gain value of works of art. Although the color reproducibility can be enhanced, the optimal solid density cannot be determined, resulting in ghosting and deformation of works of art [12]. Ghosting and deformation are caused by failing to control the difference in density within a certain range. In order to solve this problem, this paper proposes a method for enhancing the quality of artworks based on image processing technology [13]. In the study of domestic and foreign cases, it is found that the use of color defect detection, noise processing, color division and other methods can effectively enhance the quality of various art works. In order to overcome the instability of the subjective visual inspection method used in the detection, some foreign scholars, based on the image processing technology, combined with the concept of machine vision, carried out real-time detection with the help of detectors, and realized the online control of the quality of art works [14]. On this basis, adjust the acquired information, and

use multiple color line scan cameras to capture the surface information of the artwork, compare it with the standard artwork, and analyze and detect defects point by point. However, this method still lacks certain practicality. In this design, this method is used as a reference to complete the design. In terms of expression, the model has further requirements for readability [15]. The generated text description should not only reflect the information of the image, but also take into account the fluency of the language [16]. After years of development, current image understanding technologies can usually be classified into three methods: template-based methods, retrieval-based methods, and end-to-end automatic understanding methods based on deep learning [17].

The quality enhancement method of artworks based on image processing technology is a collection of various techniques that can improve the visual effect of artworks. First establish the CIE L^* a^* b^* color space model, divide the color magnitude, and then apply a simple algorithm to give a three-dimensional color histogram [18]. After feature extraction, detect color defects, classify images, and enhance the quality of artwork. In the research process, it is found that the application of defect identification algorithm will affect the effect of enhancing the quality of artworks [19]. For this reason, dynamic thresholds are used to set pixel points to achieve inspection-free and shorten the inspection time [20]. In order to ensure the feasibility of the established method, the method of numerical comparison is used in the experiment to verify whether the quality enhancement method of art works based on image processing technology meets the needs of use.

Section I of the study elaborated on the background description of various technologies that can enhance the visual effects of artworks. Section II analyzed the construction of machine learning in the context of artificial intelligence by various scholars. Compared to re-creating works of a specific style through extensive training, correctly establishing the artistic understanding ability of machines is more in line with the long-term needs of artificial intelligence cognitive intelligence. Section III describes the artistic image processing scheme. Section IV conducted simulation experiments, analyzed experimental parameter settings, established an RGB space conversion model, and then used raw data to model color targets according to experimental requirements. Section V summarizes the entire text. The enhancement effects of the two methods were compared numerically. The experimental results indicate that the method meets the design requirements.

II. Related Work

The research on the processing method of artistic image color sequence data based on artificial intelligence technology is highly relevant for improving the digital efficiency of artistic creation, accurately controlling color transition and expression, and promoting the deep integration of the art field and technological innovation. This study aims to analyze and optimize the color sequence of artistic images through intelligent algorithms, providing powerful color processing tools for artists and designers, and promoting the personalized and diversified development of artistic creation. Assisting the artistic process with artificial intelligence technology is an emerging topic in recent years, but it has a vitality that cannot be ignored. The study in [21] organizes the computational aesthetics task of combining art and artificial intelligence from the perspective of human cognition. The particularity of art makes researchers pay special attention to what kind of performance machines can have in this field, how to make machines have the same understanding and aesthetic power as humans, and whether existing technologies can endow machines with intelligence in this area. In the understanding of artificial intelligence art, there are two schools of thought. One school believes that artificial intelligence replaces only repetitive labor and techniques, and cannot replace human free will to create. The other faction recognizes the autonomous creativity of artificial intelligence and believes that artificial intelligence has the potential to replace human designers to achieve independent creation. Repetitive work is just replaced with a higher priority; and the process of being replaced takes longer for links that require more creativity. The researchers conducted a variety of research explorations against these two viewpoints.

