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Patterned Fabric Image Retrieval Using Color and Space Features ⋆

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Abstract

Image retrieval has been an active research topic in the last decade. As one of the promising approaches, color histogram based image retrieval has been attracted by many researchers. However, it is sensitive to noisy interference and lost any spatial information. To overcome drawbacks, the algorithm combined weighted color histogram with image segmentation is proposed for patterned fabric images in this paper. Firstly, the patterned fabric images are preprocessed using image enhancement. Secondly, color and spatial information features are respectively extracted by weighted color histogram and image segmentation method, which are transformed into feature vectors. Finally, the similarity between objective image and image database is calculated with Euclidean distance. The retrieval results are displayed in decreasing order of similarity. Experimental results, including comparisons with color histogram algorithm and weighted color histogram algorithm, demonstrate the effectiveness of proposal for patterned fabric images.

Keywords: Image Retrieval; Image Enhancement; Weighted Color Histogram; Image Segmentation; Similarity

1 Introduction

There has been a rapid increase in the size of digital patterned fabric images collections in the recent years. A huge amount of information is stored in these images. However, it is unable to be accessed or made use of the information unless it is organize so as to allow efficient browsing, searching and retrieval. There has been a very active research in the area of image retrieval [1–4] since the 1970s, with the trust from two major research communities, database management and computer vision [5].

In this paper, the algorithm combined weighted color histogram with image segmentation is presented to retrieve patterned fabric images. As is known to all, color histogram method is

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significant to retrieve images, which is first proposed by Swain and Ballard [6, 7]. It has been widely used, especially color feature representation of images. However, two disadvantages are commonly existed in color histogram method, which is respectively noisy interference and lost any spatial information. In order to solve problems, weighted color histogram and image segmentation are adopted. In image segmentation, Markov Random model (MRF) model is chosen to extract spatial information feature, which is proposed by S. Geman and D. Geman in 1984 [10, 11]. MRF model could be applied widely, because that spatial information in an image is described and it has a perfect theory effectively. The algorithm of this paper is mainly divided into three parts. Firstly, the patterned fabric images are preprocessed with image enhancement [14], which RGB space are transformed into HSV space to void certain concentrated color features of the space. Secondly, the color features and spatial information features are respectively extracted by weighted color histogram method and MRF model. Then these features are converted feature vectors. Finally, similarity between objective query image and image database is computed by Euclidean distance [16, 17] and displayed in decreasing order.

The structure of the following paper is organized as: Section 2 describes image preprocessing, which RGB space is converted HSV space. Section 3 contains feature extraction, including color feature and spatial information feature. Section 4 presents similarity calculation to obtain results of image retrieval. Section 5 discusses the experimental results step by step, comparing the results of proposed algorithm with color histogram algorithm and weighted color histogram algorithm. Final Section 6 is devoted to conclusions.

2 Image Preprocessing

Image enhancement refers that certain feature of the patterned fabric images, including edge, contour and contrast, are emphasized to display, observe or be further analysis and processing. Image enhancement technology [15] is roughly divided into spatial domain and frequency domain. In this paper, spatial domain is adopted, which is that the information of the RGB space is converted into the information of the HSV space, as shown in Eq. (1). Certain features of the RGB space are concentrated, which is disadvantage to extract the color features. However, after converting RGB space into HSV space, the color features could be uniformly distributed to prepare for extracting color features. The results of the patterned fabric image enhancement are viewed by histogram, as shown in Fig. 1.

$$\begin{cases} V = max(R,G,B) \\ S = \dfrac{max(R,G,B) - min(R,G,B)}{max(R,G,B)} \\ H \text{ is not defiined if } S = 0 \\ H = \begin{cases} 60 \times (G-B)/(S \times V), \text{ if } S \neq 0 \text{ and } \max(R,G,B) = R \\ 60 \times (2 + (B-R)/(S \times V)), \text{ if } S \neq 0\text{and } \max(R,G,B) = G \\ 60 \times (4 + (R-G)/(S \times V)), \text{ if } S \neq 0\text{and}\max(R,G,B) = B \end{cases} \\ H = H + 360 \text{ if} H < 0, \end{cases} \quad (1)$$

where, H, S and V represent hue, saturation and value, respectively. R, G and B show the three primary color of light, including red, green and blue.