Content Based Image Retrieval Using Multiwavelet

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Abstract— This paper presents Content Based Image Retrieval using multiwavelet. The database image features are extracted by multiwavelet based features at different levels of decompositions. In this paper, we have tested 500 images with 11 different categories. The experimental results show the better results in terms of retrieve accuracy and computation complexity. Euclidean Distance and Canberra Distance are used as similarity measure in the proposed CBIR system.

Index Terms— Accuracy, Energy, Euclidean distance and Canberra distance, Image retrieval, multiwavelet.

1. Introduction

Content-Based Image Retrieval (CBIR) is the process of retrieving images from a database on the basis of features that are extracted automatically from the images themselves [1]. A CBIR method typically converts an image into a feature vector representation and matches with the images in the database to find out the most similar images. In the last few years, several research groups have been investigating content based image retrieval.

A popular approach is querying by example and computing relevance based on visual similarity using low-level image features like color histograms, textures and shapes. Text-based image retrieval can be traced back to the 1970's; images were represented by textual descriptions and subsequently retrieved using a text-based database management system [2].

Content-based image retrieval utilizes representations of features that are automatically extracted from the images themselves. Most of the current CBIR systems allow for querying-by-example, a technique wherein an image (or part of an image) is selected by the user as the query. The system extracts the features of the query image, searches through the database for images with similar features, and displays relevant images to the user in order of similarity to the query [3].

Image Retrieval aims to provide an effective and efficient tool for managing large image databases.

With the ever growing volume of digital image generated, stored, accessed and analyzed.

The paper is organized as follows. Algorithm of proposed method is presented in Section 2. Section 3, describes the multiwavelet. The texture image retrieval is Presented in Section 4. Feature Similarity is made in Section 5. Results are shown in section 6. Section 7 describes the conclusion.

2. Algorithm of Multiwavelet

The algorithm of proposed method as shown below

Select query image
For i=1: numberofdatabaseimages
x=imread(x)
S=size(x)
x=histeq(x) %apply histogram
[a1, b1, c1, d1]=multiwavelet(x);
*E1=1/m*n**∑∑1a
*E2=1/m*n**∑∑1b
*E3=1/m*n**∑∑1c
*E4=1/m*n**∑∑1d
D=Euclidian distance
T=sort (d)
End

The Euclidian distance and multi wavelet are explained in next section.

3. Multi Wavelet Transform

Multiwavelets were defined using several wavelets with several scaling functions [7]. Multiwavelets have several advantages in comparison with scalar wavelet [8]. A scalar wavelet cannot possess all these properties at the same time. On the other hand, a multiwavelet system can simultaneously provide perfect representation while preserving length (Orthogonality), good performance at the boundaries (via linear-phase symmetry), and a high order of approximation (vanishing moments) [9]. Thus multiwavelets offer the possibility of superior performance and high degree of freedom for image processing applications, compared with scalar wavelets.

During a single level of decomposition using a scalar wavelet transform, the 2- D image data is replaced by four blocks corresponding to the sub bands representing either low pass or high pass in both dimensions. These sub bands are illustrated in Fig. 3. The multi-wavelets used here have two channels, so there will be two sets of scaling coefficients and two sets of wavelet coefficients. Since multiple iteration over the low pass data is desired, the scaling coefficients for the two channels are stored together. Likewise, the wavelet coefficients for the two channels are also stored together

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L_1L_1	L_1L_2	L_1H_1	L_1H_2
L_2L_1	L_2L_2	L_2H_1	L_2H_2
H_1L_1	H_1L_2	H_1H_1	H_1H_2
H_2L_1	H_2L_2	H_2L_1	H_2L_2

Fig.1. Image decomposition after a single level scaling for multiwavelets

4. Texture Image Retrival Procedure

The multi wavelet is calculated of each image from the database. The multi wavelet decomposed in to 16 sub bands then calculate the energies of 16 sub bands and those energy values are arranged in a row vector.

For example

Energy= [e1 e2 e3 -------e16];

Where

e1, e2, e3 are the energy values of each sub band.