The advantages of deep learning in tasks such as feature selection and image matching provide new options for image restoration. Currently, it has great auxiliary significance for tasks such as restoration of historical relics and video special effects rendering. Bertalmio et al. used the idea of partial differentiation [22] to complete and repair the image, and use the information outside the entire area to repair the contour inward. Pathak et al. Combining the codec architecture and generative adversarial network technology [23], the image information is complemented by the judgment of the prediction map, and the image can also be filled in the case of large-area information defects, and the completed image can be semantically. It matches the original image. Iizuka et al. added the judgment of local information on the basis of the former, and the output repair map takes into account global and local information, which is semantically consistent with the overall semantics, and also strengthens the performance of details locally [24]. Image restoration guided by artificial intelligence technology is especially suitable for the restoration of stained and damaged paintings.

When expanding the research boundaries of artificial intelligence (AI) systems' emotional response capabilities, it innovatively shifts the focus to AI's ability to understand and respond to emotional tones in artistic image color sequence data [25]. The research aims to explore in depth how the emotional tendencies contained in color sequences in artistic images affect the judgment and decision-making process of AI systems, particularly through an AI based method for processing color sequence data in artistic images. In order to construct this research scenario, some scholars carefully selected a series of art promotional images of vacation rentals as experimental materials [26]. These images not only showcase different vacation environments, but also convey diverse emotional atmospheres through changes in color sequences. Using advanced image analysis techniques, extract color sequence data from images and design algorithms to identify and analyze the emotional tones (such as positive, negative, or neutral) contained in these color sequences. There are still many controversies about the intelligence and originality of works obtained by intelligent machines through style imitation.

Compared with re-creating works of a specific style through a lot of training, the correct establishment of the machine's artistic understanding ability is more in line with the long-term needs of artificial intelligence cognitive intelligence. Although Gatys et al.'s art transfer model and subsequent Prisma applications have achieved significant results in art style imitation, there is still controversy over the intelligence and originality of intelligent machines obtaining works through style imitation. This reflects the limitations of artificial intelligence in the field of artistic creation - that is, current technology is more focused on imitation rather than creation. Considering that errors are prone to occur in color difference space conversion, the RGB space conversion model is used to improve the conversion accuracy. On this basis, according to the process of improving the quality of artistic works, enhance the quality of artistic works. Finally, the enhancement effects of the two methods were compared numerically.

III. Art Picture Processing Scheme

A. Color Scale Division

In order to avoid the difference in color evaluation, the color difference evaluation standard is divided into the demand level, as shown in Table I.

TABLE I. Color Difference Evaluation Standard

Color Difference Value	Color Difference Evaluation	Visual Perception Cognition
0-1.5	Slight chromatic aberration	Very little difference
1.5-2.5	Small color difference	Slight difference
2.5-3.5	Small color difference	The difference is obvious
3.5-4.5	Large color difference	The difference is very obvious
4.5 以上	Large color difference	Strong difference

Select a device-dependent color space according to Table I. In information collection, images in RGB color mode should be used to enhance the connectivity of components. The value in the RGB color space is 0~256, which is divided into 257 levels. When the value of R, G, B is 0, the color space will appear black. If the value of R, G, B is 255, R, G, B will appear cyan in turn. If the values of R, G, and B is 255, 0, and 255 in sequence, the color space presents magenta. In terms of grayscale information, the values of R, G, and B are the same, the color components will increase, and the image will gradually change from black to white. The color range of the RGB color space is small, and color defects will appear when the magnitude is divided. For this reason, the CIE L^* a^* b^* color space model is established, and the expression is:

$$\begin{cases} L^* = 106\left(Y / Y_n\right)^{1/3} \\ a^* = 500\left[f\left(X / X_n\right) - f\left(Y / Y_n\right)\right] \\ b^* = 200\left[f\left(X / X_n\right) - f\left(Z / Z_n\right)\right] \end{cases} \quad (1)$$

Where L^* represents the brightness of the artwork, a^* represents the red-green axis, b^* represents the yellow-blue axis. It can be seen from Formula (1) that in the RGB color space, L^* represents the brightness of the luminance axis, and when the color space is 0, it appears black. When the color space is 50, it is white. When the color space is between 0 and 50, it is gray. X, Y, Z represent the tristimulus values under the color of the light source. Color defects can be detected by applying Formula (1), and color levels can be accurately divided.

