Folk Paper-cutting Patterns in Visual Art

Weijie Liu

Weifang University, Shandong, China

xurx@wfu.edu.cn

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Abstract: Chinese folk paper-cutting is the crystallization of the wisdom of the working people, and a cultural treasure that has been passed down from ancient times to generations. This article mainly studies the design style changes of folk paper-cut patterns under the influence of visual art. Before proceeding to the pattern transfer mode, it is necessary to preprocess the most similar paper cuts in the input image and paper cut library. After drawing the paper-cut outline, extract the appropriate pattern from the pattern library and embed it in the paper-cut image according to the characteristics of the folk paper-cut. At the same time, the position and direction of the pattern need to be determined. Finally, pattern recognition is performed. Binarize the image by closed value segmentation, clearly distinguishing background and object. Use four adjacent edge detection algorithms to obtain the edges of the image. By tracking the edge of the image, adjust the coordinates in a counterclockwise or clockwise direction in pixels and save them. The data shows that the algorithm used in the experiment has a good discrimination effect for different types of patterns. Its total recognition rate is 91.06%. The results show that the multi-scale attributes of wavelet moments not only have the overall characteristics of the image, but also have local characteristics, so as to better characterize the difference in image details, and the recognition rate is higher when identifying similar objects.

1. Introduction

Known as "window cut", the paper-cut is mainly cut, carved and cut. Paper cut art has a long history. The prototype of this art form existed long before paper was invented. Folk paper cutting is the embodiment of the common belief of most people, and it is a kind of behavior handed down from generation to generation. People not only cherish the memory of their ancestors, but also express their desire for a better life through the experience of paper-cut paintings every year. As a symbol of folk custom, paper-cut painting is an art form reflecting national spirit, moral tradition and national unity.

Folk paper-cutting is an important part of human culture and art history. The research of folk paper-cutting is of great significance for spreading the knowledge of folk paper-cutting and the theoretical guidance of national and world culture. Not only can it improve the fine folk culture of the Chinese people, but it can also summarize the reasons for the further development of paper-cutting. In addition, it has reference significance for the development of other design arts, and has a certain social function and practical value. Folk paper-cutting is influenced by social customs, production, politics, religion and other fields, forming its own living space, thus forming the fossils of traditional Chinese philosophy, aesthetics, and folklore.

Visual art is the way of thinking of designers for artistic creation. Kim K believes that flocking is a theoretical model. He simulates the collective behavior of animals such as birds or fish, and each entity moves according to the behavioral rules of separation, cohesion, and arrangement. This planting cashmere is mainly used in virtual reality game content or artificial intelligence, and network formation theory. His research aims to explain flocking from the perspective of visual art design elements (including unity, diversity and rhythm). To this end, he realizes flocking through variable control and user interaction (including separation, cohesion, and arrangement of entity behavior rules). Although his research can explain flocking from multiple angles, it lacks necessary data [1]. Aprotosoaie-Iftimi believes that visual arts courses should allow various activities to develop children's imagination and creativity, and provide a balanced framework for the harmonious development of people who can cope with the large number of images that infringe our daily lives. He believes that contemporary art has developed a new language. So far, this language is still unknown to most of the public and has not been included in the art curriculum. Although his research has a certain reference in theory, it is not comprehensive [2]. Harman V reflects on the use of visual art studios in interdisciplinary feminist projects, focusing on the interaction between participants, between participants and researchers, and the cultural and institutional structures that influence research and the images produced. He uses the feminist "giving voice" as an analytical tool. Although his research direction is correct, it is not accurate enough [3]. Cypher believes that the study of visual art based on practice is a field where the role of non-human actors in the creative process is unwittingly realized. Usually, this relationship is described in terms of the artist's skillful manipulation of objects and materials and the symbolic interpretation of these actions. He uses an actor network approach to advocate reconsidering non-human actors as important collaborators, and explores how this relationship undermines the assumption of artistic control. Finally, he described how to generate intention, motivation and knowledge in these key relationships. His research feasibility is not strong [4].

On the basis of visual art, this paper studies the design of cutting patterns of folk paper-cut. Emotional language is added to the design of dynamic graphics, which improves the affinity and artistry of paper-cut works. In this paper, taking folk paper-cut as the object, a series of innovative paper-cut patterns are designed. The patterns are embodied into visual art, which promotes the development and inheritance of folk art paper art, and creates a new design path of visual art culture. Paper cutting art reflects people's early aesthetic concept and spiritual quality. It is created by people in order to meet their spiritual needs. It has clear artistic characteristics and interest in life.

