Research on Digital Image Technology in Oil Painting Image Processing

Yu Zhang*
Xi’an Academy of Fine Arts, Shaanxi Xi’an 710000, Province, China

*Corresponding author e-mail:18149300113@qq.com

Abstract. In this era of information and intelligence, it seems that painting graphics have been seriously marginalized, which also produced how to better develop painting technology in the modern society, this is not only the responsibility of all painters, but also the common cultural inheritance that all human beings need to face. Today's prevailing digital image technology has had a profound impact on the field of artistic creation, and oil painting has suffered an unprecedented blow in this process. The purpose of this paper is to explore how to make use of modern digital image technology to make the creation of traditional optimization not only retain the traditional flavor, but also keep pace with the pace of The Times. This paper introduces the origin and development of oil painting, introduces the application of digital image technology in the field of painting, and puts forward some strategies to improve the quality of oil painting by preprocessing oil painting with image processing technology. The research results show that in the process of oil painting creation, we should regard oil painting as an extension of imagination, so we can fully enhance oil painting creation with the help of modern technology, or even directly use modern image technology to spray. In other words, under the influence of realism, although the creation of oil painting is largely limited, using image processing technology to create oil painting is a very feasible creation scheme.

Keywords: Digital Image Technology, Oil Painting Image Processing, Cultural Inheritance, Quality of Oil Painting

1. Introduction
With the rapid development of science and technology today, people have successfully replaced human beings with scientific and technological achievements to do a variety of complicated work, including a certain range of artistic creation. Oil painting is also an important part of artistic creation. Adding modern image processing technology in the process of oil painting has become a phenomenon and form of oil painting, and is developing into an inevitable creative path. Nowadays, in the process of oil painting creation, the integration of digital image technology is not only a technical improvement of the artistic creation itself, but also the source of the expansion of oil painting creation ideas, making the creation concept richer.

Before the application of digital image technology, oil painting creation combined with computer
technology generally followed two creative ideas [1]. The first is through the computer programming language to program the preparation of the image quantization processing; The second approach is to use mature image processing software to directly process or create images [2-3]. However, obviously, the current image art creation only focuses on the technical innovation of realistic images, while the digital image technology for oil painting processing has not yet formed a scale, and the research results are even less [4]. However, from another perspective, it can also be seen that the combination of digital image technology and traditional optimized creation has broad development space and market prospect, which is a typical case of the integration of xinshida information technology and traditional art culture [5-6].

Although digital image technology has a large space for development in oil painting creation, it has not yet formed a research scale, the research foundation is still very weak, and the reference materials are also lacking [7]. Therefore, based on this reality, this paper will transition from the application of digital image technology in image processing to oil painting creation, and demonstrate the feasibility of the application of digital image technology in oil painting creation by fully absorbing experience [8-9]. Through the research results of this paper, I hope to promote the faster integration of traditional oil painting creation with modern digital image processing technology, so as to get rid of the old and obsolete label of traditional oil painting as soon as possible [10].

2. Method

2.1 Digital Image Technology

Simple computer technology applications can only cope with digital and conceptual graphic data, but are not very appropriate processing methods [11]. In general, the picture information we obtain is all natural images, and it is difficult for the computer to recognize and process these images according to the code, so it is difficult for the traditional computer technology to directly process the image [12]. In order for the computer to perform a series of operations on the image, the naturalized image must be transformed into a digitized resource that the computer can understand. Digital image technology is a command execution technology that recognizes and converts natural images into digital resources easily understood by the computer and urges the computer to modify the image resources.

2.2 Methods of Image Processing

After decades of development, people have summarized a number of digital image processing methods in practice, which can be processed in the spatial domain and frequency domain, or simply named the spatial domain method and frequency domain method.

(1) Spatial domain method

The spatial domain method refers to treating the set of all pixels in the plane as a graphics domain, and characterizes the graphics domain as an editable two-dimensional function for representation, and then carries out relevant processing. In the specific division, the spatial domain method can also be subdivided into point processing method and line processing method.