B. Color Space Conversion

After dividing the color level, in order to realize the nonlinear conversion of the color space, it is necessary to use image processing technology to measure the source color patch data of the RGB space model. The specific conversion steps are as follows:

1) Use image processing technology to build two spatial transformation models, and select standard sample colors. The RGB space conversion model is shown in Fig. 1.

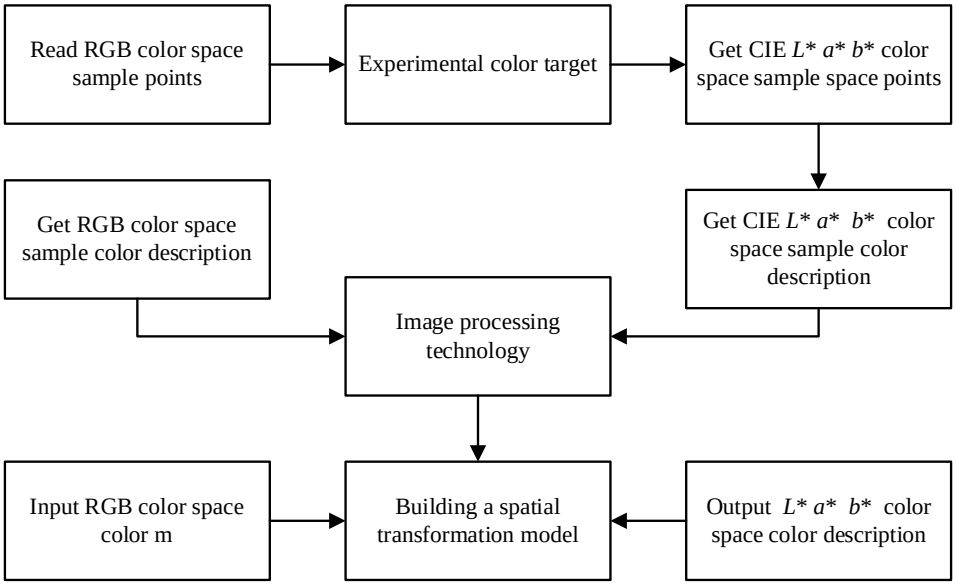

Fig. 1. RGB space conversion model.

Applying the RGB space conversion model, the L*, a*, b* expressions are:

$$a^* = \sum a_1 R^i G^j B^k \quad (2)$$

$$b^* = \sum a_2 R^i G^j B^k \quad (3)$$

Where *i*, *j*, *k* represents the order of R, G, B, respectively. And a_0, a_1, a_2 represent the color description data of R, G, B, and its value is not determined according to the color that needs to be adjusted.

Apply Formula (2) to Formula (4) to complete the conversion of color space. Without the choice of sample point requirements when solving for polynomial coefficients, it is impossible to ensure the accuracy of color conversion for all regions. In order to reduce the occurrence of such phenomena, a polynomial method is used to select an original point and add it to the RGB space conversion model to enhance the accuracy of the model transformation. The specific formula is:

$$W_{RCB} = a_0 + a_1 R + a_2 G + a_3 B \quad (4)$$

Where W_{RGB} represents the balanced color after model transformation; a3 represents the color description data of *R*, *G*, *B*, the same as a0~a2.

2) According to the determined model, calculate the optimal parameters.

3) After completing the conversion of the chromaticity information of the original color space, the data of each cube vertex is measured by using a three-dimensional look-up table, and a cube is formed to ensure that the overall color space has high precision. Then divide the RGB space into N^3 cubes, and measure the *L**, *a**, *b** values of the vertices of each cube. Calculate the surrounding vertices according to the RGB space conversion table, and use the vertices on the three-dimensional geometric solid to calculate the converted color data.

