

Content based image retrieval based on eye physiological structure and relevance feedback

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Abstract

Content Based Image Retrieval (CBIR) includes a set of methods for processing visual features of a query image to find similar images at an images database. As extracting features and determining similarity measure, are two main stages in retrieval systems. In this paper we have tried to give weight to image pixels and suggest an effective feature vector by use of eye physiological structure and annotation issue. Then modify feature components weight and optimize similarity measure by use of information of relative and irrelative images in each feedback. So by means of annotation issue in physiological structure of eye, pixels in center of image are more important and have more effective role in extracted features and also system accuracy will be increased for determining similar images, by means of optimizing similarity measure in each stage.

Experiments were done on Corel image database with 5000 images from 30 different groups. In these experiments, accuracy of suggested method was compared to three image retrieval methods based on l*a*b* color histogram, HSV, and fuzzy edge histogram. As the results suggest, high accuracy of proposed method in compare with other methods in this area.

Keywords: *image retrieval, relevance feedback, optimizing similarity function, eye physiological structure.*

1. Introduction

In recent years, different methods and systems is presented for content based image retrieval. In content based image retrieval, images are indexed based on low level features like color, shape and texture.

But the user's purpose is determining in the high-level features of images. So extensive research in this area is presented for integrating semantic features and low-level features for image retrieval. In systems CBIR, there are two fundamental challenges:

1. Sensory Gap: In this problem to be paid equipment received image and their role in understanding image content image. Usually the gap sensing problems can be solved in the form of feature extraction algorithms.

2. Semantic Gap: That pays mismatch between the concepts extracted by a CBIR system and concepts derived by a person.

In other words, the semantic interpretation of imaging data is different in humans and CBIR systems; it difficult makes the design of this system CBIR. Usually problems related to gaps are evaluated in the form of semantic pattern recognition algorithms and calculation of similarity.

In this paper is presented a new method using relevance feedback structure and physiology of the eye.

In feature extraction, we are used two types of low level features including color and texture features. During the feature extraction process, using the Attention eye physiology structure, do operation weight to the image pixels and are determined effectively feature vector images.

Next, using information from the relevant and irrelevant images in the relevance feedback process, update the weight of feature components and similarity measure.

The paper is organized manner in Section 2, the primary image retrieval systems is presented. More in Section 3, the proposed method introduced ,in Section 4, the results of the proposed image retrieval system performance and compare it with other recovery methods are presented.

2. Overview of image retrieval systems

Image retrieval system consists of two stages. Firstly, the visual image features automatically extracted from the database and secondly, after receiving the user query image, the low level features extracted and stored in the database features to find the closest images to Image Query.

Image retrieval system architecture is shown in Figure 1

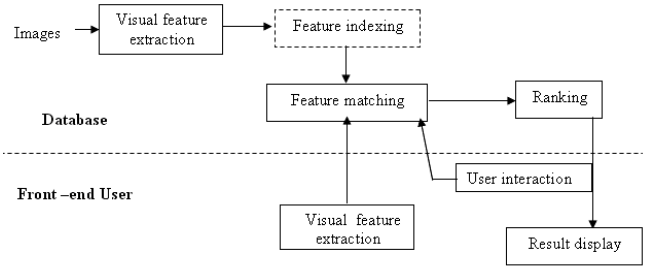

Figure1. Image retrieval system

Considering the above figure, image database contains images do recovery operation between them.

Low level features extracted from these images and the kept in database of low level features. So for every image X, feature vectors (F) that contain features associated with low levels of the image. Usually in images are used different of feature for determine color, texture and shape, that mixture in the form of a feature vector. For each image, such as X, F = [fc, fs, ft] is the feature vector, which respectively represent the characteristics of color, shape and texture.

Feature extraction stage, the appropriate features are extracted Query Image. And the similarity measure step, the query image feature vector with feature vectors database images are compared by similarity of function (Formula 1).

$$D(F_i, F_j) = \sum_{k \in \{C,S,T\}} W_n^k d(f_i^k, f_j^k) \qquad (1)$$

On top, D is distance between two image feature vectors i, j. f_i^k, indicates feature (k) in image (i). w_n^k‘, represent the weight-related features (k) and d, is a weighted similarity measure. So the system, finds the closest images to the Image Query.