(2) Frequency domain method

The frequency domain method refers to the Fourier transform of the image to be processed, the logical expression is obtained in the corresponding spatial domain, and then the Fourier transform is performed, after which a variety of related processing operations can be carried out. Specific processing instructions often include data compression, eigenvalue extraction and density analysis.

2.3 Technical Composition

The technical route adopted in this study is to apply digital image technology to oil painting images in order to carry out the operation methods of gray value processing, edge sharpening and center passivation to realize the processing of oil painting images.

The processing of gray value is to set the gray value of the pixel as $I = 0.34b + 0.62g + 0.09r$, where R, G, and B are the original three primary color components of the color image.
Edge sharpening operation is a special operation on the edge point \( f(x,y) \). After processing, the content before the change is not retained. The pixel value after the change is expressed as \( G(x,y) \):

\[
G(x,y) = \begin{cases} 
G[f(x,y)] + \alpha, & \text{if } G[f(x,y)] > T \\
G(x,y), & \text{other}
\end{cases}
\]  

(1)

In almost all image processing techniques, center passivation is performed by median filtering. After scaling, the passivation image center point \( g(x,y) \) and the pixel value \( f(u,v) \) of the original image \((x,y)\) are outputted. The pixel value \( g(x,y) \) of the output image \((x,y)\) corresponds to the pixel value \( f(u,v) \) of the original image with coordinates of \((u,v)\), which is folded to obtain the new center point coordinates:

\[
g(x, y) = f(u, v) = bt_1 + (1 - b)t_2
\]  

(2)

3. Experiment

3.1 Image Grayscale Processing

In order to meet the requirements of oil painting color level, we need to optimize the oil painting gray value, and deal with some performance problems in the color image display block. The specific operation details are to replace the three component values in the crude oil painting with appropriate values so as to obtain the gray value of the best developing effect.

3.2 Spatial Filtering

When spatial filtering is performed correctly, a new pixel will be generated, which must be located in the center of the coordinate neighborhood. The filtered pixel value is usually assigned to a corresponding point of the newly created image. We perform linear spatial filtering, so the resulting new pixels are also linear filter-based.

3.3 Frequency Domain Smoothing

In order to achieve the desired effect of image processing, we also need to select different frequency domains for high-four filtering according to different processing locations. Different cut-off frequencies are selected, the processing effect and filtering degree are also different.

4. Discuss

4.1 Treatment Effect

Normally, the noise points of oil painting are included in the high-frequency components. Therefore, in the process of adopting gaussian filtering, we convoluted the oil painting based on the high-frequency components to achieve the noise reduction of oil painting. The noise reduction effect after the implementation of gaussian filtering is shown in figure 1 below.

Sometimes we also need to sharpen the color levels of oil painting, in order to improve the effect of oil painting. Laplace operator is a kind of differential operator with homogeneity. It compares the result of image filtering and then rotation with the result of filtering after the original image rotation. The comparison results obtained in this study are shown in table 1 below.

From the comparison results, it can be found that the results obtained by filtering the image first and then rotating it are the same as those obtained by filtering the original image after rotating it, indicating that the preprocessed image can provide a reliable basis for the subsequent related image processing.
Figure 1. Noise reduction effect after gaussian filtering

Table 1. Comparison between filtered and original differential operator matrix

|                | a  | b  | c  | c  | b  | a  | a  | b  | c  | c  | b  | a  |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Low pass filter| 0  | 1  | 0  | 1  | 1  | 1  | 0  | -1 | 0  | -1 | -1 | -1 |
| Mean filter    | 1  | -4 | 1  | 1  | -8 | 1  | -1 | 4  | -1 | -1 | 8  | -1 |
| Frequency filter| 0  | 1  | 0  | 1  | 1  | 1  | 0  | -1 | 0  | -1 | -1 | -1 |

4.2 Generation of Digital Oil Painting Images

(1) Image magnification

The essence of oil painting amplification is to increase the number of pixels in the original image. In other words, the process of amplification is the process of interpolation of the original image. In the process of image magnification, the output is the image and the input is the image. Therefore, the process of magnification does not change the nature of the oil painting. But the output of the oil painting reduced the distortion of more details, so that the oil painting can withstand the test of magnification.