2. Folk Paper-Cut and Visual Art

2.1. Folk Paper-Cutting Art

Compared with other handicrafts, the material tools for paper-cutting are the simplest. It is mainly composed of paper, scissors and carving knife. Thanks to these tools, paper-cutting has its

own characteristics. Paper-cutting has a rustic and exaggerated beauty. It is characterized by highly generalizing images, choosing exaggerated actions and scenes to reveal the psychological state of objects, emphasizing their structural relationships, and creating decorative artistic images. Simple shapes, clever conceptual and imaginative artistic ideas, concise structure and clear and vivid colors are the important characteristics of paper-cutting. In today's rapid exchange of information, people pay more attention to material life, and the soil and conditions that rely on folk art for survival are gradually disappearing. Paper cutting is also moving away from the lives of modern people [5].

As an art form, it is necessary for us to objectively understand the value of paper-cutting art, convey its essence, and then combine modern art forms with traditional paper-cutting to create new art with Chinese characteristics. At the same time, artists engaged in paper-cutting need to continuously improve the timeliness of paper-cutting art. Therefore, the traditional paper-cutting art will exude a vibrant brilliance and become a work of art that decorates the lives of modern people. The principle of color application using high-purity complementary color contrast is the main tendency of color paper cutting. The role of contrast in aesthetics is obvious. People like colors and often like colors of a certain purity. The contrast of different color purity can meet people's different aesthetic requirements for colors. This intuitively shows the characteristics of the Chinese people's perceptual thinking [6].

2.2. Paper Cut Patterns

The preprocessing of paper-cut patterns is an important part of pattern recognition and classification. In the process of collecting paper-cut images, due to problems with books, machines, etc, a certain degree of noise pollution, the image becomes blurred, and post-processing becomes difficult. The purpose of preprocessing is to improve the quality of paper-cut images, remove noise, restore useful actual information, improve the detection possibilities of related information, greatly simplify data, and improve the accuracy of feature extraction, image segmentation, matching and recognition [7].

The interior decorative patterns of paper-cutting can be roughly divided into the following categories.

(1) Zigzag pattern is also called tooth pattern, burr, etc. It is widely used in paper-cutting art, especially animal paper-cutting. It is often used as the main pattern and is one of the most representative patterns.

(2) A single tooth protrudes one tooth in a semicircular pattern. The tooth pattern is generally used to decorate fish, birds, etc., arranged in an orderly shape, can produce a very beautiful effect.

(3) The willow leaf pattern is mostly used for bird decoration, the visual effect is very good, and it is freer than the zigzag pattern [8].

According to the functions and characteristics of patterns, ornaments can be divided into four types: basic structural patterns, characteristic patterns, specific patterns and decorative patterns. These four patterns constitute the pattern library. Through the pattern library, you can use these patterns to create and generate computer paper-cut images. The basic pattern is used to construct the outline of the paper-cut image. In addition to the basic structure of the pattern, there are also reflecting the characteristics of the object pattern. They make complicated things and unchangeable natural scenery orderly and concretely. The most decorative patterns reflected in mammals are crescent, serrated and wheel patterns [9].

Patterns are used in different positions in paper-cut images. When the pattern is generated by computer, the parameters are controlled, and the length, thickness, angle and curvature can be

changed according to the user's needs. In the design, the range of pattern is determined to determine whether the pattern does not intersect, so as to improve the calculation efficiency. When the pattern is zoomed in or out, the range should be changed accordingly. First, the images are collected on the computer, and then the data is collected. The purpose of the sensor is to store it in a computer and convert it into a digital signal that can be processed. Each paper pattern is connected to the paper cut base. Since the outline of a pattern is usually drawn by multiple curves, the connectivity of the pattern can be achieved by controlling the drawing method of each curve and the filling method inside the curve [10-11].