The images are provided for user through the user interface. And get thought of user about their, user interaction to achieve the desired images continues.

This process is known as relevance feedback which is used for short-term learning.

3. The proposed method to improve the feature vectors and similarity measure

In the proposed method we have used eye physiological structure for initializing weight in vector feature. Through the process of relevance feedback can be corrected weights of features and updated similarity measure than increased efficiency in retrieval systems and user receive faster response.

4. Initializing weight based on attention

The attention is a relatively new concept in cognitive science, in recent years, scientists has been used in the field of cognitive science and engineering. If a simple and practical definition of the attention we need to refer to human behavior. We know humans in look at special sights attention to the center and away from the center, the attention is too low. So Gaussian filter used on the image. And thus all pixels of image will have the same importance but which are close to the center pixel image is given more weight.

4.1. Use of relevance feedback to update the similarity measure

Weight at beginning obtains feature vectors by using the attention and Gaussian filter. In follow, by use of relevance feedback and fuzzy rules are intended to update the similarity measure. Considering that our proposed method have used 20 to 100 image returned by the system. So according to the number of relevant images returned by the system and consider its membership value Gaussian filter obtains value of membership that stage than five fuzzy sets "very low, low, medium, high, very high" .For instance returned image by sets fuzzy system are as follows

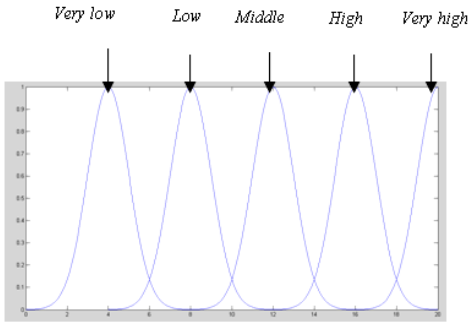

Figure2. Fuzzy set

Next, the relevant steps have to be classified in set of highest value membership. In this way the parameters k, which is fuzzy sets with maximum membership is determined. Defuzzy function does by using k in similarity measure. So that the numerical value for the fuzzy weight of each component is determined as follows:

Very large=1, large=0.8, medium=0.55, small=0.3, very small=0.1

For effective to upgrade our similarity measure we have placed next to each other weight-related components of the type attribute (color, shape). And the feature vector is defined for the whole features of image. In other words we have h = [h^c, h^s] a h^c, color and features h^s, Containing the texture features and h=[h_1^c,h_2^c,h_3^c,…,h_1^s,h_2^s,h_3^s,..] . For Set weights of component features have used the variance of each component in related and unrelated images. Relevant rules are presented in the formulation 2 and 3.In these rules weight loss if the variance components in related images (2) Most of that variance in irrelevant images (3) is the component of (relationship 2) and otherwise increases (relation 3).

$$If\ (\sigma_+^l > \sigma_-^l) and (\sigma_+^l \neq 0) then$$
$$h_l(new) = h_l(old) - k \times h_l(old) \quad (2)$$

$$If\ (\sigma_+^l < \sigma_-^l) and (\sigma_+^l \neq 0) then$$
$$h_l(new) = h_l(old) + k \times h_l(old) \quad (3)$$

In Top formula h_l (new), weight corrected and h1 (old), my weight component of l in the previous step. In this paper is used formula 1 for determining the degree of similarity between images.

5. Tests and results

In this article Corel database we have used the 5000 image. This database includes 50 different semantic groups, such as flowers, airplanes, landscapes, cars and..... 100 pictures are in each group. All database images are, color and JPEG compression in the area.

5.1. Basic features

Implemented features include: color histogram fuzzy Eten cycle representing the color features and edge histogram to represent the shape feature.
In recent years, many methods are presented based on fuzzy logic in image retrieval based color characteristics such as color histogram l * a * b *.
But most of these methods to can not identify the exact color of the pixels, especially in the case synthetic colors.
For resolve this problem, we determine the characteristic color by use Eten fuzzy color histogram.
So this method using rules of combination color cycle Eten importance of each color and importance each color, each pixel should be classified among one of 10 colors including black, gray, red, orange, yellow, Green, Cyan, Blue, Purple, White.

