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Procedia Computer Science 125 (2018) 143–148

Procedia Computer Science

www.elsevier.com/locate/procedia

6th International Conference on Smart Computing and Communications, ICSCC 2017, 7-8 December 2017, Kurukshetra, India

Clothing Image Retrieval Based On Multiple Features for Smarter Shopping

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Abstract

Modern life is truly fast paced and lives of most people are overburdened. In such a scenario online shopping is a great and time saver. Ladies clothing cannot be easily specified like grocery or furniture items. Normally, ladies clothing has numerous characteristics that are hard to describe like texture, shape, color, print, length etc. In this work, we propose a way to search for clothes where the query is in the form of image in place of descriptive set of words. The first step of the procedure is to identify in accordance with the length of the dress and sleeves. Next features like color and texture are obtained. To detect the best close match, human intervention is not obligatory. A data set of 1500 images is created. The dataset is built up from craftsvilla, jabong, voonik,myntra, amazon, snapdeal, flipkart,fashionara, shoppersstop. The outcomes confirm a precision of 89.25% and recall of 87.00%.

Peer-review under responsibility of the scientific committee of the 6th International Conference on Smart Computing and Communications.

*Keywords:*image retrieval, feature extraction, pattern matching

1. Introduction

With the advent of smart phones and shopping android applications, online shopping has come in a big way. One can shop from the comforts of one's home – no travel time, no parking hassles and no going from shop to shop looking for a particular item. The internet has revolutionized shopping; online shopping has turned into the modern, current trend of shopping.

However, a major problem in online shopping is searching through a huge collection of items for a desired product.

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1877-0509
Peer-review under responsibility of the scientific committee of the 6th International Conference on Smart Computing and Communications
10.1016/j.procs.2017.12.020

The problem becomes even more pronounced when buying ladies clothes. The dresses come in multiple colours, pattern and varying length which make it a challenging task to match and retrieve them [1]. In this work, we propose a method where a user gives an image as a query instead of a set of key words describing the dress. We identify the style of the dress by identifying the length of the dress and the type of the sleeves – sleeveless, half sleeve or full sleeves. Other features used are colour and texture.

2. Proposed Framework

Here we discuss the clothing image retrieval framework using which the user can come up with images of clothes in which they are interested. And they can find out the similar dresses in the database with the help of this framework. The proposed framework is shown in figure 1. It has 3 phases i.e. pre-processing, feature extraction and classification. In this section, each phase is described in detail. The proposed method provides a self-operating procedure to look for a matching dress and gives a good retrieval and recognition outcome on the dataset of women's dresses.

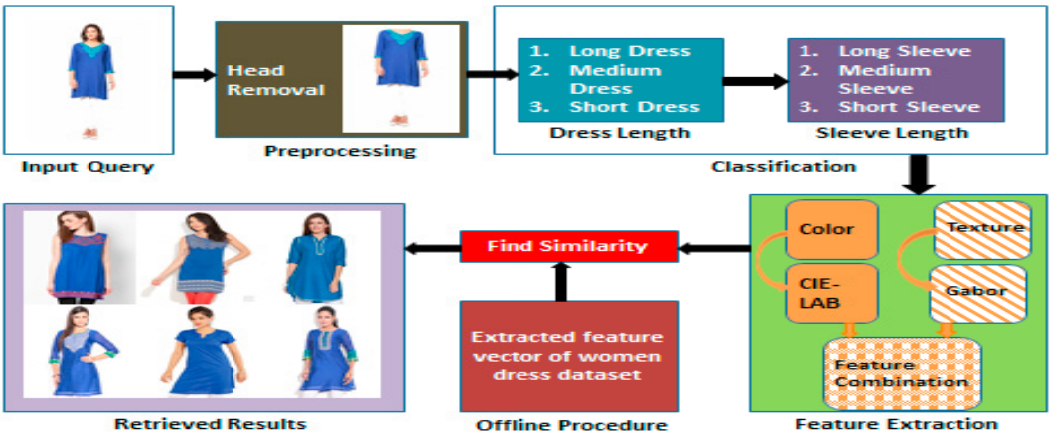

Fig. 1. Clothing retrieval system framework

2.1. Pre- processing

In this step, we first computed the region of interest by removing the head portion with the help of the Viola Jones algorithm [2]. The scale and relative position of each identified face is used to prognosticate a bounding box around the face.

2.2. Classification

In the proposed approach the dress is classified depending upon its length and sleeves.

We use horizontal projection histogram [3][4] to find out the length of the dress. The usage here is to discover the top and bottom place of the clothing. After binarization of the image [5], we get the upper and the lower bounds of the dress. The gap between the upper bound and the lower bound is noted as the length of the upper body dress. The length of the lower body clothing can be calculated as the length from the lower bound to the end of the image. To put the length of the dress under the category of long, short and medium, we calculate the ratio between the upper body and lower body by setting the threshold empirically for classifying the dress.