The paper texture image is used as the foreground image F, and the color paper cutting effect generated by the system is used as the background image B. The fusion image can be smoothly transferred from the image area F to B, that is to say, periodic changes can be generated on the boundary of the composite image region. All pixels in the region contain information from background image B and information from composite image F. Therefore, a bitmap canceller B can be generated, and the image pixels before synthesis will be saved in B. The F-layer represents the composite image, and the composite image area is the image area changed after the original image is synthesized. In this way, layer F contains the information after image change, and layer B contains information before image change. By setting the fusion parameters, the pixels corresponding to two levels can be fused to obtain the effect of image fusion [12]. After calculation, in order to realize the fusion algorithm, all pixel values will be written into the corresponding position of layer F. The paper texture image is used as the foreground image F. The pixel value is represented by the function F (x, y). The background B is the cutting pattern of the dyed paper drawn by the system. The pixel value is represented by the function B (x, y), and the function H (x, y) represents the pixel value of the fusion image. Select the N*N rectangular area as the image fusion area. In this area, spatial point processing is applied from the center of the area to the outside. Calculate all pixels, and then gradually transition the pixel values from the original background image to the composite image [13]. Set the image fusion function to satisfy the following relationship:

$$H(x, y) = K \times D(x, y)[f(x, y) - B(x, y)] + B(x, y) \tag{1}$$

The constant K is the fusion coefficient that determines the step length of the fusion algorithm. D (x, y) is a coefficient related to the position coordinate, which determines the method of gradual image change. The formula is:

$$D(x, y) = \sqrt{(x - m_x)^2 + (y - m_y)^2} \tag{2}$$

Among them, (m_x, m_y) is the center coordinate of the rectangular area. The change weight of layer F relative to layer B gradually increases as the distance increases. In other words, the background image will gradually be converted into the foreground image. The difference between F (x, y) and B (x, y) is the offset of the pixel value of the new image after synthesis relative to the pixel value of the image before synthesis. When the pixel value before and after synthesis does not change, the pixel value before and after processing does not change. If the pixel value after synthesis changes, the pixel value after fusion will also change [14-15].

2.3. Visual Arts

Visual art is art that uses specific material materials to create intuitive forms. It includes movies,

television, graphic design, merchandise design and other types of art that can be visually communicated. Visual art is a kind of feeling, namely plastic art, which mainly expresses three-dimensional or flat forms. It not only greatly improves the creative efficiency of artists, but also provides artists with infinite possibilities of artistic expression, enabling them to transcend the physical constraints of physical media and achieve more free artistic creation [16]. For example, the digitization of traditional painting art, online literature and so on. Traditional art continues to evolve with the participation of digital media, which promotes the progress of traditional art. The unique visual thinking mode of paper-cutting art stimulates the creative inspiration of modern design. When traditional folk paper cutters transform their visual perception into graphic symbols, they reconstruct and construct the order of reality according to their inner desires, and rationalize them into visual forms [17]. At the same time, the traditional folk-art silhouette emphasizes the natural beauty of the material itself from an artistic point of view. The natural ecological concept of using natural materials is also a new inspiration for modern design from traditional folk silhouettes. By refining the elements of traditional folk paper-cut styles, this kind of packaging art is the artist's pursuit of natural creation, advocating the beauty of materials, craftsmanship, and the rules of natural beauty, and it also pays attention to the exchange of ideas between people and things [18].

3. Paper-Cut Pattern Recognition Experiment

3.1. Image Preprocessing

Before the transfer mode, it is necessary to preprocess the input image and the paper cut that is most similar to the input image in the paper cut library. The image preprocessing is mainly divided into three steps. First extract the target object from the natural image, and then perform the image hierarchical division of the target object to obtain the boundary intensity map of the target object, and retrieve the highest similarity from the paper-cut library through contour matching [19]. The preprocessing of the cut picture is modeled by a digital model. The filter mask value determines the subsequent recognition effect. Different images have different filtering thresholds and have different effects. In order to determine the filter threshold of the wavelet coefficients, the average value of the wavelet coefficients is usually used. Assume that the average value of the wavelet coefficients is E. After several experiments, the threshold was set to E/3. Keep the coefficients larger than the wavelet coefficient threshold in the coefficients, and set the coefficients smaller than the threshold to 0 [20].

3.2. Establishment of Pattern Library

The method of creating an independent pattern database mainly includes: First, extract the basic characteristic symbols from the existing paper-cut patterns. After that, in the two-dimensional graph, perform Boolean operations such as intersection, connection, and difference to obtain a new graph. The diversity of decorative patterns determines the diversity of paper-cut images [21].

(1) Types of patterns: After drawing the outline of the paper-cut, appropriate patterns need to be extracted from the pattern library and embedded in the paper-cut according to the characteristics of the paper-cut. The patterns on the folk paper-cut patterns are very flexible and can be changed. The same paper-cut image decorated with different patterns will produce different artistic interests and inner meanings [22].

(2) The position of the pattern: First, determine the range of the quadrangle according to the contour of the face, and then determine the position of the eyes according to the quadrangle. Eyes

are usually located in half of the contour of the entire face, and the embedding positions of other facial features can be determined based on the contours of eyes and face. The position where the decorative pattern is embedded in the body is the position of the central axis point of the body contour [23].