5.2. Fuzzy Edge Histogram

Edge, is an important feature in determining the content of image. We are used competitive fuzzy edge detection by Lily Rui Liang, Carl G. Looney in 2003 to detect the exact edges of image and classified pixels of image in edge classes and backgrounds. In this way four types of edges to form edge histogram is used, including directional edge in the direction of horizontal, vertical, 45 degrees and 135 degrees. Details are extracted from the reference 14.

5.3. Results and comparison with other methods

To measure the effects of quality algorithm proposed in this paper we have used 5000 image size of 256 × 384 which is composed of 50 groups of different image COREL database. All testing is done on software MATLAB, 1 MB of memory and processor +3500. Figure 3 shows a comparison of average precision retrieval generally obtained from six group picture of the basis of 20 to 100 image retrieved by the system using four methods described, on the 5000 image database COREL using 150 image the query. According to Figure 4, clearly seen that our proposed method is the best method with the highest accuracy for any number of images retrieved from 20 to 100. Comparisons of recall retrieval are shown in Figure 4 the different number of retrieved images, so it can be said with regard to the

resulting graph Our approach shows a higher overall recall to any number of images retrieved in the system

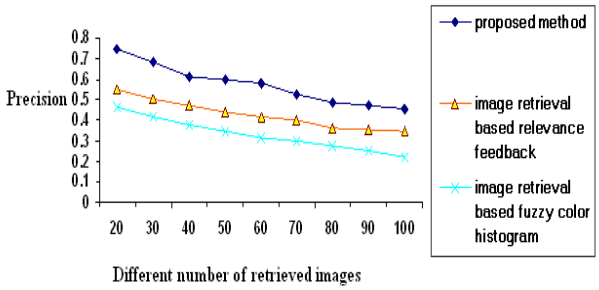

Figure3. Compression of precision retrieval for 3 methods

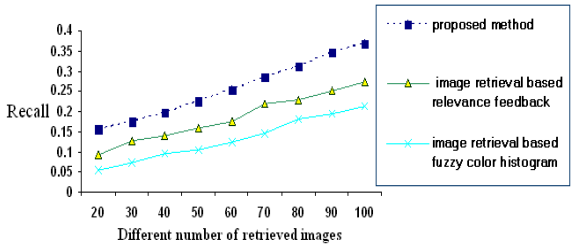

Figure4. Compression of recall retrieval for 3 methods

Considering all the tests performed and review the results, we can say that the method of fuzzy color histogram l * a * b *, is used only color information for retrieval.

Therefore does not provide good results in images with a sophisticated edge. because using fuzzy histogram HSV in relevance feedback based retrieval methods do not able to detect the exact color of pixel images, especially in combination of colors. And also considers the same weight for all the pixels, and cannot do retrieval operation effectively. But in a way that we have offered use competitive fuzzy edge detector to determine effective pixels of edge, background and even marginal edges.

Using color information and edge histograms, we have determined that the feature vectors. Those are well defined by the Eten fuzzy color histogram.

Next, using the eye physiological structure, we can effectively determine the initial weight for feature vector.

And continue using fuzzy logic techniques and relevance feedback in each stage of retrieval, the correct feature vector and Upgrade similarity measure between images is well. So this has led to increase efficiency retrieval process.

6. Conclusions

In recent years has provided many ways for content based image retrieval. All they are trying to provide new methods for extracting efficient features and methods determine optimal for measuring similarity between images. One of the fundamental problems in image retrieval techniques is, semantic gap between human perception and understanding of system. So that the proposed method is suitable method if that could further reduce this parameter.

Fuzzy color histogram has recently presented is a method based on fuzzy logic. In this way, because it does act of retrieval only on the color distribution of images and methods based on relevance feedback, the reason for determining the edge feature is very dependent on the colors and some parameters quantized approximation cannot be appropriate to retrieve images with complex spatial place. To solve these problems and determine the edge characteristics and color we have to offer an efficient method based retrieval relevance feedback and eye physiological structure in this paper. In the proposed method, we determine vector feature using competitive fuzzy edge detection and Eten fuzzy color histogram.

So that the various tests performed in the paper shows high accuracy in retrieval by proposed method.

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