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Image retrieval system for natural images based on local features

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Abstract: In this paper a retrieval study for natural image learning environment is proposed. The content of this paper is a result of projects called Image content-based retrieval on a natural image database. The objective of this project is to develop an image content-based search engine, which can perform identity check of a natural image. It is well known that conventional natural image databases can only be retrieved by text-based query. In this paper we use the shape, color, and other features extracted from a captured natural image to search the natural image database. The developed technique is able to perform scale, translation, and rotation invariant matching between natural images. Currently, the database contains several hundreds of natural images. In future, we shall enhance the capability of the search engine to deal with more than 30,000 natural image species, which is the total amount of natural image species along the coast.
Keywords: Content-Based Image Retrieval CBIR, feature extraction, Information retrieval, Image retrieval, Image databases, Wireless Communication, Mobile Learning

Introduction

This paper propose to design and implement of the image Recognitions core technology and construct a mobile content-based image retrieval system for a natural image learning system. The Image recognition system includes Image Acquisition, image preprocessing, and segmentation. The task of Image Acquisition is to understand the quality of the image. The task of image preprocessing is to enhance the quality of the image i.e. Remove the foreign material added to the image and use of Image blurring and image normalization In the stage of segmentation to find out a shape of image and Compute feature extraction, the result feature will be compared with Data base and result is feedback for the interpretation.

In this paper, we propose a system, which could Learn the family, name, ecology, and activity behavior of natural image, and uses content-based image retrieval system to easily acquire the natural image information without giving any data about the characteristic during the natural image-watching activity. Feature extraction is the basis of the content-based image retrieval. Sometimes image feature may include text (Caption, keywords etc.) or visual feature (shape, color, texture) or both. We can characterize image feature into two categories. This issue is most relevant to partitional approaches designed to optimize a squared error function. This optimization can be accomplished using traditional techniques or through a random search of the state space consisting of all possible labeling.

Approach

In the proposed mobile content-based image retrievals system, the image recognition technology is used to retrieve the information of the captured image from designed image database. The system architecture is depicted in Fig 1. The image recognition system consisting of Image Acquisition, image preprocessing, and segmentation. The Image Acquisition unit understands the quality of the query image and passes to the preprocessing unit. The preprocessed image is enhanced in quality by the use of Image blurring and image normalization. In the stage of segmentation the Edge detection is computed for a natural image image, histogram equalization and Thresholding is then applied to find out an exact shape of image. The feature extraction is processed by finding out the R,G,B component of given image and find resultant features as explained below. A Online Classifier is used on the resultant features to compare with Data base for the best classification of given query form the database to retrieve its details.

Feature Extraction

Texture features or more precisely, Grey Level Co occurrence Matrix (GLCM) features are used to distinguish between normal and rotational images. Co-occurrence matrixes are constructed in four different spatial orientation namely horizontal, right diagonal, vertical and left diagonal i.e. (00,450,900 and 1350). A final matrix is constructed as the mean of the obtained four matrices.

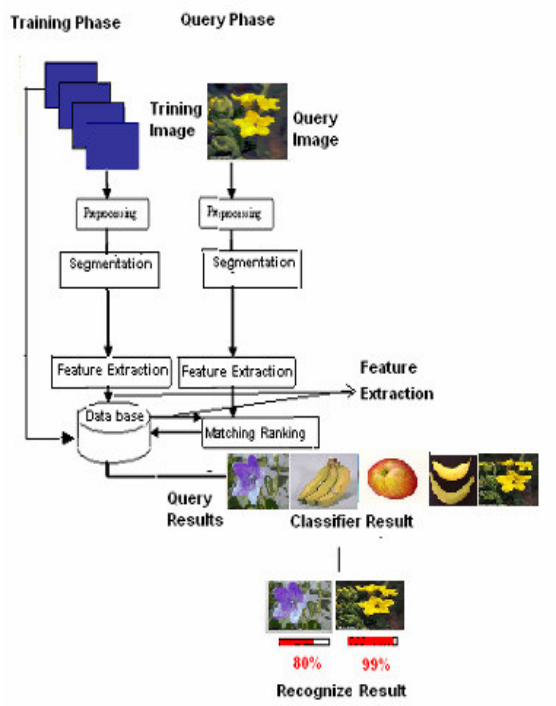


Fig. 1- The system architecture of the proposed CBIR natural image system

The process for features Extraction is carried out as;