(3) The direction of the pattern: The central axis of the profile of the horns is composed of several line segments connecting the central axis points. Connect the points in the center of the pattern to form a new polygonal segment. The direction of the angle bisector of two adjacent polygonal segments is the direction of the embedded zigzag pattern. The direction of the eye needs to set the angle range θ, and the direction of the eye is controlled by this angle [24].

3.3. Pattern Recognition

The basic idea of SVM algorithm is to find the best classification function of two linear separable classification problems, separate the two samples as much as possible, and maximize the gap between the two types. For non-linear separable case, the input space will be transformed into high-dimensional feature space by using nonlinear mapping function, and the optimal linear classification surface will be established in the new space. The kernel function uses the function of the input space, even if it does not know the specific form of the mapping, it can also realize the inner product operation of the feature space. In order to eliminate the influence of specific value decomposition on singular value amplitude recognition caused by image scale change, the feature vector is normalized, and the relative size of singular value is not changed in the normalization process [25-26].

First, physical devices such as scanners and digital cameras are used to obtain images. In the process of image acquisition, transmission and reception, there is a risk of noise at each step, which leads to image quality degradation. The noise is eliminated by average filtering, and the image is binarized by closed value segmentation to distinguish background and object. Four neighborhood edge detection algorithm is used to get the edge of the image. By tracking the edge of the image, the edge arranges the coordinates by the pixel anticlockwise or clockwise and stores it. In order to reduce the number of edge points and improve the speed of image processing, the key points of edge can be extracted. That is to say, the corner points and non-linear points of the image are kept, and the points on the straight line are discarded. The figure is reconstructed according to the extracted corner points. Finally, spatial paper-cut graphics are obtained. After that, the lighting model was added to the space paper-cut graphics, and various parameter settings were used to make the graphics more beautiful and stereoscopic [27-28].

4. Analysis of the Interaction between Paper-Cut Patterns and Visual Art

4.1. Analysis of Pattern Recognition Effect

After SVD of two-dimensional images, singular values are arranged in order of magnitude. Singular values reflect the energy distribution of the matrix. The larger the singular value, the greater the proportion of its corresponding components in the matrix, reflecting the contour information of the image; the smaller the singular value, the smaller the proportion, and the corresponding components reflect the details of the image. Therefore, the dimension of r-dimensional eigenvector can be reduced again, and the dimension of feature vector can be reduced by removing small singular value and filtering noise. Let the contribution rate of the former n-dimensional singular values = the sum of the former n-dimensional singular values / the sum of

all singular values. The contribution rate of singular values of the first ten dimensions is more than 90%, and the image details corresponding to the smaller singular values have less influence on the distance classifier. Here, we use the singular values of the first ten dimensions as the final feature vector. The feature vectors of patterns are shown in Table 1 and Figure 1. It can be seen that although some of the same kind of patterns have great differences, the extracted feature vectors are very similar, and the numerical value fluctuation is not large. The difference between the feature vectors of different kinds of patterns is large, which indicates that the nine-dimensional feature vector can be used as the recognition feature of paper-cut patterns.

