Image Matching for Image Labeling System

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Abstract

Interest in the potential of digital images has increased enormously over the last few years, fuelled at least in part by the rapid growth of imaging on the World-Wide Web. Automatically assigning keywords to images is of great interest as it allows one to retrieve, index, and organize and large collections of image data. Many techniques have been proposed for image annotation in the last decade that gives reasonable performance on standard datasets. However, most of these works fail to compare their methods with simple baseline techniques to justify the need for complex models and subsequent training. To segment input image, N-Cut algorithms are used in this system. In this paper, the image database is created by using segmented parts of an image, nature scene, animals, vegetables, buildings and so on.

Keywords: Image Segmentation, Image Database, Annotation

1. Introduction

The problems of image retrieval are becoming widely recognized, and the search for solutions an increasingly active area for research and development. Given an input image, the goal of automatic image annotation is to assign a few relevant text keywords to the image. With rapidly increasing collections of image data on and off the Web, robust image search and retrieval is fast becoming a critical requirement. Tagging images with words describing their content can contribute to faster and more effective image search and classification [12].

Automatic image annotation is closely related to computer vision, image processing and content-based image retrieval. During the last decade, we have seen great advance in developing automatic image annotation systems, related works involve considering image annotation as a clustering/categorization problem, considering image annotation as an image searching problem, and considering image annotation as statistical modeling problem[9].

There exist some methods that cluster image representations and text to produce a representation of a joint distribution linking images and words. Image segmentation into regions may help to find out the semantic relation between words and objects contained in image. To segment an input image, we use N-Cut that measures both the total dissimilarity between the different groups as well as the total similarity within the groups.

The starting point is a training set of images that have already been annotated by humans. Image analysis techniques are used to extract features from the images such as color, texture, and shape, in order to model the distribution of a term being present in the image [11]. Features can be obtained from the blobs, which are segmented parts of the image. To extract the same feature information from an unseen image

the system compares it with all the previously created models.

Particularly in image retrieval, many annotated data sets have been assembled during the last years to study the relationship between pictures and words for image auto-annotation and retrieval tasks [2]. Segmented images represented in the spatial domain are usually described by Region Adjacency Graphs [3], or by multidimensional indices representing the spatial distribution of the color cluster[4]. In addition, T.J.Ross [5] introduced some other related technique like graph matching, neural nets, genetic algorithms, simulated annealing, and fuzzy logic.

The rest of this paper is organized as follows. Section 2 represents system overview, section 3 consists pre-processing steps, section 4 expresses the image labeling process, section 5 is the experimental result and section 6 includes conclusion of the system.

2. System Overview

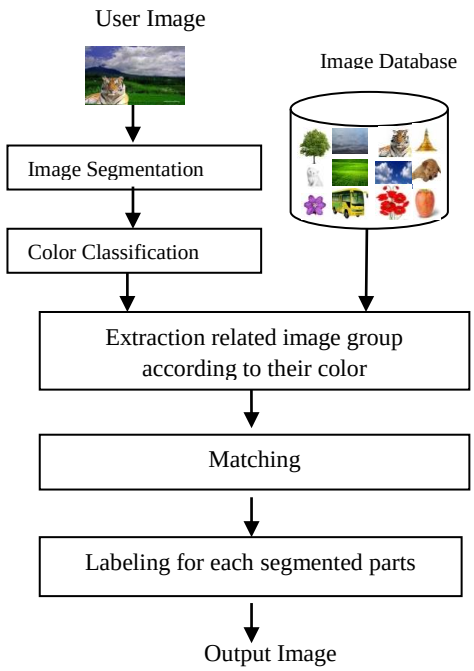

Figure 1. System Flow Chart

The system overview of the proposed automatic image annotation system is shown in figure 1. According to the figure, the system starts user's desired image is input image to label. After image segmentation process, color classification is calculated by their color value. And then, these segmented parts compare with image database according to their color intensity. To produce output image, feature extraction and labeling with their appropriate texts. The final output is annotated image with texts.

