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The Application of Yangliuqing Woodcut New Year Paintings Based on Image Extraction Technology in Clothing Design

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Abstract. As a traditional Chinese folk art, Yangliuqing Woodcut New Year (YWNY) paintings with unique artistic symbols and rich artistic values have formed varied artistic styles since century. The purpose of this study is to explore the innovative application of traditional folk art combined with other technologies in the field of fashion and art design. Through literature research and object investigation methods, this paper analyses the subject and artistic characteristics of YWNY paintings, classifies the paintings and creates an image bank. Using the image extraction technology, we extract the characteristic elements with cultural symbols and representative colours and construct the corresponding elements resource libraries. Based on the modern design aesthetic and clothing craft design means, YWNY paintings are flexibly applied to fashion design and other design fields. Fashion trends in combination with the elements in YWNY paintings create works that have regional characteristics, which achieve the creative transformation of Tianjin folk art in fashion clothing design.

1. Introduction

Yangliuqing Woodcut New Year (YWNY) paintings are the representative of Chinese New Year paintings, which occupy an important position in the history of Chinese folk culture and Tianjin culture. It has special cultural and historical research value. Therefore, the extraction and application of its elements in modern design is not only a simple reproduction of YWNY paintings, but also a kind of transmission of the Chinese traditional culture. Nowadays, traditional arts have been applied to many modern designs such as animation design, product design, fashion design, etc. The applications of YWNY paintings in clothing are still in the decorative design stage. In addition to the traditional design methods, the intelligent design and manufacturing technology of clothing can be integrated into the structure and function design of clothing in a new perspective [1].

In this work, we collect YWNY paintings and manually divide them into 6 categories, according to the categorization methods of publishers at sources, the pattern and text information in the pictures and the theme presented in the whole painting. Then we extract the pattern, line and color elements of YWNY paintings by using the k-means and mathematical morphology algorithms. Finally, the elements are applied to fashion design through three methods: direct decoration, decomposition and reconstruction, and deformation and combination of multiple elements.



2. YWNY Paintings Analysis

2.1. Theme and culture implication

The theme of YWNY paintings is particularly rich, and it directly reflects the current affairs and customs of various periods, historical stories and so on. According to the subjects, the paintings can be divided into fairy tales, historical stories, novel characters, auspicious figures, beauties, babies, customs, and current affairs, etc. In addition to praying for auspicious, fortune, safe health and so on, YWNY paintings also reflect the local people's atmosphere of life and folk culture, convey the traditional loyalty, filial piety, etiquette and moral concepts. These art works with multi-form subjects have been endowed with vivid life by paintings artists, express history and emotion, and pin peoples' prayers and hopes [2].

2.2. Style characteristics and color features

The shape of YWNY paintings is full, lifelike, terse and exaggerated, the paintings' layout pays attention to integrity and harmony, and its performance is simple and unadorned, bold and vivid [3]. The paintings boldly use the black, red, purple, green, yellow as the main color, which is the traditional "five-color view". Red and yellow add the festive atmosphere to the paintings and fit the jubilant atmosphere in New Year. And pink, green, pale yellow and other colors render the picture harmonious, unified and fresh. By referring the colors of natural image, YWNY paintings designers make exaggerated and free design of the color, and use the complementary color to create contrastive relationship, such as red and green, blue and yellow and other simple bright colors.

3. Research on Feature Extraction

3.1. YWNY paintings database building

With the rapid development of social life in China, great changes have taken place in people's lifestyles and aesthetic standards. YWNY paintings should adapt to these changes [4], so we should not mechanically and blindly copy the past design means, but explore how to develop and inherit it in a new and intelligent society and era.

126 YWNY paintings are collected in the Internet and exhibition halls that are updated continuously as shown in **Figure 1**. We classify them according to 6 types, including 10 images of door god, 54 images of baby and beauty, 6 images of drama story, 44 images of auspicious pattern, 9 images of custom and current event, and 3 images of myth. And we establish the corresponding databases that will be continuously updated with the appearance of new YWNY paintings in the future.