Table 1. Feature vector of pattern

| Single tooth pattern	0.5994	0.2313	0.1752	0.1083	0.08405	0.07429	0.0515	0.02967	0.02385
Petal pattern	0.5752	0.3029	0.2122	0.1423	0.12776	0.09524	0.08051	0.07219	0.03350
Jagged	0.6021	0.3605	0.1868	0.1224	0.10889	0.08709	0.08343	0.06633	0.04666
Willow pattern	0.6379	0.3864	0.2297	0.1592	0.14453	0.10S36	0.07932	0.05593	0.05334
Longevity pattern	0.5202	0.4718	0.2372	0.1593	0.12199	0.10875	0.09023	0.08027	0.06740
Long pattern	0.3933	0.3004	0.2792	0.1453	0.1053	0.07014	0.0547	0.0436	0.03749
Flower pattern	0.4629	0.2571	0.2059	0.1967	0.15903	0.12657	0.12434	0.10208	0.08424
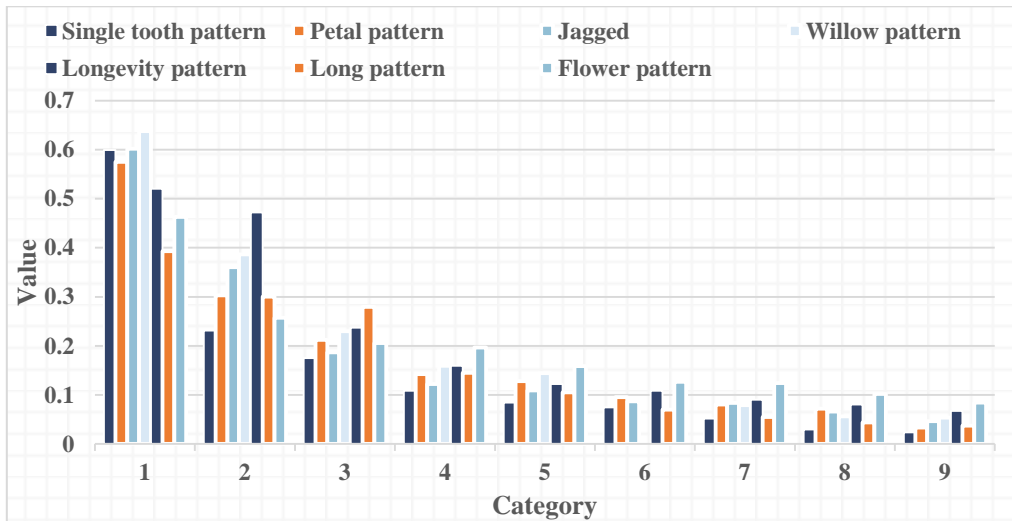
Figure 1. Feature vector of pattern

Use the nearest neighbor classifier for classification. The recognition results are shown in Table 2. According to the above table, it can be seen that it has a good recognition effect for different types of patterns. The total recognition rate is 91.06%. Compared with the traditional recognition method, the wavelet transform and singular value decomposition are combined to recognize the paper-cut pattern. In image processing, singular value decomposition is an effective algebraic feature extraction method, and singular value represents the algebraic features of the image, which has algebraic and geometric invariance. The stability, transposition, translation, rotation and other invariance of the singular values obtained by the image decomposition, make it very suitable to be the characteristics of the image. The multi-scale analysis of wavelet can provide time scale information of any resolution. The singular values extracted after wavelet transformation reflect the image features at different scales. On the one hand, the original feature space is reduced in dimension, and on the other hand, it is effectively removed. To avoid the interference of noise, it is

convenient for the classifier to classify it.

Table 2. Recognition results

Pattern type	Single tooth pattern	Petal pattern	Zigzag pattern	Willow leaf pattern	Disc long pattern	Longevity pattern	Flower pattern
Recognition rate	92.5%	94%	87.179%	89.286%	85%	100%	88.889%

4.2. Application of Folk Paper-Cut Patterns in Visual Art

The art of paper-cutting belongs to the category of plane modeling. The connected lines, highly generalized, highly concise hollow shapes and bright colors form the unique artistic temperament of paper-cutting. The reason for these characteristics is that the creation group of ancient paper-cutting art is mainly the folk working class, limited by the production tools and materials; they can only use the simplest way to portray objects. Over time, the paper-cutting art has formed the characteristics of highly generalized and highly concise plastic art. Paper-cutting strives to achieve perfection in terms of artistic modeling, and has the inherent artistic essence of perfection, perfection, beauty, beauty and harmony. This is an important part of Chinese artistic thinking. Due to the limitations of tools and materials, when dealing with paper-cut images, it is necessary to grasp the characteristics of the object and to connect the lines naturally. Therefore, paper-cutting artists are accustomed to using their own observation, analysis and imagination to depict images, rather than adopting naturalistic realistic techniques. As shown in the original artistic modeling, the image of a person or animal, whether it is front or side, must show its hands, feet, eyes and ears together on the screen. In terms of technique, the positive pattern of paper-cutting must be connected by lines, and the negative pattern of paper-cutting must be intersected, forming a model structure that is unstoppable and constant cutting—this is also an important feature of the art of paper-cutting. Although the shape is exaggerated and deformed, it also makes the pattern constitute some rules of the beauty of the form, such as symmetry, uniformity, balance, combination, and continuity.
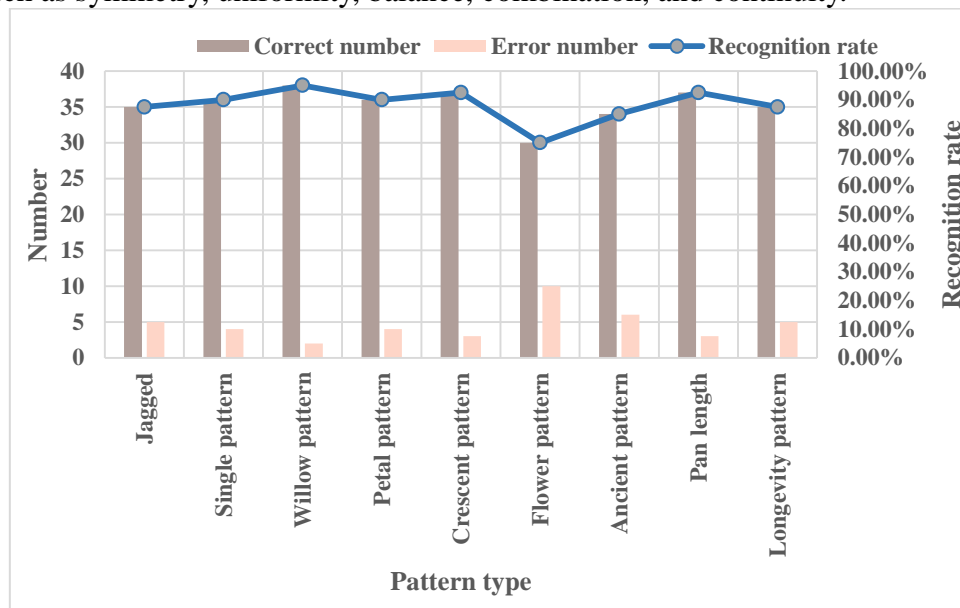

