



Application of Information Technology in Woodcut Prints

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Abstract. The traditional woodblock printing plate has certain limitations. Because of the lack of accuracy of manual processing, the picture effect is weakened. Under the background of the diversification of modern art styles, woodblock prints are easily impacted by other art forms. The application of information technology in woodcut printmaking by woodcut makers can make woodcut printmaking more diversified, and at the same time improve the overall efficiency of design and the creative effect. Based on this, this paper introduces the problems existing in traditional woodcut prints, and puts forward the advantages of applying computer technology to assist woodcut prints. It also introduces the specific application of Photoshop software in information technology woodcut prints, and uses the pre-training VGG19 model to complete woodcut prints, hoping to provide a reference for the development of woodcut prints production technology.

Keywords: Information technology · Woodcut prints · Neural network · Photoshop · VGG19 model

1 Introduction

Woodcut print is the oldest type of print, which has the characteristics of image transmission from the beginning and hides its artistic value. With the rapid development of image technology, the function of woodcut prints as communication has been weakened. By 180, the original print movement jointly carried out by France and Britain gradually built woodcuts with independent artistic significance. By the early 20th century, German expressionist woodcuts had certain characteristics. China's woodcut prints developed in the 1920s and became one of the most important artistic achievements in the 20th century. With the update and popularization of information technology, it provides a lot of convenience for the production of woodcut prints. Therefore, how to apply information technology to woodcut prints has become a concern of many producers.

2 Problems Existing in Traditional Woodcut Printmaking

(A) Limitations of wooden boards

The four types of templates of traditional woodcut prints, concave, convex, flat and leaking, are defined according to the printing principle of prints and the physical properties of templates. Template represents the basic attributes of the picture, but also determines the technicality and interest of the picture. Templates and equipment restrict the technical specifications of printing production, so that the theme and form of the picture are confined to a small scope [1]. Under this background, the author's creativity can only be created on the basis of meeting the template, which obviously limits the creative ability of the creator. At the same time, because of the difference of template making principle and raw materials used, it also has different effects on the creative ability of creators.

(B) The impact of different types of art forms

With the rapid development of network technology, visual images are expressed in various ways, robbing people's retina. Surrounded by electronic devices, people can browse a large number of visual works such as different types of advertising images, photographic works and digital images through home TV, mobile phones or computers without leaving home. Excellent art can always show the current visual experience, and its materials, production techniques and aesthetic concepts are related to the life of the times. The information age has changed people's visual experience and aesthetic methods, and the audience's demand for visual stimulation has also increased significantly. Traditional woodcut prints are essentially the product of the agricultural era, and we need to rely on industrial civilization to realize the modernization transformation. In recent decades, the pace of industrial development has continued to accelerate, and woodcut prints have gradually developed in a convenient and practical direction, which has gradually been known by people. The emergence and popularization of computer technology will undoubtedly have a certain impact on the development of woodcut prints [2].

(C) Indirectly weaken the picture effect

The particularity of traditional woodcut prints is that the artistic language of woodcut prints can't be directly expressed in the picture, and the lines, shapes and colors in the printing process show an indirect image effect. The creation of traditional woodcut prints must be transferred and conveyed through an intermediary, that is, wooden block. This period is the process of transferring images by using intermediary, so there are a lot of contingencies during the production. These contingency factors may cause unexpected picture effects, but they may also lead to significant differences between the final painting and the author's artistic conception.

3 Application Advantages of Information Technology in Woodcut Prints

(A) The diversity of expressions

Woodcut prints are generally trapped in a relatively narrow creative space, and it seems that innovation is very difficult. But the application and popularization of information technology have changed the present situation. By flexibly applying computer technology, creators can try to use a single graphic design software or cross-apply different graphic software to create, and achieve diversified expression effects. Take Photoshop as an example, which contains different types of creative tools such as pencils and pelvic cavity. Painter can truly reproduce the natural brush strokes; 3DMAX can make three-dimensional modeling, and the creator only needs to add some graphic design software to carry out post-effect and image rendering. Creators can even use scanning equipment, digital cameras and other external devices to input the image data produced by the audience or natural image data into the computer, so as to enrich the creative effect of woodcut prints.

