A Novel Color and Texture Features Based on Image Retrieval by Using Color-Histogram and Discrete Curvelet Transform

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***Abstract*— CBIR is the best applicable Digital image processing techniques, it has been extensively used. In image retrieval the feature extraction is one of the best procedures used for interpretation and images indexes. An effective storage managing number of image collections are a difficult task in computer systems. There are many existing methods to overcome these problems. In this paper we are proposed combination of color histogram and Curvelet transform (DCT) in different color space based content based image retrieval by using both color and texture. In past the curvelet transform were used for image de-noising. Now we research on curvelet transform it can be used for the better retrieval results. The average normalized rank and probability to evaluate and compare the proposed method against different methods. The obtained result shows the better performance in different types of similarity measurements.**

Keywords: *Color, Texture, Color Histogram, Image Retrieval, Discrete Curvelet Transform.*

I. INTRODUCTION

Nowadays the growth of technology has a low cost storage and the use of internet have the number of digital images as nature, satellite, medical, signature, images and so on incredibly increasing. At present the storage, search and classification of images are highly demand. A search designing is a mechanism depends on user requirements of query image related to client demand has become an important research topic in this field. CBIR is a process that searches for a selected query image from the image database. CBIR is can be able to find appropriate images according to query image or human perception. In the study of image retrieval there are two main research fields one is database management and second is machine vision [1, 2].In this proposed image retrieval research color is most common feature, which is stable the size of image and background color [3]. The HVS color spaces is needed to have the characteristics as following: 1) the uniform perception, it means the distance between colors has to be proportional with human perception. 2) The user simply understandable and imaginable [4]. In this paper we are used (RGB) Red, Green, Blue color spaces, because of these color spaces are robust and against digital image variation in comparison with other color spaces [4]. Although the only colors feature extraction has low complexity in retrieval, so we are not considering the color distribution locations [5]. Generally the image retrieval consider based on texture. The texture feature extraction is widely used in various fields such as machine vision, pattern recognition and image retrieval [5]. Texture is also considered as one of the feature extraction, it attributes by many authors. Although there is no mathematical formula and definition for texture, intuitively this descriptor provides different properties such as image smoothness, coarseness, and regularity. Mainly the texture features of images are analysed through statistical and spectral methods [6]. However, statistics techniques suffer from the insufficient number of features and sensitive to the image distortions i.e is image noise. Those spectral methods cannot capture edge information accurately. A new texture feature based on curvelet transform is proposed and then the color feature for the image is calculated. The combination of discrete curvelet transform with color features works well and get efficient results in multi-resolution analysis.

II. PROPOSED CBIR SYSTEM

The general features in CBIR system such as color texture and shape. The Texture and Color features are simple for computing the similarity. CBIR systems have combination of both texture and color features are provide better performance and retrieved relevant images from the large image database [7]. Standard CBIR system involves two important parts such as, the first part is extracts the image features, and also it generate the feature vector of each image from the database and represent content of image accurately. The second method is similarity measurement in CBIR system. It computes distance between the query image and each image of the database using the feature vector of the query image and each image of the database to obtain similar color images displayed in allotted axes of three colors Red, Green, and Blue.

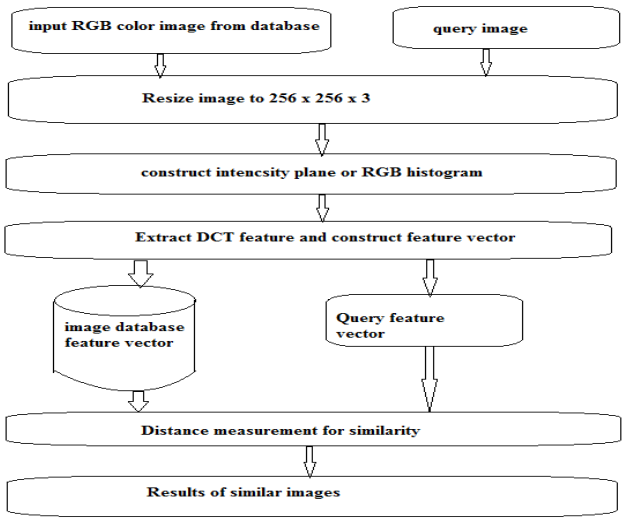

Fig.1 Block diagram of the proposed CBIR system.