4) Color space conversion using neural network. The schematic diagram of the neural network structure is shown in Fig. 2. The conversion of color space is completed by transmitting information through the input layer, hidden layer, and output layer.

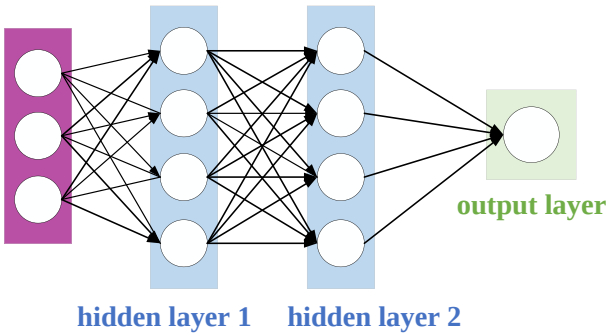

Fig. 2. Schematic diagram of neural network structure.

C. Methods of Enhancing the Quality of Works of Art

First divide the color scale of the artwork, and then convert the color space. In order to enhance the quality of art works, use color defect detection to determine the color difference threshold.

The specific operation steps are as follows:

Step 1: Determine the color defect threshold, and measure the *L**, *a**, *b** values according to user requirements.

Step 2: Set the values of luminance information ΔL, Δa and Δb according to the threshold requirement of the total color difference ΔE_{ab}. If one item does not meet the requirements, it means that the quality enhancement effect of the artwork is unqualified. If the threshold point of the total color difference ΔE_{ab} exceeds 60% of the original image, it is an overall color cast or a local color cast.

Step 3: Step3: Judging whether it is in line with the quality enhancement effect of art works, the judgment is based on:

1) When ΔL > 5.05, it means that the artwork to be inspected is brighter than the standard artwork, and the quality enhancement effect is ideal.

2) When ΔL < -5.05, it means that the artwork to be inspected is darker than the standard artwork, and the quality enhancement effect is not good.

3) When Δa > 4.65, it means that the artwork to be inspected is redder than the standard artwork, and the quality enhancement effect is better.

4) When Δa < -4.65, it means that the artwork to be inspected is greener than the standard artwork, and the quality enhancement effect is better.

5) When Δb > 3.21, it means that the artwork to be inspected is more yellow than the standard artwork, and the quality enhancement effect is good.

6) When Δb < -3.21, it means that the artwork to be inspected is bluer than the standard artwork, and the quality enhancement effect is poor.

Step 4: After screening, select qualified samples, and use image processing technology to enhance the visual effect of art works to meet quality standards.

Taking into account the problem of image difference, image processing technology is used to separate the target from the back. Let the artwork after the difference shadow be $f(i, j)$, the binarization threshold is Th, and after binarization, the artwork is $g(i, j)$, and the calculation formula is:

$$f(i,j) = \begin{cases} 0, & f(i,j) < \mathrm{Th} \\ 255, & f(i,j)..\mathrm{Th} \end{cases} \quad (5)$$

Set the Th threshold to 56, and apply Formula (6) to eliminate the shadow. Combining the above steps, the design of a method for enhancing the quality of art works based on image processing technology is completed.

D. Image Beautification Processing Implementation

This paper analyzes the application of computer graphics and image processing technology in art, and on the basis of image noise reduction preprocessing, the beautification of night scene images is carried out. This paper proposes a night scene

image beautification processing technology based on illumination multiple chromatic aberration compensation, adopts the illumination adaptive equalization technology to optimize the white balance of the night scene image, and searches for the threshold value according to the edge contour information of the image. The neighborhood of the feature point i in the image noise distribution is defined by N_i as:

$$N_i = \left\{ i' \in S \middle| \left[dist\left(i, i'\right) \right]^2 ,, r, i \neq i' \right\} \tag{6}$$