Figure 2. Recognition rate

Abstract graphics and text are the basic and main visual elements that make up a dynamic design. Then, if you want to create beautiful dynamics when designing, they must combine the concept of time and abide by the laws of nature and the laws of formal beauty. The generation of dynamics is closely related to the laws of nature. Gravity, buoyancy, rebound, etc. belong to the laws of nature. Dynamic design that abides by the laws of nature is a reasonable design. Dynamic graphic design is inseparable from the law of formal beauty. It adjusts abstract graphics and text through the rules of size and density, rhythm and rhythm, contrast and virtual reality, symmetry and balance. They are independent and complementary to each other, aiming to improve the design. The content expressed in the work is clearly and clearly conveyed to the viewer, and the viewer can get their own unique feelings from it. In visual communication design, graphics have static and dynamic forms. Static graphics can present a dynamic trend. Dynamic graphics are composed of static graphics at a certain point in time. Static graphics can be displaced or zoomed on the time axis. After the change, the graphics have the dynamic is the dynamic graphics. The law of plane composition still applies to dynamic graphics. Therefore, the time dimension has become the biggest difference between the two. Select the first 30 images of each category in the pattern library, a total of more than 300 patterns are used as training samples for training, and the recognition rate is shown in Figure 2. It can be seen from the figure that the recognition rate of the willow pattern is the highest, and the difference between the obtained feature and other patterns is the largest, so the error rate is low. Because of the variety of patterns, many patterns are less similar, and patterns such as ancient money patterns have some similarities with them, so the recognition rate is low. The total recognition rate can reach 88.33%, and the overall effect is relatively satisfactory.

4.3. Characteristic Analysis of Paper-Cut Patterns

Chinese traditional folk paper-cut is a kind of national art and the image representative of national personality culture. It is lyrical, simple and easy to make, but it has rich connotation that shakes the soul. However, in the current development process, the traditional folk paper-cut art is facing many restrictive factors. In addition, the living space of Chinese traditional folk paper-cut in contemporary society, that is, the social recognition of paper-cut art and market expansion, needs us to face in time, and take effective measures to make it develop healthily. This requires us to look at things from the perspective of development and create the Chinese paper-cut art with the characteristics of the times with the new thinking of the times. In view of the influence of the number of neurons in the hidden layer on the number of training times, this paper makes a comparative experiment on the number of different neurons. Because of the randomness of neural network, each kind of hidden layer neuron is trained many times. During the experiment, when the number of neurons in the hidden layer is less than or greater than, the recognition rate decreases significantly. The recognition rate and training times are shown in Figure 3. Combined with training times and recognition rate, it is not difficult to find that when the number of hidden layer neurons is 7, the network training speed and recognition effect are the best. In order to combine the image with the paper-cut to produce a pattern which is not only in line with the vividness of the image content but also with the artistic characteristics of the paper-cut, it is necessary to preprocess the image first, and then to segment the target object into paper-cut from the whole image, and then focus on the target object. The paper-cut pattern has the characteristics of clear and regular geometric structure. In order to transform the object in the image into a paper-cut with certain similarity, it is necessary to extract the spatial structure characteristics of the target object by using image hierarchical segmentation technology.