A. Color Based Retrieval

The most useful information can be extracted from images to compare the characteristics of color image. To analyze the algorithms that can be compare the similarity measurement based on their color content. Number of algorithms has been developed since the late 1980's color information extracted from images for retrievals. The most basic form of color retrieval involves specifying the color values that can be searched images from a database. In Google's editing software, Picasa 3.0, allows an experimental tool to search certain colors in images.

The most common approach is comparing the color content of a query image to that of a database images is that of comparing the color histograms. The color histograms are computed for each image so as to identify the relative pixels with certain values. The basic idea is that similar images it contain similar proportions of certain colors. The CBIR is based on color histograms is fairly efficient and easy in terms of processing content information.

In this proposed methodology different types of the similarity computation were carries out. The first involves the Euclidean distance calculation and to compute difference between the numbers of certain set of pixels found one image versus another for each bin in the histogram.

B. Methodology Of Curvelet Feature Extraction

The DCT (Discrete Curvelet Transform) is employed using the fast discrete curvelet transform. Mainly it is computed in the spectral domain to employ the advantage of FFT. The query image, both the image and the curvelet are transformed into Fourier domain, and then the convolution of the curvelet with the image in spatial domain becomes the product in Fourier domain. Then finally the curevelt transform apply the inverse Fourier transform on the spectral product. Once the curevelet coefficients have been obtained the probability, the mean, and standard deviation, entropy are computed as the texture features for the curvelet. For each curvelet, two features are obtained. For example if n curvelets are used for the transforms, 2n texture features are obtained. The 2n dimension texture feature vector is used to represent each image in the database for image retrieval.

Feature extraction is applied to each of the images in the database. The end of each image in the database is represented and indexed using its curvelet feature vector. The given a query image, its curvelet features are computed. The system then compares the query feature vector with all the feature vectors in the database using distance.

$$d(Q,D) = \sqrt{\sum_{i=0}^{2n-1}(Qi - Di)\text{^}2} \qquad (1)$$

Where $Q = \{Q_0, Q_2, \ldots, Q_{2n-1}\}$ is the feature vector of the query image, and $D = \{D_0, D_2, \ldots, D_{2n-1}\}$ is the feature vector target image in the database. Finally, the images in the database are ranked according to their distance d to the query image, and the ascending order of the ranked list of images is restored to the user.

III. ALGORITHM AND METHODOLOGY

The proposed algorithms can be utilized in our testing of color histogram approach, GLCM, CCM, and DCT to CBIR system. Outline of the method is follows.

- ✓ Read query image in a database and then extract the RGB format pixel information from images of different file formats, JPEG, BMP, TIFF.
- ✓ Then to create 48 bin normalized histogram for each of the RGB component of all images from database. Each image will have three histograms are associated with it.
- ✓ In a query image read and extract the pixel information.
- ✓ Then compute the Euclidean distance to comparing the query image to each image in the database.
- ✓ The resultant images sorted in database in ascending order to query image and return as result.

A. Extraction Of RGB Information

This algorithm was implemented in MATLAB, and thus built in methods provided, can be utilized to retrieve an array containing pixel values in RGB format. A result, only image formats compatible with Matlab built in methods was utilized. The most common image file formats are including JPEG, BMP, GIF, and PNG.

B. Histograms

The histogram consists of 48 bins where each bin defines a small range of pixel values. This value stored in each bin is the number of pixels within the range of images. The range represents different levels of intensity of RGB component.

Coming to texture features in previous we used GLCM and CCM techniques are used, [4], [12].

C. Comparison

Once the histograms are created then find the Euclidean Distance and different types of distances are calculated in this paper. The differences are calculated for each bin by the pixel intensity level and then squared the differences. The squared

root value is taken. This process is continued for each histogram, which the averages of the three values are taken.

IV. Experimental Result

Image database can be used to evaluate the proposed algorithm. The database contains different categories, each which has about 45 images. The hole database have number of images is about 1000. They are planes, flowers, foods, mountains, balls, animals, medical images. Both color feature and texture features of each image are extracted. Precision rate and recall rate are used to evaluate the performance of the proposed method. Our proposed methodology mainly compared with image retrieval method based on color feature, the performance of image retrieval method based on texture feature is poor. There have two possible reasons for it. One is the color variation between various images in the image database is more obvious and the color performance of image retrieval based on color feature is better. Other one is that same image database, the extracted texture features may be insufficient results for difference between the different classes, which makes the performance of the image retrieval based on texture features poor. For the better performance of image retrieval system based on texture features is expected to increase the performance of image retrieval system based on multi-feature (color +GLCM and color +CCM) and DCT.