In the white balance processing of night scene images, the illumination adaptive equalization technology is used to optimize the white balance of night scene images. Use $dist\left(i, i'\right)$ to describe the distance of pixels in the neighborhood of the night scene image to be beautified, r is a constant, and get the multiple color difference kernels of the night scene image to be beautified.

$$R_i = \frac{1}{\gamma_{ije}} \sum_j d\left(\square i - j \square_2 \right) l\left(g_i - g_{j1} \right) \tag{7}$$

The morphological segmentation method is used to deconvolute the image completely blindly. In the sparse prior regularization distribution space, the adaptive equalization constraint function of image color difference is obtained according to the prior knowledge of the blur kernel as follows:

$$\min kp = \lambda g_i + \beta g_j \tag{8}$$

where, λ and β are regularization parameters. Based on the mathematical expression of the blur kernel, the white balance optimization result of the night scene image is obtained as:

$$\mathrm{LRT} = \min kp \left| R_i \cdot N_i \right|^s \tag{9}$$

Where s is the Total Variation (TV) term of the fuzzy kernel.

The illumination chromatic aberration of night scene adopts the method of shadow area and brightness area segmentation to compensate for contour shadow deviation. Through image multi-threshold segmentation, the segmentation curve of shadow area and brightness area is obtained and described as:

$$G_{\mathrm{mar}}\left(\overrightarrow{x_i}\right) = \frac{\sum_{j=1}^{p} G_j\left(\vec{x}_i\right) / G_j^{\max}}{p} \tag{10}$$

where, $i \in \{1,2,\ldots,\mathrm{N}\}$ is the sequence value. In the measurement of the whole image, the time cost of the regular term of the blurred image is measured, and the blur kernel of the high-frequency image y is obtained as:

$$\Omega = \left\{ \vec{x} \in s \middle| \; g_j(\vec{x}),, 0, \; j = 1, 2, \cdots, l; h_j(\vec{x}) = 0, \; j = l+1, l+2, \cdots, p \right\} \tag{11}$$

The fuzzy kernel is updated using the unconstrained iterative reweighted least squares (IRLS) algorithm, which is expressed as:

$$\min \vec{y} = \vec{f}(\vec{x}) = \left(f_1(\vec{x}), f_2(\vec{x}), \cdots, f_m(\vec{x}) \right) \tag{12}$$

Where $\vec{x} = \left(x_1, x_2, \cdots, x_n \right) \in X \subset \Re^n$ is the initial value vector of each feature point of the beautified night scene image, X is the decision space for optimal evolution, Y is the target space of optimal evolution. The image contour shadow deviation compensation realizes the superposition of the low-frequency information of the image, and the objective function of the image contour shadow deviation compensation is:

$$G(\vec{x}, \vec{y}) = \min \vec{y} \sum_3^4 G_{\mathrm{nor}}(\vec{x}) + \Omega^3 \tag{13}$$

IV. Simulation Test

A. Experimental Parameter Settings

First establish the RGB space conversion model, then use the original data, model the color target according to the experimental requirements, and use professional equipment to detect the quality enhancement effect of art works. According to the data requirements of the experiment, the RGB source color space is divided into nine levels, which are 0, 20, 34, 56, 68, 124, 234, 245, and 276 respectively. Use Adobe Illustrator CS6 software to make experimental color targets. In order to ensure the validity of the built RGB space conversion model, it is necessary to select six works of art, and the color difference information of the works is shown in Fig. 3.