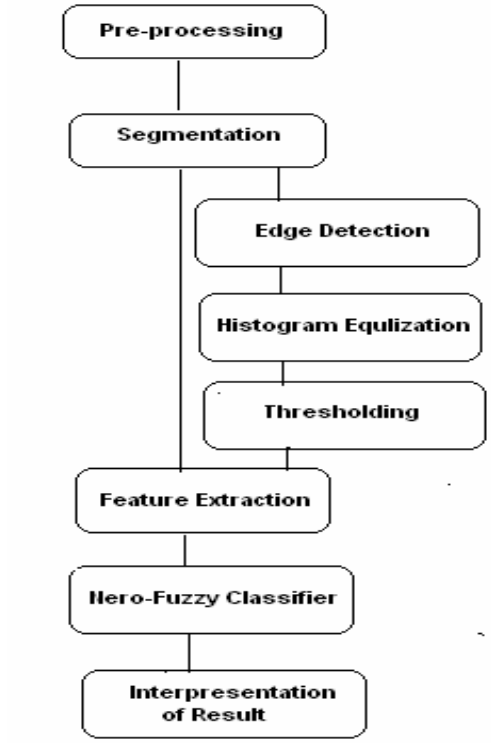


Fig. 2- Process of feature computation

Texture Features (Grey Level Co-Occurrence Matrix Features)

From each co-occurrence matrix, a set of nine features is extracted in the different orientations for the training of the online model. Let P be the N*N co-occurrence matrix calculated for each sub-image, then the features as given by Byer [14] are as follows;

1. Maximum Probability

$$f^1 = \max_{i,j} p(i,j) \quad (1)$$

2. Contrast

$$f2 = \sum_{i,j=0}^{N-1} P_{i,j}(i-j)^2 \quad (2)$$

3. Inverse Difference Moment (Homogeneity)

$$f3 = \sum_{i,j=0}^{N-1} \frac{P_{i,j}}{1+(i-j)^2} \quad (3)$$

4. Angular Second Moment (ASM)

$$f^4 = \sum_{i,j=0}^{N-1} P^2_{i,j} \quad (4)$$

5. Dissimilarity

$$f^5 = \sum_{i,j=0}^{N-1} P_{i,j} \left| i-j \right| \quad (5)$$

6. Grey Level Co-occurrence Mean (GLCM)

$$f^6 = u_I = \sum_{i,j=0}^{N-1} i\,(P_{i,j}) \quad (6)$$

7.Variance

$$f^7 = \sigma_i = \sum_{i,j=0}^{N-1} (P_{i,j} (i - \mu_i)^2 \quad (7)$$

8. Correlation Coefficient

$$f^8 = \sum_{i,j=0}^{N-1} P_{i,j} \left[\frac{(i - \mu_i)(j - \mu_j)}{\sqrt{(\sigma_i^2)(\sigma_j^2)}} \right] \quad (8)$$

Where

$$\mu_j = \sum_{i,j=0}' j(P_{i,j})$$

$$\sigma_j = \sum_{i,j=1}^{N-1} (P_{i,j} (j - \mu_j)^2$$

9. Entropy

$$f^9 = \sum_{i,j=0}^{N-1} P_{i,j} (-\ln P_{i,j})$$

Feature selection

Feature selection concerns the reduction of the dimensionality of the pattern space and the identification of features that contain most of the essential information needed for discriminating between normal and abnormal cases. Selection of efficient features can reduce significantly the difficulty of the classifier design. There fore feature selection based on the correlation co-efficient between features is performed. The correlation matrix was calculated for the set of 9-texture feature for both normal and abnormal spaces.