When there are several BBM vectors with large direction difference in the neighborhood of a local region, the amplitude of the BBM vector obtained by the pixel is relatively small, which indicates that the boundary direction of the local region is fuzzy, which leads to the weakening of its role in the subsequent matching. Paper cutting art belongs to the plane modeling category. The unique artistic temperament of paper-cut is formed by the hollow shape and bright color of the line connected, highly generalized and highly concise. The reason for these characteristics is that the creative groups of ancient paper-cut art are mainly the folk working class. Limited by the production tools and materials, they can only use the simplest way to depict objects. Over time, the paper-cut art is highly generalized and highly concise. The paper-cut strives to achieve perfection from the artistic modeling, which has the inherent artistic essence of perfection, satisfaction, beauty, beauty and harmony. This is an important part of Chinese artistic thinking. Due to the limitation of tools and materials, when dealing with paper-cut images, we should not only grasp the characteristics of objects, but also make the lines connect naturally. Therefore, people in the art of paper-cut are used to using their own observation, analysis and imagination to depict the image, instead of adopting naturalistic realism. As shown in the original art modeling, the images of people or animals, no matter in front or in the side, will display their hands, feet, eyes and ears together on the screen.

Figure 3. Recognition rate and training times

4.4. Influence of Folk Paper-Cutting on Visual Art

Design is different from pure art, it is produced to better meet people's actual life needs. With the development of the global economy and the continuous enrichment of materials, people's needs are gradually refined. One of the important manifestations is the emergence of the emerging design industry. For example, on the basis of traditional design categories such as dyeing, weaving and ceramics, many new design categories such as modern clothing design and modern toy design have emerged. Combining the traditional Chinese folk art of paper-cutting with different design fields is like injecting fresh blood into the traditional Chinese paper-cutting art, thereby creating more design

works with paper-cutting characteristics. The decorative form of paper-cutting is restricted by the plane form, paper craftsmanship and other materials. It pays attention to the contour characteristics of the shape. Its shape is concise and exaggerated, emphasizing the transmission of the big dynamics, while ignoring the complicated details. The structure and decorative details of the image rely on hollow skills. Zigzag is the unique modeling language of paper-cutting. The decorative graphics represented by the shape are exaggerated and the decorative expression is transparent. It is often tangible in shape and floral in flower. The paper is mostly red, green, and gold according to the needs, and the graphics are filled with different atmospheres. The communication method of the art of paper-cutting is mainly based on the connection of the image in the content, using a large number of combinations, and reasonably exaggerating and deforming the shape, thus showing the artistic beauty of the pattern form. Among them, symmetry, balance, repetition, and emission are the most commonly used methods in the paper-cut pattern form. In these methods, the elements of plane composition are used to varying degrees. There are many interlinkages between the intentional modeling of folk paper-cutting and modern graphic design. The conveying method of folk paper-cutting contains this rich graphic design element, and modern graphic design can also learn from the art of paper-cutting to enrich and expand its own conveying methods.

