An image recognition method by rough classification for a scene image

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Abstract

We have analyzed the regions of scene images for the image recognition. At first, the segmentation method which we have proposed classifies images into several segments without using the Euclidian distance. We need several features to recognize regions, but they are different between chromatic and achromatic colors. Regions are divided into three categories (black, achromatic, chromatic). In this paper, we focus on the achromatic category, the several features of the regions in the achromatic category are calcurated and plotted.
Keywords: Scene image, Image recognition, Image segmentation, Chromatic color, Achromatic color

1 Introduction

Recently, enormous image data exist on the world wide web by the rapid development of the Internet. Therefore, it is difficult to obtain only requested images on the web. There have been several methods for the image search. They are classified into three kinds; keyword search, similarity-based image retrieval, and browsing search. In the keyword search method, requested images are retrieved by using a database such as Google searching system which is constructed by images and keywords. Using the searching method, only requested images are not always obtained, since they are based on the file name searching. In the similarity-based image retrieval method, requested images are drawn by selection of sample images [1],[2],[5],[6]. However, users have taken many tasks for selecting or drawing a requested image. The browsing search method is an interactive method. The method takes much time to search images. Therefore, we focus on searching the keyword from an image. Once the database is constructed, the system enables us to search images by keywords which are desired by users. Some extraction methods [3],[4] by using location information have been proposed. Since they depend on specific images, it is difficult to construct a database.

In this paper, we propose a method to extract keywords from images automatically. The method enables us to add the keywords to the database. The object images in this paper are only scene images. The images are segmented into some regions in order to specify a keyword for the region of the image by the method which we have proposed. In this paper, we propose the region recognition method by using the image segmentation method which we proposed. In the proposed method of image segmentation, an achromatic color is considered. Since, features of colors are different between chromatic and achromatic colors. Therefore, we classify roughly regions into the chromatic and achromatic colors.

2 The image segmentation method

We segment the images for the region recognition. The conventional methods[7]-[11] have been proposed, but they have used the Euclidian distance. We have

(a) An original image

(b) The image segmentation result

Fig. 1: An image segmentation result by the proposed method

proposed the new image segmentation method. The proposed method segments images without using the Euclidian distance, since the Euclidean distance does not always correspond to the difference between colors in human eyes. The process of the proposed method is as follows.

At first, we transform image information from RGB to HSI (hue, saturation and intensity), since HSI color space is close to a human visual sense and the components of HSI are the high independent components. Human pays attention to not only a pixel but also pixels around it, when he sees an image. To reflect the human characteristics, the moving average method is used. We calculate the histograms of the image for each component, and obtain three results of the image segmentation from each histogram. The clustering is to decide the boundaries among the classes on the histograms. The boundary is decided by maximizing between-class variance. The method is that a boundary is decided at a valley between peaks in a waveform of a histogram. One or more boundaries are obtained by iterating the same process until a maximum value of between-class variance is less than a threshold. The final segmentation result is obtained by the AND operation from three clustering results. However, the simple AND operation may result in many regions obtained, since the simple AND operation does not consider the achromatic colors. In our research, we obtain the final segmentation results by AND operation with the consideration of the achromatic colors. The achromatic colors have low intensity or low saturation values. In the former, only the result of the intensity is reflected to the final result. In the later, the results of the intensity and saturation are reflected to the final result. A result of the image segmentaiton method is shown in Fig.1

3 Features distribution of the regions

The regions which are obtained by using the image segmentation method are recognized. We need several features to recognize regions, but these are different between chromatic and achromatic colors. As regions are divided into the black, achromatic and chromatic categories in the image segmentation phase, we divide regions into three categories in the recognition phase.

In this paper, we recognize the regions in chromatic category. The main regions in the category are "Cloud", "Sky" and "Snow". In the category, the effective color feature is only intensity. The average and the standard deviation of the regions are calculated, and distributions of the features are checked. The energy and the homogeneity which are obtained from gray-level co-occurrence matrix are also calculated and checked. $P(i,j|d,\theta)$ denotes the (i,j)th element of a co-occurence matrix, where d is a distance, θ is an angle. The energy $E(d,\theta)$ and the homogeneity $H(d,\theta)$ are given as follows.

$$E(d,\theta) = \sqrt{\sum_i \sum_j P^2(i,j|d,\theta)} \tag{1}$$

$$H(d,\theta) = \sum_i \sum_j \frac{P(i,j|d,\theta)}{1+(i-j)^2} \tag{2}$$

The results are shown in Fig.3.

From Fig.3, The average is effective for recognizing the regions. However the standard deviation and the features from the gray level co-occurrence matrix are not effective. From Fig.2(b), it is found that the value of intensity is different among the regions. Therefore, the average is effective. However, the reason why the standard deviation is not different among the regions is that the differences between the average of the region and the value of intensity are not large. The reason why the texture features are not different among the region is the same as above.

4 Conclusion

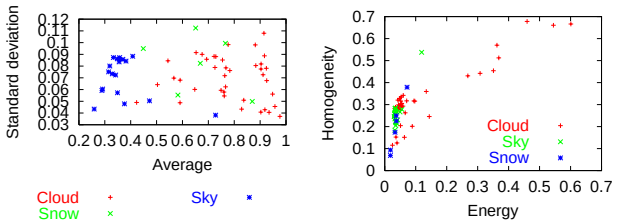
In this paper, we have analyzed the features of the regions for the image recognition. At first, regions have been obtained by using the image segmentation method which we had proposed. The regions have been divided into three categories. The features of regions in the achromatic category have been calculated and plotted. From the results, we must obtain new features.

(a)Regions of the black category

(b)Regions of the achromatic category

(c)Regions of the chromatic category

Fig. 2: Regions examples of the three categories



(a) Average and standard deviation

(b) Energy and homogeneity

Fig. 3: The distributions of the features

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