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Image Retrieval by Fusion of Color Histogram and Edge Orientation Histogram and wavelets

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ABSTRACT

It has very important practical significance to analyze and research minority costume from the perspective of computer vision for minority culture protection and inheritance. As first exploration in minority costume image retrieval, this paper proposed a novel image feature representation method to describe the rich information of minority costume image. Firstly, the color histogram and edge orientation histogram are calculated for divided sub-blocks of minority costume image. Then, the final feature vector for minority costume image is formed by effective fusion of color histogram and edge orientation histogram. Finally, the improved Canberra distance is introduced to measure the similarity between query image and retrieval image. We have evaluated the performances of the proposed algorithm on self-build minority costume image dataset, and the experimental results show that our method can effectively express the integrated feature of minority costume images, including color, texture, shape and spatial information. Compared with some conventional methods, our method has higher and stable retrieval accuracy.

I. INTRODUCTION

China is a country consisting of 56 ethnic groups, and each of them has its own apparel style with distinct ethnic characteristics, due to the influence of different culture, traditions, and geographical feature. The minority costume is the important symbol of the ethnic group identification and the precious wealth of the Chinese nation. However, with the acceleration of global economic and political integration in China, various minority costume cultural traditions have been rapidly disappearing. This prompted people to think the survival of minority costume under the new historical situation. For now, the minority costumes are mainly protected by museums statically. Compared with the traditional protection mode of physical originals in museums, digital protection has longer protection time and promotes minority costume culture more conveniently. Content-based image retrieval is a very important topic in the field of pattern recognition and artificial intelligence. It has been

successfully applied to many fields, such as medical diagnosis, textiles industry and so on. The minority costumes of same nation have their own distinguished characters (unified tone, style and patterns.), which make them more advantageous than ordinary natural images in image processing. Therefore, it is of great importance to analyze the visual features of minority costumes. In this paper, the digital protection of national costume is studied from the perspective of computer vision. Although national minority clothing image have complex visual features, the main characteristics still are clothing color, fabric texture and totem shape, which are in accordance with the image feature in computer vision. So we can use traditional feature extraction algorithms to extract the features of minority costume images. At present, a large number of approaches on extraction of color, texture and shape features have been put forward and have already obtained good results in many fields. Color is the most dominant and distinguishing visual feature. The existing color feature extraction methods include color histogram color moment, color coherence vector and color correlogram .In the current version of the MPEG-7 Final Committee Draft, several color descriptors have been approved including number of histogram descriptors [5]. Texture is used to specify the roughness or coarseness of object surface and described as a pattern with some kind of regularity. Many researchers have put forward various algorithms for texture analysis, such as the famous gray level co-occurrence matrix (GLCM) [6], local binary patterns (LBP) [7], local directional patterns (LDP) [8], and so on. With the continuously expanding of the application field, new theory, like the theory of wavelet, is introduced. And in 1996, Tai Sing Lee [9] used Gabor filters to extract texture features. Shape is the most essential feature of the object. The classic shape descriptors are the Hu moment invariants [10], the Fourier transform coefficients [11] and the histogram of oriented gradients (HOG) [12]. The minority costume image have very complex visual features, which make it more difficult to be expressed by single feature extraction algorithm. So our goal is to design a feature extraction algorithm based on multi-features to express the information of minority image comprehensively. A lot of image feature extraction algorithms based on multi-features have been proposed in recent years. In 2010,

II. RELATED WORKS

Currently, the research work of minority costume image retrieval is still in its infancy and exploration stage. We are the first ones to conduct exploratory research on the retrieval

technology of minority costume image. In this paper, we construct a minority costume image dataset, in which some images are taken by ourselves and some are from the internet. Most of the minority costumes in these images are dressed by minority people or human body model, and some are photographs of tiled minority costumes. Every ethnic group has its own costume style, so we can distinguish between ethnic groups by their costumes. After a series of researches on the characteristics of minority costumes in Yunnan, we choose the six most characteristic ethnic groups' costume as the research object, including Bai nationality, Jingpo nationality, Hani nationality, Miao nationality, Bouyei nationality and Va nationality. For each nationality we collect 100 costume images and preprocess them to size 128×96 or 96×128 in JPEG format. Figure 1 shows some image examples in the minority costume image dataset. For now, no researcher has conducted exploratory research on the retrieval technology of minority costume image. Nevertheless, many scholars have researched on the image processing technology of ordinary clothing image (especially in e-commerce field) from the perspective of computer vision.

Choi Yoo-Joo [17] presents a novel approach to retrieval the person image that contain the identical clothing to a query image from the image set captured by multiple CCTV camera. Firstly, the clothing area is found based on the position of the face area; Then a feature vector is built for the clothing area, which composed by six color histograms of six sub-regions defined in the clothing area. Wang Hai-long [18] presents a method of contour feature extraction, expression and matching to implement clothing image retrieval comprehensively, where the clothing image is from e-commerce websites. Chen jia-lin [19] presents an interactive clothing retrieval system, which supports query by a real-world image with target clothing and returns real-world images with similar clothing. A novel clothing shape feature is proposed to describe the shape of clothing in human-oriented coordinate system. And a supervised method is also proposed for learning a weighting matrix to minimize the intra-class distance while maximize the
inter-class distance.

Wang Yatong [20] designs and implements an image querying and retrieval system based on color feature for e-commerce apparel. The paper compares a variety of color feature extraction methods and similarity measure methods. Experiments show that Euclidean metric and global color histogram using RGB space are relatively appropriate for clothing image search. In general, all above algorithms are designed to describe the feature of ordinary clothing image from perspective of color, shape, and texture.

Figure 1. An example of the minority costume image dataset

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III. FEATURE EXTRACTION OF MINORITY COSTUME IMAGE

Color is an important visual attribute for both human perception and computer vision and it is widely used in image retrieval. The color histogram is one of the most direct and the most effective color feature representation [21]. It has advantages of transform invariant, rotate invariant and scale invariant and has been widely used in image retrieval. But it lacks spatial information. This paper incorporates spatial information to it by combining the color histograms for several sub-blocks defined in the minority clothing image. An appropriate color space and quantization must be specified along with the histogram representation. In this paper, three color spaces (RGB, HSV and CIE L*a*b*) with different quantification number are used to test the performance of our Method. The experimental results in Tables 1-3 demonstrate that the RGB color space with 8×4×4=128 quantification number is the best choice in our framework. For an image with a size of M×N, we set the color quantification number to L and denote the image by the equationC x y x N y M

Calculation of Edge Orientation Histogram

In the system of theory on computer vision, edge detection of image plays an important role. This paper construct a feature descriptor namely edge orientation histogram, which can be seen as a texture feature and also a shape feature. The classic edge detection operator are Sobel, Roberts, Prewitt and Canny. Sobel is one of the most popular operator [22], which is named after Irwin Sobel and Gary Feldman. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in the horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. The operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical. If we define R, G, B as the unit vectors along the R, G, B axes in RGB color space

IV CONCLUSION AND FUTURE WORK

In this paper, We propose a novel feature extraction approach for minority costume image retrieval which combines color, texture, shape and spatial features of minority costume image effectively. Our experimental results demonstrate that our method has good retrieval performance and strong adaptability. And it's much more effective than other algorithms reported earlier in the article, such as GLCM, LBP, LDP, Gabor-based feature descriptor, Hu invariant distance,

HOG, MTH, MSD and CDH. Because the local feature of minority costume image are obvious, region-based image retrieval for minority costume image dataset will be studied in future work. Maybe, image segmentation will be considered as an assistant to extract the local feature and semantic feature of minority costume image.

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