3. Pre-processing Steps

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics image segmentation. The goal of image segmentation is to partition an image into a certain number of pieces which have coherent features (color, texture, etc.) and in the meanwhile to group the meaningful pieces together for the convenience of perceiving.

In order to cluster the collection of pixels of an image into meaningful groups of regions or objects, the region homogeneity is used as an important segmentation criterion. Many cut criteria in graph theory have been studied for this purpose. The most widely used cut criteria include normalized cut, ratio cut, minimum-cut and so on [10]. Among these criteria, normalized-cut and color-based segmentation methods are used in this paper.

In graph partition, the image is converted into an undirected weighted graph. Every pixel in the image corresponds to a vertex of a graph. And the weight on one edge is assigned

according to the similarity between two corresponding pixels. The criteria of similarity are different in different applications. In general, the similarity can be defined by the distance, color, gray level, textures and so on. Considering the computation of the algorithm, we usually restrict the relationship of pixels in a neighborhood [6].

For convenience, denote the two parts as A and B. Then we can reform the cost of a cut:

$$Cut(A,B) = \sum_{p\in A, q\in B} \omega_{pq} \quad (1)$$

Shi and Malik [5] pointed out that this criterion tended to cut a small segment from the graph, and based on the normalized cut, they proposed a new criterion which is a minimal cut penalizing small segments. The measure of normalized cut can be written as:

$$\sum_{p\in A, q\in B} \omega_{pq} \left(\frac{1}{\sum_{p\in A} D_p} + \frac{1}{\sum_{q\in B} D_p}\right) \quad (2)$$

where $D_p = \sum_{q\in V} \omega_{pq}$ is defined as the degree of the vertex p. From Eq. 2, the normalized cut measures both the total dissimilarity between the different groups like Eq. 1, as well as the total similarity within groups.

Figure 2. (a)Input Image and (b)Gray Image

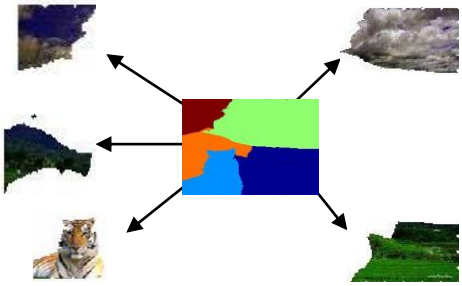

Figure 3. Segmented parts of an image

The process of color classification involves extraction of useful information concerning the spectral properties of object surfaces and discovering the best match from a set of known descriptions or class models to implement the recognition task [7].

Color segmentation is attractive because it is not computationally expensive. It can essentially be performed with a look up table. Color segmentation is easily adaptable to uncalibrated color cameras. Colors do not vary too widely between cameras, and simple training allows different cameras to function equivalently. Color can give more information than a luminance only image or an edge segmented image. Connected regions are easily extracted because they tend to be the same color. Since pixels are a mixture of three colors, this gives information that a luminance only image does not have [8].

4. Image Labeling

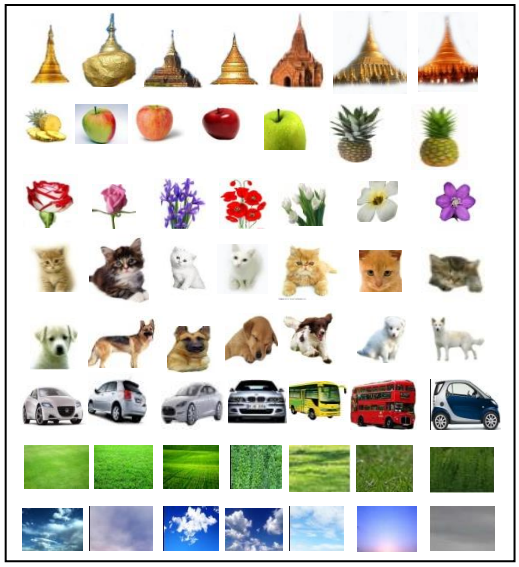

Figure 4. Representative Sample Image Database

Images in database are equally sized with 160*160 images. To compare images, image database with segmented parts are needed. So,

the database is created by using segmented parts, general nature scene (e.g. sky, water, and grass), animals, and vegetables and so on according to their color intensity.