Figure 1. The classifications of Yangliuqing Woodcut New Year paintings¹.

¹ Image courtesy of Tianjin Yangliuqing Woodcut New Year Paintings Museum, http://www.360doc.com/content/18/1210/08/52920_800578244.shtml, and http://blog.sina.com.cn/s/blog_53866a2a0102yzhq.html.

Then the pattern, line and color elements in the paintings are extracted by using image extraction technology. Designers can reasonably and conveniently use these elements with folk characteristics to design clothes with more personality and national characteristics, or apply them to virtual exhibition halls and other fields, the framework is shown in **Figure 2**.

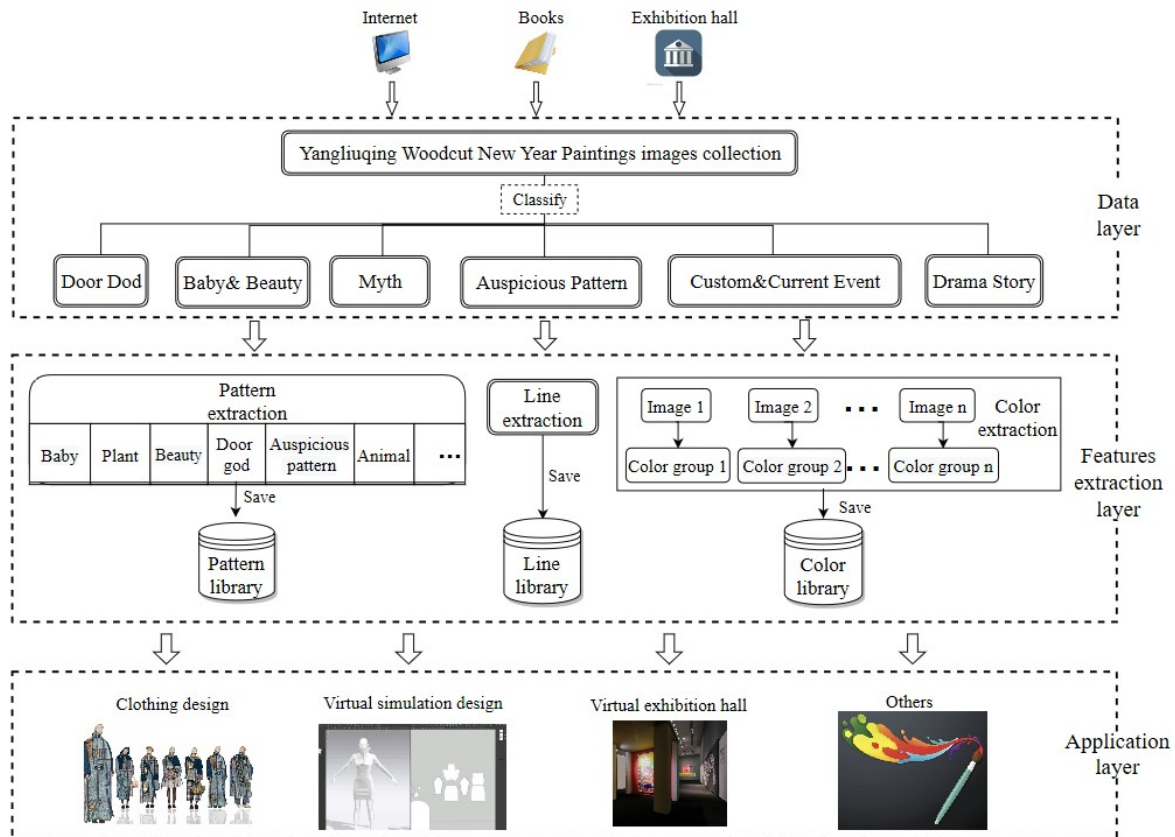


Figure 2. The framework of YWNY paintings' elements extractions and applications system.