(2) Color block boundary processing

Color block boundary processing is determined by the graph method, which can ensure the continuity of color block boundary. However, the calculation amount of curve fitting is still maintained at a large amount, even with a large error. Therefore, in view of the non-diffusivity of oil painting, this paper adopts the pixel method to deal with the boundary. Only the boundary of the color block needs to be marked with a graphic pen. After the size changes, discontinuous places will be added automatically according to the mark. The disadvantage is that the changed details may be distorted.

(3) Calibrate the image color block

We determine the process of image color block is the process of image segmentation, the number of color blocks will exist in the process of segmentation. In order to obtain more subtle color blocks, we adopted the method of merging adjacent color blocks, but the specific implementation is determined by the image quality after the first magnification.

5. Conclusion

The research topic of this paper is to discuss how to integrate oil painting creation with it under the background of the popularization of digital image technology. This paper first introduces the
development of digital oil painting, and do the research necessity analysis. In the process of research, this paper smooths the image with mean filter to suppress and eliminate the noise contained in the image, sharpening the oil painting with gaussian filter to improve the quality of oil painting, and finally realizes the application of digital image technology in oil painting creation, achieving the goal of making the oil painting visual effect more ideal.

References
[1] Dutta T, Gupta H P. Leveraging Smart Devices for Automatic Mood-Transferring in Real-Time Oil Painting[J]. Model of Realistic Oil Painting Style Based on Association Memory Network, 2017, 64(2):1581-1588.
[2] Jana Striöva, Chiara Ruberto, Marco Barucci. Spectral imaging and archival data in analyzing the Madonna of the Rabbit painting by Manet and Titian[J]. Angew Chem Int Ed Engl, 2018, 130(25):53-55.
[3] Qian Wenhua, Xu Dan, Guan Zheng. Simulating chalk art style painting[J]. Journal of Image & Graphics, 2017, 74(26):50-51.
[4] Li Beilei. Pursuing the Pioneer of Chinese Oil Painting Wang Daoyuan[J]. Ethnic Art Studies, 2017, 903(34):219-220.
[5] Adrián Rabadán, Manuel Álvarez-Ortí, Ricardo Gómez. Optimization of pistachio oil extraction regarding processing parameters of screw and hydraulic presses[J]. LWT- Food Science and Technology, 2017, 83(22):7-8.
[6] Sandhya Nair, Jacques Gagnon, Claude Pelletier. Shrimp Oil Extracted from the Shrimp Processing Waste Reduces the Development of Insulin Resistance and Metabolic Phenotypes in Diet-induced Obese Rats[J]. Appl Physiol Nutr Metab, 2017, 42(8):841-849.
[7] Paula De Vos, Rosewater and Philosophers’ Oil: Thermo hemical processing in medieval and early modern Spanish pharmacy[J]. Centaurus, 2018, 60(3):159-172.
[8] E.F. Sousa-Aguiar, V.L. Ximenes, J.M. Araujo Ribeiro De Almeida. CHAPTER 1: Catalysts for Co-processing Biomass in Oil Refining Industry[J]. Rsc Green Chemistry, 2018, 46(42):21-24.
[9] Y. Sun, J. Ma, W. Meng. Application of H/CAMS software in optimization of crude oil processing[J]. Petroleum Refinery Engineering, 2017, 47(12):28-31.
[10] Nathaniel Francis Brown, Sai Aditya Pradeep, Shubb Agnihotri. The Power of Processing: Creating High Strength Foams from Epoxidized Pine Oil[J]. Acs Sustainable Chemistry & Engineering, 2017, 5(10):2-3.
[11] Kelechi E Anyaoha, Ruben Sakrabani, Kumar Patchigolla. Evaluating oil palm fresh fruit bunch processing in Nigeria[J]. Waste Management & Research, 2018, 36(3):7342-7344.
[12] Mao Li, Jiancheng Lv, Jian Wang. An Abstract Painting Generation Method Based on Deep Generative Model[J]. Neural Processing Letters, 2019, 46(24):903-905.