After image segmentation process, the system classify image according to their color. And compare these images with images in database. In database, all images are organized by their color (Red, Green, Blue). This is the reason for easy compare between input image and image in database shown in figure5. From this stage, segmented images are labeled with appropriate words. As a result, annotated image is output for this system.

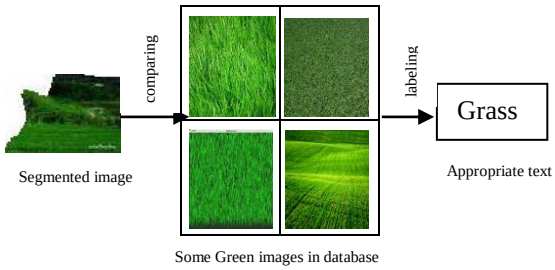

Figure5. Comparison between input image and some images in database by their color

In the traditional database system, a context based query and retrieval scheme, based on the textual keyword or file name, is usually adopted. However, a visual database is usually very large, so that such an approach requires complicated pre-classification and, furthermore, the same image might be described in different ways by different people. In this system, we built own database to easily retrieve for image annotation.

Database of 5000 images of 100 different classes is used to check the performance of the algorithm developed. Some representative sample images which are used as query images are shown in Figure4.

5. Experimental Result

Image matching aims at establishing the relation between two images. Image matching is also applied when features, others than points. The similarity measure has to measure how well the two images match with each other. This is usually based on the normalized cross correlation or on a function of the intensity differences of the values themselves, actually measuring the distance between the images.

	Original	**Automatic**
	Water, tree, Grass, Sky	Grass, Sky, Tree, Bridge, Water
	Buddha, Sky, Tree, Path	Sky, Tree, Buddha, Path
	Mountain, Tree , Grass, House, Sky	Sky, Grass, Tree, House, Mountain
	Pagoda, Tree, Sky, Bushes, Mountain	Sky, Grass, Pagoda, Mountain, Bushes
	Airplane, Mountain, Sky, People	Sky, People, Mountain, Airplane

Figure6. Comparison between Original and Automatic annotation

The advantage of automatic image annotation is that queries can be more naturally specified by the user. Research in image retrieval has been handled separately in database management systems and computer vision. In general systems related to image retrieval assume some sort of system containing complex modules for processing images stored in a database [13]. In this version, several issues regarding the combined low level and semantic features image retrieval are added. The goal of content-based image retrieval (CBIR) systems is to define a set of properties (features) able to effectively

characterize the content of images and then to use such features during retrieval process.

6. Conclusion

Retrieval of particular images from such collections is inherently labor intensive and often serendipitous. An image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images. Most traditional and common methods of image retrieval utilize some method of adding metadata such as captioning, keywords, or descriptions to the images so that retrieval can be performed over the annotation words. Manual image annotation is time-consuming, laborious and expensive; to address this, there has been a large amount of research done on automatic image annotation. A normal usage situation requires much faster response, because the users are not willing to wait so long. Speedup indices and the database structure should be designed so that similar images can be found from the database without exhaustive search methods. However, researchers are still facing two major difficulties that may undermine their effort of providing reliable and accurate annotations for images. The first difficulty is lacking of comprehensive benchmark image dataset with high quality text descriptions. The second difficulty is lacking of effective way to represent the image content and make it associate with the text descriptions. This system helps to represent the image content with the accurate text descriptions.

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