Like dress length, sleeves are also categorized into three types, sleeveless, full sleeves and half sleeves. Preliminary manual tagging is used to know the sleeves of clothing. S.liu et al. In [6] wielded the mechanical turk website to automatically tag the image. To automate the procedure of finding the sleeve length, we have introduced an algorithm. We explore the idea that, the sleeve length can find out with the help of skin color pixel. We can easily find out the length of the sleeves by taking the ratio of skin color and dress color.

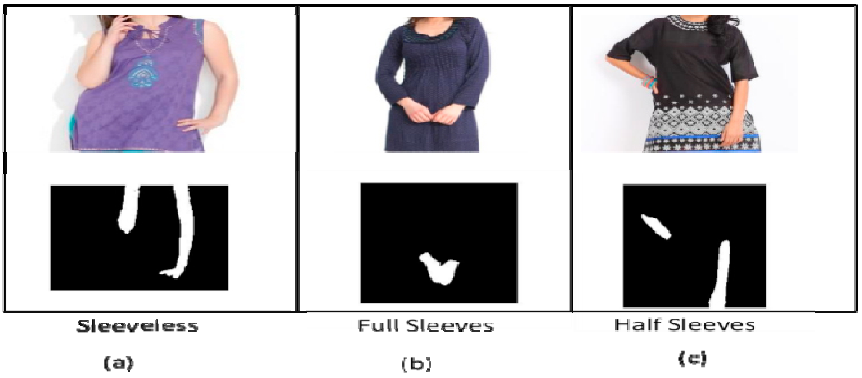

Fig. 2. Classification of sleeves

2.3. Feature Extraction

For detecting a matching dress, the information related to its color and pattern design have a great importance. So, we obtain these two attributes and then use the similarity measure technique to retrieve the matching dress.

Color: As guided in [7] CIE lab space has an exquisite ability in defining the information of color in images and thus advantageous in assessing the distinction between different images. For better matching, we take the central part of the image as the region of interest.

In the proposed algorithm, the colors are divided into three categories namely- primary, secondary and decorative. When the primary threshold is less than the number of pixels in the region of interest, it is called the primary color. It is considered as secondary when the number of pixels are less than the primary threshold and more than the secondary threshold. A very less number of pixels, less than the secondary threshold, but more than decorative threshold makes the color decorative or it is called decorative color. On the basis of these categories similarities between the clothes is found. When a dress has primary colors, the similarity is found between the database which has the primary colors and the primary colors of the target image. Similarly, if a dress has secondary colors, then it is found for similarity in between the database which has secondary colors and secondary colors of the target image. In the case of decorative color, the score of the color is put to zero in order to minimize the errors. The similarities between color palettes are calculated with the help of Chroma difference which is computed by the formula $\sqrt{a^2 + b^2}$ Where a and b are the color palettes of the target image and database images.

Pattern: Gabor filter [8] is utilized to take out features for pattern. A Gabor filter is generally a Gaussian multiplied by a cosine that discovers edges at a certain frequency and angle. In order to increase effectiveness, we first compute and store our family of filters. The equation of a Gabor filter with angle ‘θ’ and frequency ‘f’ is as follows:

$$G(x, y, \theta, f) = \exp\left(\frac{-1}{2}\left[\left(\frac{x'}{sx'}\right)^2 + \left(\frac{y'}{sy'}\right)^2\right]\right) cos\ 2\pi f x' [8]$$

$$x' = x\cos\theta + y\sin\theta$$

$$y' = y\cos\theta + y\sin\theta$$

An algorithm to take out the feature vector for pattern feature is shown below [9]. To compare images, we take difference of two descriptor vectors, which provides us a value of distance. The similarity between database images and target images depends upon the distance, if the distance is high, there is less similarity and if the distance is less, there is more similarity.

Feature Combination: A dress with a particular design/pattern can be available with different colors. That is why pattern has a crucial role in women dress matching. So we give pattern feature more weight than color. The proposed method uses the following weights.

$$W_g = 1.7$$

$$W_c = 1.$$

3. Experiment results

3.1. Dataset

In order to evaluate the success of method using actual world clothing image data, a collection of 1000 Indian dress images is prepared from various online shopping websites namely- flipkart, jabong, snapdeal, voonik, shopper stop, myntra. Randomly 10% of the images from the collection are chosen as queries, and the remaining images are to be retrieved later arbitrarily. Since all clothing images have a clear background so no image processing technique is required to refine the images, and the central part of each image, which is our region of interest (ROI), will be cropped out after removing the head and hand portion.