3.2. YWNY paintings feature elements extraction system

There are usually two methods of interface design: one is to write MATLAB files directly; the other is to generate relevant files by GUIDE. When the GUI is constructed by GUIDE, the designed GUI interface can be stored as a fig data file, which automatically form the corresponding MATLAB file, and this file contains the initialized codes of the GUI and the control codes of the interface.

3.2.1. Interface design. We design the interface of color extraction by writing MATLAB file directly, and design the interface of pattern and line extraction by building GUI with GUIDE. The interfaces can present the color, pattern and line features of YWNY paintings in real time.

3.2.2. Program design and extraction experiment. K-means algorithm is a clustering analysis method, which is used to extract pattern feature elements in YWNY paintings. Given a set of observations ($x_1, x_2, \dots, x_n$), where each observation is a d-dimensional real vector, k-means clustering aims to partition the n observations into k sets $S = \{S_1, S_2, \dots, S_k\}$, where $k \leq n$ so as to minimize the within-cluster sum of squares [5]:

$$\arg \min_s \sum_{i=1}^k \sum_{X_j \in S_i} \|x_j - u_i\|^2 \quad (1)$$

Where u_i is the mean of points in S_i .

In this study, the data is the pixel RGB value in the image. The program calculates the distance between any pixel to the cluster center, and puts each pixel into the closest cluster center. Multiple calculations get the corresponding cluster center until the cluster center no longer change, then the system outputs the results of extraction [6].

There are 4 basic procedures in morphology, which are given as follows: expansion, erosion, opening and closing. Mathematical morphology was essentially designed for binary images, later it is continued to grayscale activity and images [7]. Corrosion can make the target area "smaller", and its essence is to cause the boundary of the image to shrink. Expansion make the target area "bigger", merge the background points in contact with the target area into the target object, expand the target boundary outward. These two changes only occur at the edges, the one offset another image to extract the edge, so we can get the line elements by noise elimination, expansion, corrosion, etc (**Table 1**).

Table 1. Partial extracted pattern and line images.

Types	A	B	C	D	E
Original images					
Pattern images					
Line images					

Images recognized by human vision are generally presented as RGB mode true colour images, which are respectively represented by components in R, G and B directions. In theory, 224 color distributions can be arranged, and each pixel component is assigned a value within [0,255] and used to express brightness [8]. Although this space can't use Euclidean distance to calculate color difference, and it is sensitive to illumination, which is not enough for colour processing [9]. However, most image acquisition hardware and design software use this space to represent colours [10], and when designers design through computer design software, they can intuitively refer to the colour matching of the paintings and modify the colours of design works, thus realizing the expression and redesign of colours in YWNY paintings as shown in **Figure 3**. **Figure 4** is the extraction interface of colour.

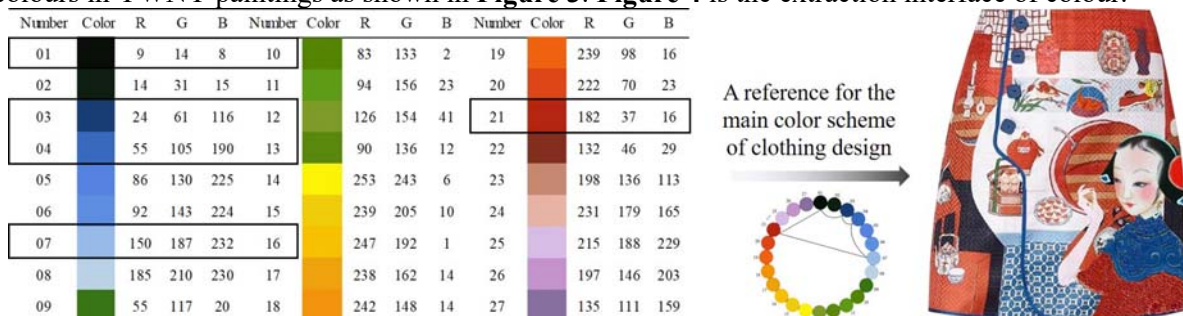


Figure 3. The example of color storage and color scheme application.