(B) Optimize the creative environment of woodcut prints

Traditional woodcut prints give people the impression that the creator has a carving knife in his hand, a lot of pigments on his waistline, and the environment is filled with all kinds of inks and chemicals. Therefore, the creative working environment gives people the impression of congestion and boredom, while the chemicals in the air are not conducive to human health. However, with the extensive application of information technology, the industrial workshop-style production mode of traditional woodcut prints has been changed, and the staff can complete the creation of prints in the studio, which has changed the traditional working environment [3].

(C) Ensure the directness of the creative effect

The creators of traditional woodcut prints need to create according to the process of drawing, making wooden block and printing. This process cannot be separated from diversified printing equipment and materials, and the production process is very complicated. Rubbing is close to manual labor, which is the main influencing factor of printmakers' creation efficiency. The core of artistic creation should be mental work, and showing rich emotions requires the creator to have enough energy. If the production process is too complicated, it will make the creators get involved in complicated work, leading to the gradual lack of spirituality in artistic creation and weakening the artistic creation ability of woodcut prints [4]. The two processes of plate making and printing of traditional woodcut prints are relatively independent. Before printing, the creator can only analyze the effect that may be obtained after printing according to his experience. If information technology is used, what you do is what you see, and the error between plate making and printing can be reduced as much as possible, which is of positive significance for improving the design effect. In addition, the computer technology has excellent function of engraving and cloud backup of engraving content, which enables creators to modify woodcut prints at any time and any place, avoiding the waste of woodcut prints and improving the creation accuracy of woodcut prints.



Fig. 1. Image file



Fig. 2. Processed image

4 Specific Application Ways of Information Technology in Woodcut Prints

(A) The application of Photoshop in woodcut prints

Creators can use the filter function in Photoshop software to simulate many painting effects on different materials in a reasonable way, and woodcut prints are one of them. Through this software, it can provide convenience for woodcut print design and improve the efficiency of woodcut print design. It can be implemented by tools such as Find Edges filter, Grayscale command, Texturizer filter and Level adjustment. The specific methods are as follows:

First, the processing of image files. Open the image file (as shown in Fig. 1). Select the Filter|Stylize|Find Edges filter in the menu, and modify the search edge of the image. The image effect obtained is shown in Fig. 2. As far as this image file is concerned, the color of the original image is very rich, while the target image, that is, the key image of woodcut prints, is a depiction effect and cannot contain such rich materials. Therefore, it is only necessary to deal with texture and brightness, so it is necessary to convert the original image into a grayscale image for processing.

Secondly, the creator selects the Image|Mode|Grayscale command to convert the picture into a gray image. During the conversion of grayscale images, the system will automatically generate a confirmation dialog box asking whether to reject color information. That is, to confirm whether to discard the color information, it is recommended to choose discard.

Thirdly, adjust the color ring of the gray image to make it more suitable for the effect of woodcut prints. It is suggested to choose Image|Adjustments|Level, open the editing dialog box for adjusting the color levels, design the Input Levels to be 0, 1 and 220, and confirm to save. Then, select the File|Open command, select an image made of wood grain, finally select Filter|Texture|Texturizer, and bring up the Texturizer filter

editing dialog box, in which the list on the right side Load Texture selects the processed file, and sets the Scaling value to 100%. After confirmation, you can get the final effect image depicted by the woodblock.

(B) Neural network image style transformation

Neural network image style transformation, if the high-order features extracted by the image recognition system are closer in European distance, the two images are similar in content. This is because the accepted and trained image recognition system's high-order features coordinate with the semantic information in the images, and the style of artistic works is regarded as visual texture, which has low-order spatial statistical features. For example, the timely image is the low-order features extracted by the system and has the same spatial statistics. Then the two images are similar in style, and the difference in style between the two images can also be judged by using Euclidean distance. Pre-trained VGG19 model is mostly used as feature extraction equipment, and relevant feature representations extracted by higher layers of CNN are regarded as content representations, and the correlation of output feature maps among all channels of convolution layer is regarded as style representations [5]. The overall process of woodcut style transformation is shown in Fig. 3.