Any two features with correlation coefficient that exceeds 0.9 in both spaces can be combined together and thought as one feature reducing the dimensionality of the feature space by one. Therefore, the maximum probability and the contrast can be removed and the numbers of features are reduced to seven features. The precision ~ recall graphs for a few queries are shown in Fig. 4. For different images it can be seen that the performance of 6% and 9% filtering is clearly better than 0% filtering and no filtering results. One more observation made, which is worth mentioning, is different region filters can be used for different categories of queries. Though the system will have overheads, the overall retrieval performance can be improved.

Experimental

To validate the proposed approach, the System is implemented on Matlab tool and been tested for various images captured. The experimental setup is constructed considering 25 families, in which among each family we consider 5 Natural image images and all these are stored in database as clustered images, which reduces the isolation process time. The features of each natural image are pre-computed and stored in database. When test image is input to the system, the preprocessing, feature extraction process as mentioned in previous section are applied to compare with images in Database. The matching degree and ranking are computed, the results are then output to screen according to the ranking of similarity. The proposed system is implemented in a client-server manner. The client side device is a PDA while the server side device is a notebook. The experiment consists of four natural image-watching activities of independent learning. The natural image watching procedures of independent learning are:

1) Self selection process: the team learners find the target natural image of interest and take close picture of it

2) Self determination process: after that the learners transfer the picture and give searching conditions based on the picture. They observed to the system. According to the searching results, the learners are able to determine the name of the observer natural image.

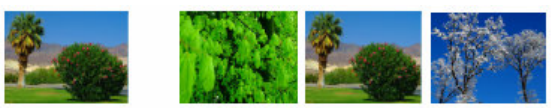
3) Self-modification process: the system further suggests the possible name list of the observer natural image trough image mapping technique. This gives the chance for the learners to modify their previous searching conditions and conclude to different determination.

Self checking process: the learners record their learning process to the journal, including the picture of the searching conditions, searching results suggestions

The precision vs. recall graphs for a few queries are shown in Fig. 4. For different images it can be seen that the performance of 6% and 9% filtering is clearly better than 0% filtering and no filtering results. One more observation made, which is worth mentioning, is different region filters can be used for different categories of queries. Though the system will have overheads, the overall retrieval performance can be improved.

The observations obtained are,

Query image Recognized images



Query image Recognized images

Fig. 3- Observations of Query and Recognized images

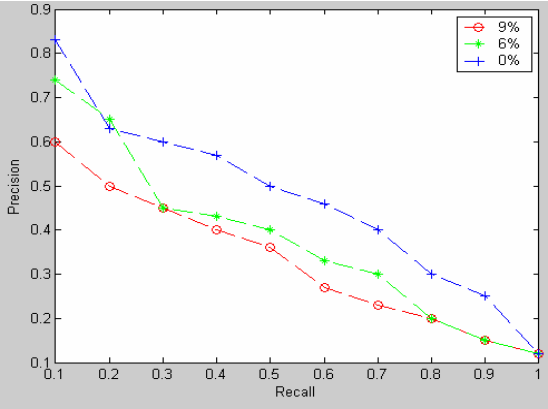


Fig. 4- Precision vs. Recall graph

Conclusion

In this paper, we develop an independent learning based mobile natural image watching learning system, which aims to construct an outdoor mobility-learning activity under the up-to-date wireless technology. The proposed Natural image system is designed on the wireless mobile ad-hoc network .the major spirit of our system is to let the leaders could take actions dealing with their own learning. Via the content based image retrieval technique. All have the beginner to go outside for natural image watching can be faster and easer to acquire. The information of the natural image you observed. One other contribution of this system is the nature journal sub system which is an integrated learning method including independent learning method and the brand new wireless networks information technology. These works aims to provide an excellent experience for the feature classroom learning platform.

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