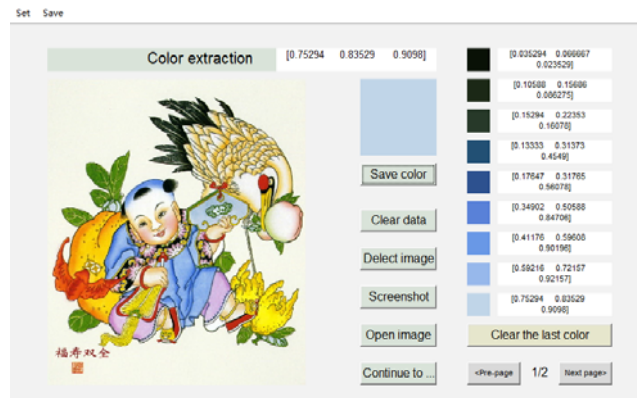


Figure 4. Color extraction interface.

4. Design and Application

These extracted classical pattern elements can be utilized efficiently as inspiration elements in fashion clothing, graphic design, packaging design and poster design. In this way, through the visual or invisible communication of modern brands and culture, the younger generation has a deeper understanding and sincere love for cultural heritage and traditional cultural heritage. The extraction, reorganization and application of cultural elements is a combination of comprehensive skills based on the perception of image information, the analysis of fashion trends and the eruption of design inspiration. Therefore, we extract elements from the collected YWNY paintings and classify them manually, and build an element database to provide materials for designers.

From the perspective of fashion design, this work integrates the extracted elements with women's clothing as shown in **Figure 5**. The main methods are as follows: a) Traditional patterns in