Generate a graph initialization image g and a content image p , which will be re-encoded in all layers of VGG19 model. The total convolution kernel of the 1st layer is N_1 , and the specification of the feature graph is set to M_1 , which is the product of the width and height of the 1st layer feature graph. The L -layer feature map is saved as the matrix $F^l \in N_1 * N_1$, and the relevant feature representation of the image in the L -layer is obtained. F_{ij}^l represents the activation of the image at the j position on the i th convolution kernel in the 1st-layer. The relative high-level features are expressed as the content representation of the image, and F_1 and P_1 represent the content representation of the initialization image g and the content image p in the first layer, respectively, so that the defined content loss function can be obtained as follows:

$$Lc(p, g, l) = \frac{1}{2} (F_{ij}^l - P_{ij}^l)^2$$

The derivative of this function to the 1sr layer activation item is:

$$\frac{\partial Lc}{\partial F_{ij}^l} = \begin{cases} (F^l - P^l), & \text{if } F_{ij}^l > 0 \\ 0, & \text{if } F_{ij}^l < 0 \end{cases}$$

The style image style of woodcut prints is characterized to determine the correlation among all channel feature maps in the same convolution layer of VGG19 model. Gram matrix is used to calculate the correlation of each feature map of all convolution layers in the network as the style representation, Gram matrix $G^l \in N_1 * N_1$, where N_1 represents the total amount of convolution kernels in the 1st layer, and G_{ij}^l represents the product of the i th convolution kernel feature map and the j th convolution kernel feature map after the image is subjected to the 1st vectorization. The specific formula is as follows:

$$G_{ij}^l = \sum_{i,j} F_{ik}^l F_{jk}^l$$

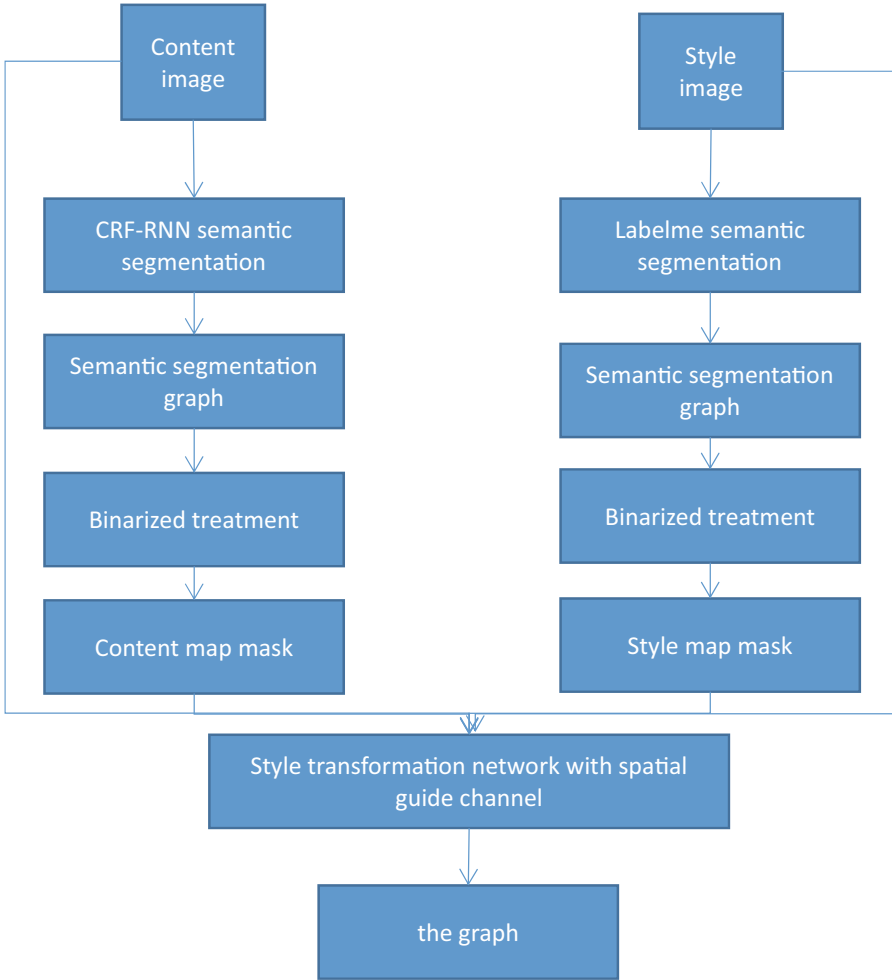


Fig. 3. Overall flow chart of woodcut style conversion algorithm

The initialization image g of the generated graph is defined, and the woodcut style image is set as a . G and A respectively represent the style representation of the generated image and woodcut style image in the i th layer of the network [6]. The mean square error is used to determine the style difference between the living layer picture and the woodcut print style image. In this way, you can define the loss function of the i th layer woodcut style, as follows:

$$E_i = \frac{1}{4N_i^2 M_i^2} \sum_{i,j} (G_{ij}^i - A_{ij}^i)^2$$



Fig. 4. The effect of regional style transformation of woodcut prints

WI indicates that all convolution layers of the network activate the corresponding weight factors, and the derivative formula of this formula with respect to the response value of the I-th layer number is as follows:

$$\frac{\partial L_c}{\partial F_{ij}^l} = \begin{cases} \frac{1}{N_i^2 M_i^2} [(F^l)^T (G^l - A^l)], & \text{if } F_{ij}^l > 0 \\ 0, & \text{if } F_{ij}^l < 0 \end{cases}$$

In the above formula, L_c represents the loss function between the content image and the generated image, and L_s represents the loss function between the woodcut image and the generated image. α and β respectively represent the content loss function and the style of woodcut prints, and the weight of the loss function can effectively control the stylization level of woodcut prints by using α and β . Through the style transformation, the creator can directly transform the image materials into woodcut prints, and directly make the prints [7]. In this way, the time required for image design is greatly reduced, and the final effect of the pictures is significantly improved, which is of positive significance for promoting the development of woodcut prints. The effect of regional style transformation of woodcut prints is shown in Fig. 4.

From the point of view of image space control, there will be some problems such as inconspicuous woodcut notch texture and chaotic distribution in the living layer map with neural style conversion algorithms such as Gatys, which will destroy the semantic information to some extent. The reason is that Gram matrix can only refine the global average characteristics of the image, and lacks the restriction on the spatial information of objects. Therefore, this paper uses the mask image as a guide and adds a space guide channel to solve the above problems. Firstly, the spatial guide feature map is generated to complete the image segmentation and transformation. Combining the network mask image to form a space guide channel T_r^l on all convolution layer channels, where T_r^l represents the R space guide channel on the L layer in the network, and multiplying T_r^l and the vectorized feature map by corresponding elements to obtain a space guide feature map:

$$F_r^l(x) = T_r^l F^l(x)$$

where $F_r^l(x)$ represents the i th column vector. Save the spatial guidance feature map as a two-dimensional matrix F_r^l to obtain the spatial guidance feature representation, and define the spatial guidance content loss function on the spatial guidance feature representation as follows:

$$L_{\text{css}}(p, g, l) = \frac{1}{2} \sum_{r=1} \sum_{i,j} (F_r^l(g) - G_r^l(a))_{ij}^2$$

Similarly, in the aspect of space guiding characteristics, the guiding Gram matrix is defined, and all guiding matrices are used as spaces to guide the optimization goal of the channel area. The style loss of each floor is as follows:

$$E_{\text{ls}} = \frac{1}{4N_l^2 M_l^2} \sum_{r=1} \sum_{i,j} (G_r^l(g) - G_r^l(a))_{ij}^2$$

By using the control of the space guide channel, the image optimization is carried out in the corresponding space guide channel area, ensuring that the pattern is only transmitted in this area, so as to avoid the chaotic distribution of the notch texture characteristics of the image [8].

5 Conclusion

As an art form, woodcut prints are sensitive and avant-garde. Creators should accept new ideas as soon as possible, and reasonably introduce the advanced technology of information technology, so that woodcut printmaking, a traditional art form, can be integrated with advanced information technology. Although information technology cannot completely replace woodcut prints, it does provide help and new development courses for the design of woodcut prints, and promotes the production efficiency and quality of woodcut prints. The organic integration of woodcut prints and information technology has also attracted the attention of many scholars.

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