3.2. Performance Evaluation:

Precision and recall of a system help in finding out its potential retrieval. Recall calculates the performance of the system to retrieve all the models that are relevant, while precision calculates the performance of the system to retrieve only the models that are relevant. They are defined as:

$$precision(P) = \frac{\text{Number of relevant image retrieved}}{\text{Total number of images retrieved}} = \frac{\text{A}}{\text{A} + \text{B}}$$

$$recall(R) = \frac{\text{Number of relevant image retrieved}}{\text{Total number of relevant images}} = \frac{\text{A}}{\text{A} + \text{C}}$$

Where A indicates the number of images retrieved that are relevant, B indicates the number of images retrieved that are irrelevant and the C indicates the number of relevant images not retrieved.

Accuracy is reported using the best F-score criterion:

$$\text{F} = \frac{2\text{RP}}{\text{P} + \text{R}}$$

In the cloth segment, P and R are the precision and recall of pixels relative to our manually sectioned ground truth. We achieve 0.879 F -score on an average over this random sample, which shows reasonable accuracy in our approach as for F –score, it reaches its best value at 1 and worst at 0. Also in addition, by visually inspecting figure 3, we can definitely say that retrieval results are reported qualitatively. We can observe that the system is reliable with relevant clothing outcomes of a similar color, pattern, dress length and sleeves length retrieved.

Fig.3.Three samples of flipkart online shopping site are used as queries, and the retrieved imag0es of Indian dress dataset are displayed in separate rows. Correctly and wrongly retrieved clothing attributes are marked by blue stars and red stars respectively.

4. Result Analysis

The proposed method has been implemented using Matlab 13a. Each query sends back the top 10 images from a database, and afterwards calculates precision values, using the equation 1, and average precision utilizing equation 3. This proposed work results into an average precision of 83% which refers to better retrieval outcomes than the others. Recall calculates the performance of the system to retrieve all the relevant models, whereas, after the calculation of system's performance by precision, it retrieves only the relevant model.

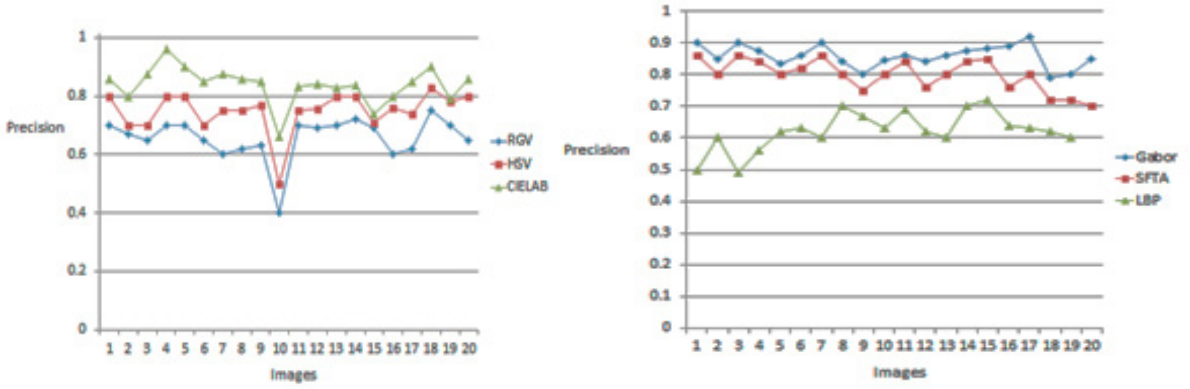

Fig.4(a). Compare precision of RGB, HSV, and CIELAB color space model. 4(b) Compare precision of Gabor, SFTA, LBP.

In this paper, we have conducted experiments on a number of features like color and pattern feature descriptor. In an experiment on color, the comparison is made among the results of RGB, CIELAB, and HSV color space model. The result shows that, the CIELAB color model is better than HSV and RGB color model, And the results are shown in Figure 4(a). Likewise, an experiment on the pattern feature descriptor, where the results are compared among Gabor, CBP and SFTA, results in better performance of Gabor filter, as shown in Figure 4(b). Hence, these experiments and their results enhance the quality of our proposed work.

Dress length and sleeves length found by the proposed method gives the performance up-to-the mark. The average precision for dress length is 93% which shows that the dress length classification done by our method gives state of art results and sleeve length classification proposed by us gives average precision 89%. Empirical results on a commercial clothing image dataset verified that the proposed framework produced satisfactory retrieval results when comparing to other state-of-the-art methods.

5. Conclusion and Future Work

Thus, to conclude we can say that a very novel approach towards the retrieval and recognition of Indian dresses is presented through this paper. The present work is built on the basis of extraction and comparison of four main properties of images of clothes. These properties are Color, Pattern, Dress length and Sleeve length. On the basis of the similarity between the target image and database images, a score is calculated for each property. The outcomes show that the system on which this work is based, works very well for the majority cases. We further aim to expand our work to other women accessories like jewellery and footwear.

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