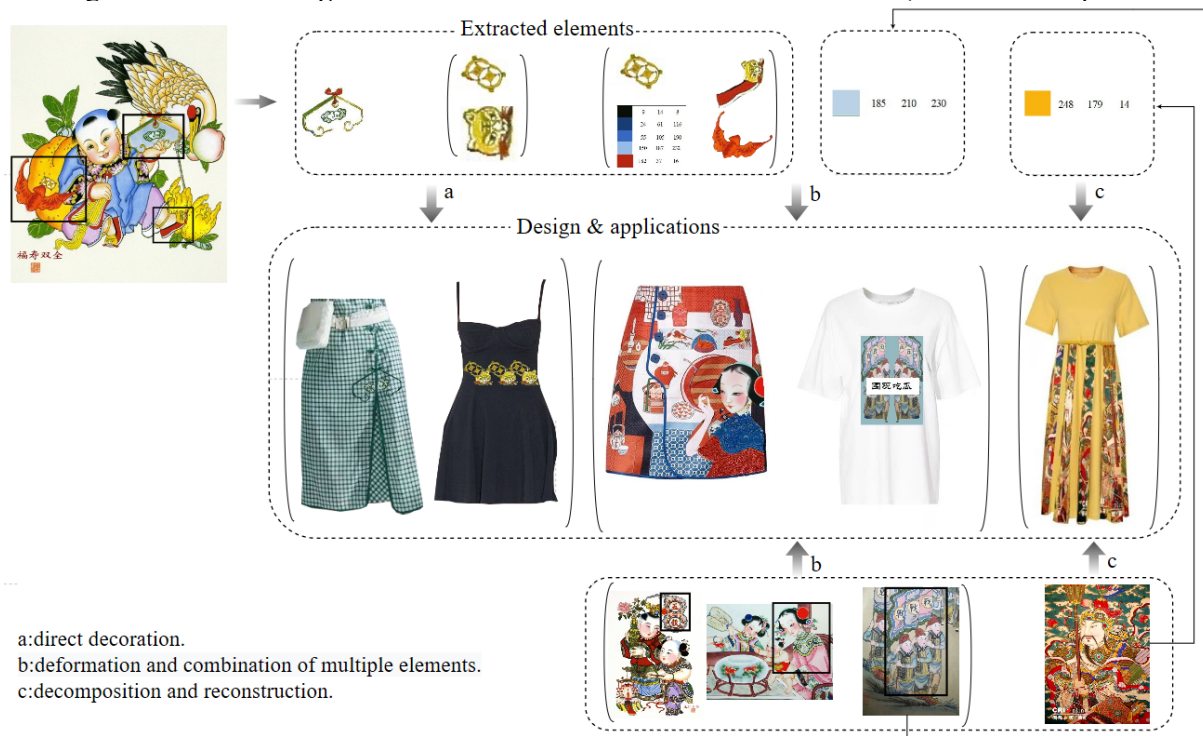


Figure 5. Application of the feature elements in women's clothing design².

² Partial images courtesy of <https://jx.tmall.com>.

combination with embroidery and other clothing crafts are applied to the clothing by the mean of partial decoration. b) Based on the colour scheme in YWNY paintings and modern aesthetics, on the one hand, the appropriate patterns are re-colored and added to the garment, on the other hand, the combination of patterns and modern network terms are designed to decorate the clothing with hot stamping pictures. c) According to the clothing style and the color hue in the paintings, on the basis of not changing the original paintings, YWNY paintings are cut and added to the garment.

5. Conclusion and Prospect

YWNY paintings inherit and absorb the traditional art forms of several dynasties, which is the epitome of history, culture and development since hundreds of years. People have been exploring effective ways to protect and inherit the paintings. This paper transforms intangible assets of YWNY paintings into tangible clothing through creative design, and transforms their potential economic value into business opportunities, which gives them the opportunity to feed back their own survival and development. Therefore, it is of great significance to turn YWNY paintings into modern fashion design products that can be accepted by modern people.

In this paper, our main works are as follows: 1) build the image database of YWNY paintings, and classify them according to the theme of the paintings, 2) extract feature elements such as patterns and colors based on K-means and morphology, and 3) enumerate the applications of several YWNY paintings in women's clothing by manual design. The limitations of this work are the extraction accuracy of the extraction system, the automatic degree of the process, and the applicable range of elements. In addition to improving the accuracy and automation, our future work is to expand continuously the database of YWNY paintings and establish an application system based on the image extraction system and element storage system of YWNY paintings. The system will be composed of different application modules including clothing, printable handicrafts, virtual exhibition hall, game animation and so on. In addition, the system can be further combined with other emerging technologies and applied to the design of daily necessities with national style and economic value.

Acknowledgments

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References

- [1] Zhang X and Yang Z C 2016 *J. Packag Eng.* **37**(18) 44-8
- [2] Zhu D 2018 *J. Art Mag.* (04) 134-5
- [3] Yin Y D 2014 *J. Art.* **11** 67-8
- [4] Lei H Y 2014 *3rd IEEE Int. Conf. on Cloud Computing and Intelligence Systems (China)* ed H Ma and W Wang et al (New York: IEEE) pp 277-81
- [5] Zheng X M and Liu N Z 2012 *IEEE Int. Conf. on Intelligent Control, Automatic Detection and high-end Equipment (Beijing)* ed P Cao and X Niu (New York: IEEE Computer Society) pp 49-53
- [6] Cong S A and Wang X X 2018 *J. Electron Technol Softw Eng.* **17** 155-6
- [7] Jacintha V and Karthikeyan S 2019 *Proc. of the 2019 IEEE Int. Conf. on Communication and Signal Processing* (New York: IEEE) pp 801-5
- [8] Li J, Jiang N, Bao Y B T, Zhang F, Zhang W J and Wang W 2020 *J. Jilin Univ (Sci Edit).* **58**(03) 627-33
- [9] Ong S H, Yeo N C, Lee K H, Venkatesh Y V and Cao D M 2002 *J. Image Vis Comput.* **20** 279-89
- [10] Garcia L F, Cervantes J, Lopez C A and Ruiz C S 2020 *J. Multimed. Tools Appl.* **79** 1555-84