Calculate the energy of all decomposed images at the same scale, using:

$$E = \frac{1}{MN} \sum_{i=1}^{m} \sum_{j=1}^{n} \left| X(i,j) \right|$$

------ (1)

Where M and N are the dimensions of the image, and X is the intensity of the pixel located at row 'i' and column 'j' in the image map. These energy level values are stored to be used in the Euclidean distance algorithm.

5. Feature Similarities

In this section, we are using Canberra distance and Euclidean distance to measure the similarity between Database images and query image.

Canberra distance between two vectors P and Q is given by

$$d^{CAD}(\mathbf{p},\mathbf{q}) = \sum_{i=1}^{n} \frac{|p_i - q_i|}{|p_i| + |q_i|},$$

------- (2)

Here,

Pi is the energy vector of Query mage

Qi is the energy vector of database images.

The Euclidean distance is given by

D= (sum ((ref-dbimg). ^2). ^0.5)

Here

ref is the query image vector

dbimg is the database image vector.

In equation 2 the numerator signifies the difference and denominator normalizes the difference. Thus distance values will never exceed one, being equal to one whenever either of the attributes is zero.

The performance is measured in terms of the average retrieval rate, which is defined as the average percentage number of patterns belonging to the same image as the query pattern in the top 20 matches.

6. Results

The proposed system is developed on matlab tool for the **evaluation** of performance metrics. The obtained simulation results were processed on coil database images. The simulative result obtained are illustrated below

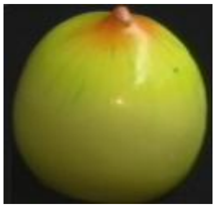

Fig.2.Query image of mango coil

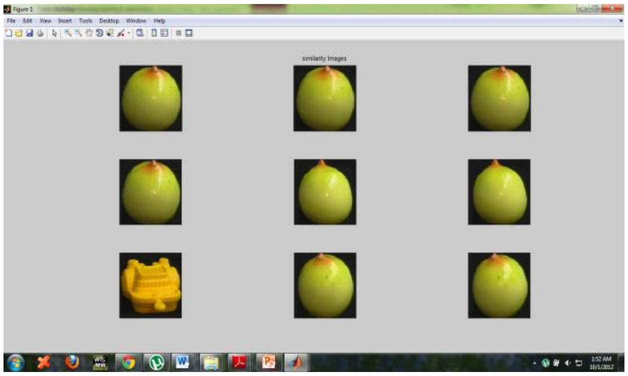

Fig.3.similarity image retrivals using multiwavelet

In fig 3. It retrive 8 simirality images out of 9 image. So the accuracy is 88%.

We can also retrive images which contain human faces with 100% accuracy by using multiwaavelets.

Fig.4. Query image

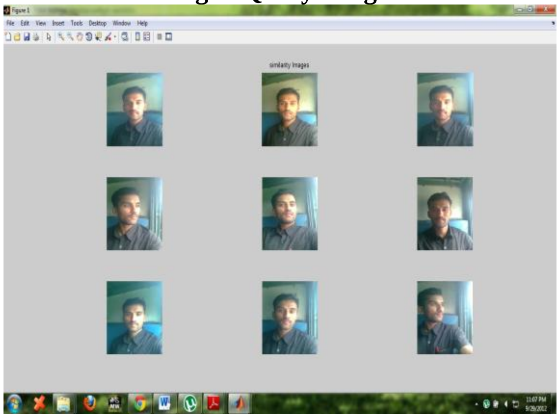

Fig.5.similarity image retrivals using multiwavelet

In fig 5. It retrive 9 simirality images out of 9 image. So the accuracy is 100%
It takes 1 minute 3 sec time of 500 images. In Gabor wavelet takes around 5-6 minutes time. So the computation time is less compare to Gabor wavelet.

7. Conclusion

This paper presents image retrieval based on multiwavelet has been proposed. It is better accuracy and computation complexity is low. The computational steps are effectively reduced with the use of multiwavelet. As a result, there is a substation increase in the retrieval speed. The whole indexing time for the 500 image database takes 1 minute 3 seconds.

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