Visual art is a kind of plastic art that can be appreciated from the perspective of human beings, including painting, sculpture, architecture, practical decorative art, etc. It uses a certain amount of material, modeling means is also rich and diverse; there are two-dimensional plane paintings and three-dimensional sculpture and architecture and other art forms. In the visual art of architecture and painting, the formal beauty of symbol form is influenced by many factors such as regional human geographical environment, social form consciousness, ideological culture, etc., thus showing different characteristics. The simplified design method is to extract a part of the design as the design center, simplify the pattern design, extract the essence and discard the dregs, simplify the processing, design the essence of the left pattern, and design the new pattern with thought. The characteristics of simplified design are to reduce the complexity and complexity of traditional patterns, highlight the focus of expression, improve the functionality and wearability of patterns in fashion design, and make it easy to process and produce. The existence of everything follows the law. The artistic value of folk paper-cut works is because it follows the law of balance and symmetry, order and repetition in composition principle and expression form, and conveys the unique charm style and formal beauty of paper-cut art. The art form of folk paper-cut is a kind of rational and subjective thinking activity for the creator to design new patterns according to the formal rules of beauty. A good work can be handed down to this day, and its inherent formal beauty is very important. The composition structure with symmetrical characteristics will present a stable visual effect. This balanced and symmetrical composition is one of the important rules of formal beauty. The results of six geometric features of the same kind of pattern and its deformation pattern are shown in Figure 4. It can be seen from these six feature quantities that the six feature quantities of pictures a, b and c are completely equal, indicating that the features are translational and rotation invariant. There are differences in the feature quantities of d, e and f, but the difference is not big, indicating that they are the same type of patterns. The combination of visual art and geometry is not a momentary idea of some artists to be unconventional, but a historical necessity of the development and integration of disciplines. The times are developing, geometry and visual arts are also evolving on their own tracks. Whenever the two crosses over on the road of development, they will inevitably shine brightly. Visual thinking is not without benefit for an open-minded artist. It can make him appreciate mathematical forms and produce art forms.
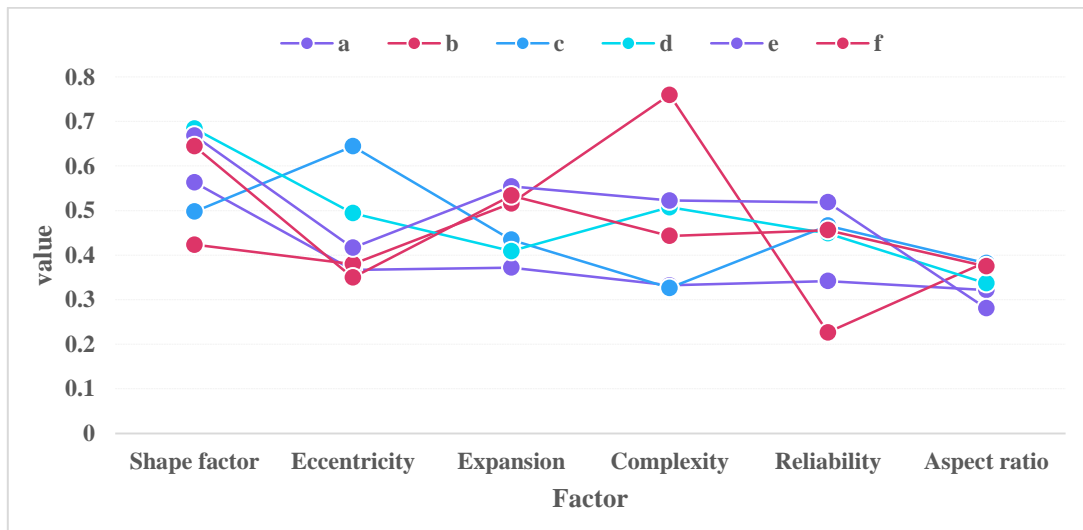
Figure 4. Results of six geometric features of similar patterns and their deformed pattern images

5. Conclusion

This article mainly studies the design tendency of folk paper-cut patterns under visual art. With its broadest mass character, paper-cutting is deeply rooted in the soil of our nation. It is one of the richest historical connotations and one of the most representative national art forms. Analyzing the distinctive artistic characteristics of paper-cutting from the three aspects of folk paper-cut themes and their titles: implication and high generalization, simplicity, subjective image modeling and composition characteristics, and morphological decoration characteristics, reflecting the unconscious formation of the working people Aesthetic consensus.

With the development of today's visual art, its art language can be said to be very perfect, has formed a relatively stable system. The artist must perform within the scope of vision, in which case one can imagine the artist's creative achievements. In the process of the rapid development of modern society and modern culture, artists who only rely on vision cannot see the whole world, let alone show it. Therefore, visual art is bound to need a new interpretation and definition of its own language system, way of speaking, and forms of expression. Paper cut art has a long history of development, is a traditional folk art, with rich artistic significance, reflecting people's expectations for a better life. The creation and development of paper-cut art not only laid a foundation for the dissemination and inheritance of excellent folk culture, but also provided an effective way for modern all walks of life to derive better creative themes, ideas and means of realization.

Through practice, we have designed a series of original designs related to Chinese folk paper-cut elements used in modern design, covering two categories: graphic design and industrial design. In the design, the pattern should be repeatedly considered and designed, and the style design should be a unique folk style. Under the purpose of having the characteristics of folk paper-cutting, the shape is beautiful and in line with the aesthetic needs of modern people. The works with folk characteristics are more prominent than the current cookie-cutter works, achieving the original design purpose. In the continuous development and innovation of public visual art, dynamic graphic emotional language is a part of public visual transmission art. With its unique charm, the development of visual transmission design is becoming more and more diversified and comprehensive. Through the dynamic graphics designed by the paper-cut works, people can experience the feelings of the theme of the work, and can also generate emotional resonance.

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Conflict of Interest

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