Computer-aided design method for random patterns of apparel fabrics

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Abstract. Random pattern is a pure digital art done by computer design, which can be widely used in clothing fabric pattern. This article introduces the method of using Photoshop general image processing software with external filter plug-in to design and produce random patterns for apparel fabrics.

Keywords: Fabric, Pattern, Random, Computer-Aided Design

1. Introduction
Random patterns and fractal patterns are both computer-specific pattern forms, the former is generated randomly using computer data operations, while the latter is generated by computer algorithms and mathematical program sets based on the self-similarity principle and fractal iterations. The two types of patterns can be both independent and interrelated, and if randomness effects are added to the fractal generation algorithm, random fractal patterns can be generated. Borrowing from the concept of medium potential in electronics, coloring random patterns or fractal patterns can generate colorful and decorative art patterns, so that mathematics is no longer yesterday's boring abstract philosophy, but endowed with an endless sense of mysterious beauty, inspiring people's imagination. Random patterns and fractal patterns can be used in crafts decoration, appearance packaging, booklet binding, commercial advertising and software cover web page, etc., of course, can also be used in textile clothing fabrics, etc.. Camouflage pattern is one of the most common and typical random patterns, which can be used not only for military uniforms, but also for the popular clothing of young people. The design and production of random patterns usually requires programming in VisualC # or JavaScript, which is difficult for graphic designers who are generally engaged in pattern design. Based on years of teaching experience, the author has found a way to use Photoshop image processing software and external filter plug-ins to make random pattern design easily [1].

2. Generate random patterns with camonflage
Camouflage is a Photoshop plug-in filter designed to create random patterns for camouflage uniforms. You can find it under the "Filters" menu, and its interface is shown in Figure 1.
Figure 1. Camouflage Filter interface

The interface of Camouflage filter is basically divided into 6 main parts, and the functions of each part are as follows [2].

The first part is the preview window, through which you can directly see the effect of the generated camouflage pattern. The second part is the camouflage effect adjustment area, which has three adjustment sliders: Scale, Blur and Fall-off. Blur: used to set the roughness of the color block edges, the larger the blur value, the more rounded the color block edges, in the shape of a drop of water. Fall-off: used to control the degree of coverage of the color block size on the background color, the larger the value, the greater the coverage, the smaller the background color display area [3]; the smaller the value, the smaller the color block coverage, the larger the background color area. The background color area is larger accordingly. The third part is the color area, which is composed of 8 color blocks. The first color block from the left determines the background color of camouflage pattern, so the check box below must always be checked (i.e., put a "√" sign) and cannot be unchecked. The 2nd to 8th color block can be checked as many times as you like, but at least 1 of the following checkboxes must be checked. Click the mouse on any of the color block will pop up Photoshop color picker, see Figure 2, from which you can choose your favorite camouflage block color.

Figure 2. Selection of Color Block Color
The fourth part is the system preset pattern color style (Colors preset). The list box shows the names of camouflage patterns preset by Camouflage software [4].

Click the "" on the right side of the list box, you can pull down 23 kinds of preset camouflage patterns, see Figure 3.

Figure 3. System preset patterns

The ⑤ part is Random. Move the slider bar, or directly input the number in the number box on the right, you can make the camouflage color block change randomly. There are 5 small buttons at the bottom of the interface: OK button: OK button, click it to apply the effect seen in the preview window to the currently opened image window; Cancel button: Cancel button, click it to abort the operation and return to the opened image window; ? button: Help button, click it will open the system preset help file, you can get online help. save button: Save settings button, you can save the camouflage pattern effect you set, save the disk for the next call. camouflage software effect file save format is *.cfs. open button: Open button, you can open the effect file you saved before, apply it to the current image. Figure 4 and Figure 5 are two camouflage random pattern samples designed and produced by the software [5].
Figure 4. Camouflage pattern one

Figure 5. Camouflage pattern two

Figure 6. Camouflage Vest
3. Generate random patterns with KPT texture explorer

KPT Texture Explorer is a subroutine of the KPT 3 plug-in filter plug-in. Before using it, first install the KPT 3 filter plug-in for Photoshop, restart Photoshop, and execute the "Filter /KPT 3/KPT Texture Explorer 3.0" menu command, which opens the KPT Texture Explorer filter interface, as shown in Figure 7.

![Figure 7. KPT Interform program interface](image)

The interface is mainly composed of pattern preview window, gradient color bar, preset pattern library, change tree, rotation adjustment of pattern, opacity and 3 small windows for blending mode, etc. The large box ① in the right center of the interface is the preview window, which is the source pattern outputted by the software. Around the preview window, there are 16 small boxes (②), which represent the derivative patterns [6]. The derivative patterns are similar to the source patterns, but have some random variations from the source patterns. When you click on any of the derivative pattern windows with the mouse, the derivative pattern of this window will be transferred to the large central window and become the new source pattern, while the surrounding 16 windows generate a new random derivative pattern according to it [7]. ③ is the gradient color bar, used to color the current source pattern, click it will have a pop-up menu, can pull down the two-level menu, there are hundreds of gradient types inside. This is all preset by the system, you can also save your own design gradient color, here to call out the use. Below the gradient color bar, there are seven controls for Hue, Saturation, Brightness, Contrast, Blur, Squeeze and Cycle ④, which are used to set the parameters of hue, saturation, brightness, contrast, blur, color squeeze and color cycle of the gradient color bar respectively. ⑤ is the change tree, which consists of a series of small brown or red balls with a faint tree shadow underneath. These balls represent the degree of change in the derived pattern [8]. Clicking on the small balls near the bottom of the tree, less change occurs and the resulting derived pattern is very similar to the source pattern. Clicking the top ball along the change tree to the very top indicates a large change, and the resulting pattern will not resemble the source pattern at all. Each click on the change tree button will produce a new derived pattern. (6) is the change tree menu, click it will have a pop-up menu, see Figure 8, which lists the properties of the pattern, you can control whether to produce changes to it. For example, if an item is selected (marked with a "-" sign in front of it), the item will be changed when you click the change ball, otherwise it will not be changed. To quickly select all, select Multate All; conversely, to select none, select Multate None.
(7) is a rainbow ball, and clicking it changes the color of the derived pattern randomly. In other words, the basic shape of the pattern will not change, only the color will be changed. The ⑧ part is 3 small windows, from left to right, click or drag on the window to adjust the rotation angle, opacity and color blending mode of the source pattern and the base image respectively. ⑨ Enter the preset pattern library, click it to enter the preset pattern library as shown in Figure 9. Select a preset pattern and click it, the pattern will enter the preview window in Figure 7. Fig. 10 to 13 show the random pattern samples designed by KPT Texture Explorer program for apparel use [9].

Since the pattern is generated randomly, it is almost impossible to get the exact same pattern twice.

Figure 8. Change tree menu

Figure 9. Preset Pattern Library

Figure 10. Ice and Jade  Figure 11. Wizard of Oz
Figure 12. Neon Dress  
Figure 13. Heavenly Music  
If you copy, rotate, overlay and other deep processing in Photoshop, you can get the final dress pattern named "Heavenly Music" as shown in Figure 14, and Figure 15 is the fabric sample example of the pattern [10].  

Figure 14. The sound of the sky  
Figure 15. Pattern example  

4. Conclusion  
The main goal and entry point of computer-aided design is to free the process personnel (users) from tedious and repetitive affairs, quickly prepare complete and detailed process documents, shorten the production preparation cycle, improve the quality of garment manufacturing, and then shorten the life cycle of the whole garment, and the auxiliary function of the computer is reflected in the random pattern design of garment fabrics [11].  

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