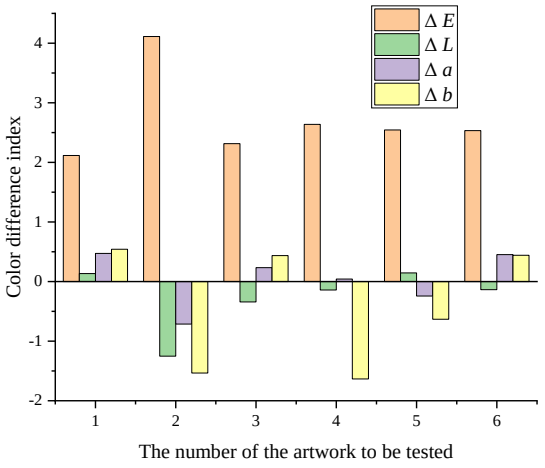

Fig. 3. The color difference information of the works.

Taking the quality enhancement method of artworks in this study as the test object of the experimental group, and the traditional enhancement method as the test object of the control group, the quality enhancement processing of six works of art was carried out by using the two methods, and the processed works were different in color. The color difference thresholds under different brightness and brightness are detected, and the results are shown in Fig. 4 and Fig. 5.

It is known that the human eye has the strongest ability to recognize colors in the mid-lightness range. According to the test results in Fig. 4, it can be seen that the color difference threshold of the control group increases gradually with the increase of the brightness L. However, the chromatic aberration

threshold of the images in the experimental group did not increase significantly due to the increase of the lightness L, but stabilized within a fixed range. There is a chromatic aberration deviation. Looking at Fig. 5 again, the control group has a larger color difference threshold due to the increase of color C, and the color difference of the visible image is not obvious. The chromatic aberration threshold of the experimental group is also within a small range. It can be seen that the two works of the experimental group did not show extreme differences in chroma after adding color. Based on the above test results, it can be seen that after the method proposed this time enhances the artwork, whether it is adjusting the brightness or enhancing the color of the artwork, the chromatic aberration threshold of the artwork has always been in a stable range. It can be seen that the proposed enhancement method is better.

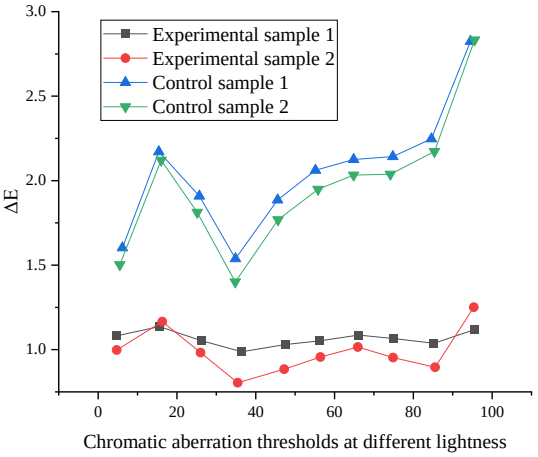

Fig. 4. Image quality enhancement effect experiment 1.

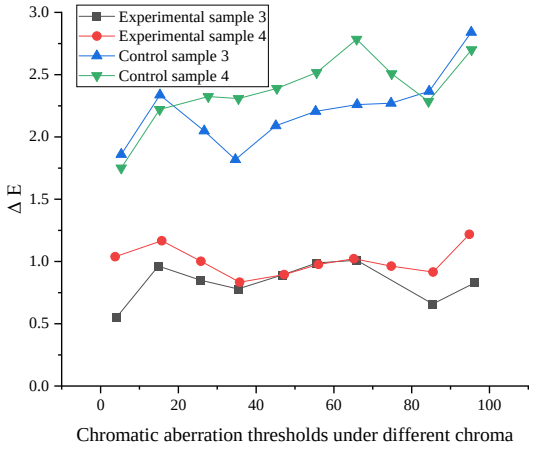

Fig. 5. Image quality enhancement effect experiment 2.

B. Analysis of Simulation Results

In order to explore the practicability of the proposed method, the method proposed in this paper, study [4] and study [5] are used to simulate and compare the digital painting images of R, G and B colors. The experiment adopts objective evaluation, and uses some mathematical variables that can objectively present the essential characteristics of the image, such as mean, variance or histogram characteristics as evaluation criteria, and analyzes the pros and cons of the method. Firstly, the influence of the number of iterations on the performance of the method is analyzed, and the image angle error before and after color correction is used as the measurement standard. The simulation results are shown in Fig. 6.

It can be seen from Fig. 6 that with the increase of the number of iterations, the angle errors of the three methods will gradually decrease. When the number of iterations is greater than or equal to 8, the image angle errors remain stable. The angle error of the method in this paper is always lower than the two literature methods, showing better algorithm performance. The reason for this phenomenon is that the method in this paper uses the optical flow-oriented feature method to effectively divide the image color distortion area, which reduces the probability of color correction angle errors to a certain extent.

The following is the comparison of the average values of R, G, and B colors between the three methods and the original image after the image color correction. After the double analysis of horizontal and vertical, it is evaluated whether the method in this paper has application advantages. The comparison results are shown in Fig. 7 to Fig. 9.

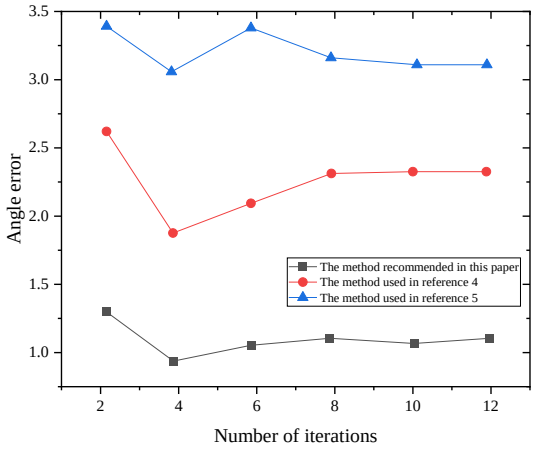

Fig. 6. The effect of the number of iterations on the performance of the method.

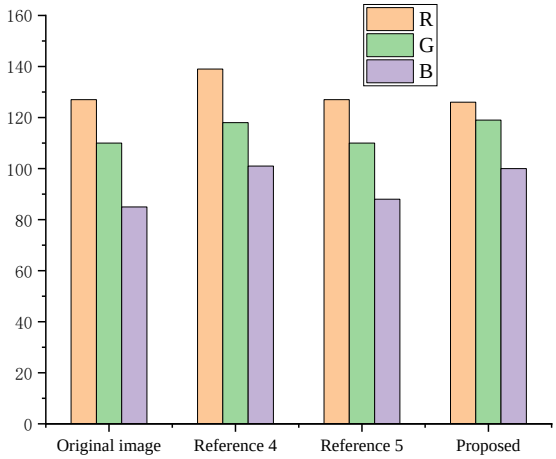

Fig. 7. Color correction comparison of reddish images.

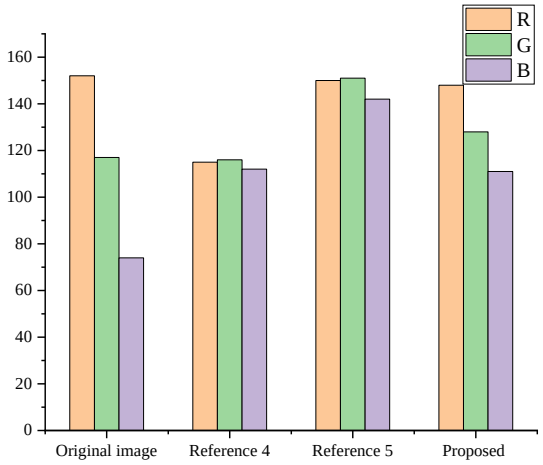

Fig. 8. Color correction comparison of greenish image.

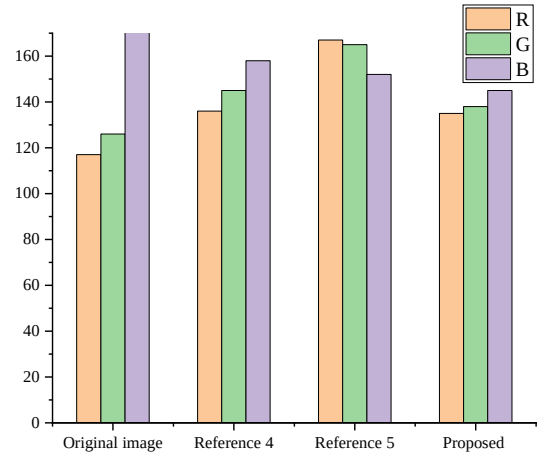

Fig. 9. Color correction comparison for bluish images.

From the experimental data in the three figures, it can be seen that the method in this paper has a good calibration effect for different color cast images. After the correction, the color distribution of the three color channels with uneven distribution of the initial color cast image is more even, and the difference of the mean value of the three color channels and the degree of color cast are reduced. The two methods in the literature are not universal, and may result in failure for some color cast images, and the correction accuracy needs to be improved. Although this method effectively divides color distortion areas using optical flow oriented feature methods, in some complex or boundary blurred images, this division may still not be accurate enough, resulting in poor local color correction effects. Although the experimental results show that the angle error tends to stabilize after increasing the number of iterations to a certain extent, excessive iterations will increase computational costs and reduce processing efficiency. Therefore, determining the optimal number of iterations is a problem that requires further optimization. The method proposed in this article performed well in experiments, but in practical applications, there may be more types of color cast images. How to ensure that the method is equally effective for these images is a problem that needs further verification. By improving the segmentation algorithm and iterative optimization strategy of color distortion areas, the angle error after color correction can be further reduced and the correction accuracy can be improved. Adjust and optimize algorithm parameters for different types of color cast images, improve algorithm adaptability and robustness, and ensure effectiveness and stability in various complex scenarios. On the premise of ensuring calibration accuracy, optimize algorithm implementation, reduce unnecessary computational overhead, improve processing efficiency, and meet the needs of real-time processing or large-scale dataset processing.

V. Conclusion

Aiming at the problems existing in traditional art quality enhancement methods, this paper proposes a new method, which uses image processing technology to enhance the visual effect of the quality of art works. Considering that errors are prone to occur in the conversion of color difference space, the RGB space conversion model is used to enhance the conversion accuracy. On this basis, the quality of art works is enhanced according to the quality enhancement process of art works. Finally, the enhancement effect of the two methods is compared by numerical comparison. The experimental results show that the proposed method meets the design requirements. However, it is found in the experiment that the quality enhancement method of art works based on image processing technology has higher requirements on the surrounding environmental factors, and further research is needed to improve it. When introducing the method proposed in this article, its theoretical basis can be elaborated in more detail. How to specifically apply the feature method for optical flow to the division of color distortion areas, and why this method can effectively reduce the angle error of color correction. In addition to using mean, variance, and histogram features, it is also possible to consider introducing more evaluation metrics such as Structural Similarity Index (SSIM), Peak Signal to Noise Ratio (PSNR), etc. to more comprehensively evaluate image quality. The paper mentions that art quality enhancement methods based on image processing technology have higher requirements for surrounding environmental factors. It is necessary to specify which environmental factors include (such as lighting, temperature, humidity, etc.), and explore how to reduce the impact of these factors in practical applications.

Fund Projects

1) Hunan Provincial Social Science Achievement Evaluation Committee in 2023:“Research on the Design of Suitable Aging Environment for Old Residential Areas in Huxiang Region,” project number: XSP2023YSC081.

2) Hunan Provincial Social Science Achievement Evaluation Committee in 2023:“Research on the epidermal texture of tourism villages in Meishan area under the background of rural revitalization,” project number: XSP2023YSC062.

3) The Natural Science Foundation of Hunan Province in 2021:“Research on Tactile Graphic Design and Application for Visually Impaired Population in the Era of Graphic-Based Reading,”project number: 2021JJ60022.

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