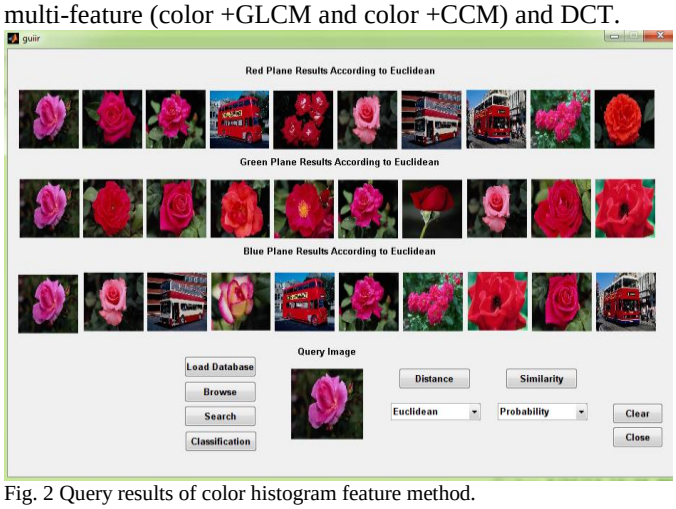

Fig. 2 Query results of color histogram feature method.

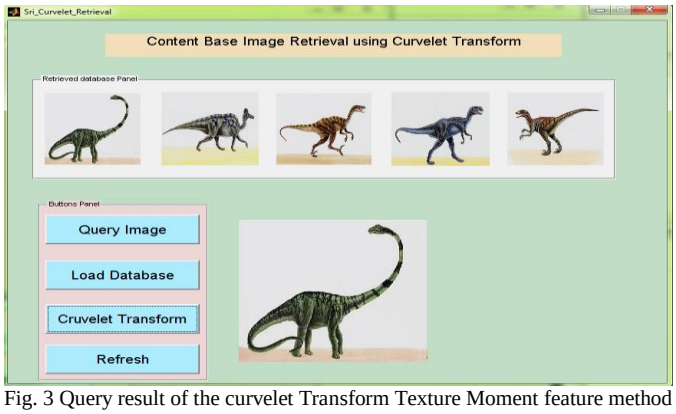

Fig. 3 Query result of the curvelet Transform Texture Moment feature method

In CBIR systems commonly used for performance measures are Precision and Recall. The Precision is defined as the ratio of number of retrieved relevant images to the total number of retrieved images.

$$P = \frac{Number\ of\ relevant\ images\ retrieved}{Total\ number\ of\ images\ retrieved} \quad (2)$$

The recall is defined as the ratio of number of retrieved relevant images to the total number of relevant images from the database. The equation of recall is:

$$R = \frac{Number\ of\ relevent\ images\ retrieved}{Total\ number\ of\ relevent\ images\ in\ the\ database} \quad (3)$$

TABLE I. Retrieval result

Retrieval mode	Recall (%)	Precision (%)
Color histogram and HSV	23.1	36.8
GLCM	26.5	39.2
CCM	29.3	44.1
Color +GLCM	28.6	41.4
Color +CCM	31.4	45.8
proposed	34.5	48.2

The fig.4 is a graph it showing the comparison of average precision obtained by proposed system with other retrieval systems.

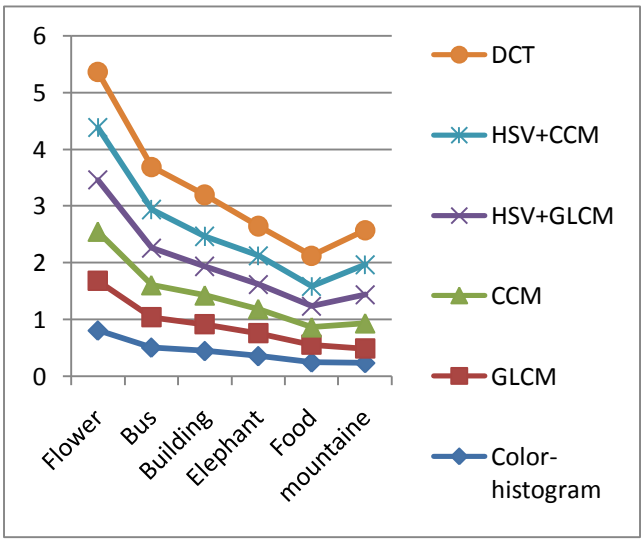

Fig.4. The average precision of different methods.

The Fig.5 is graph showing the comparison of average recall obtained by proposed systems with other retrieval systems.

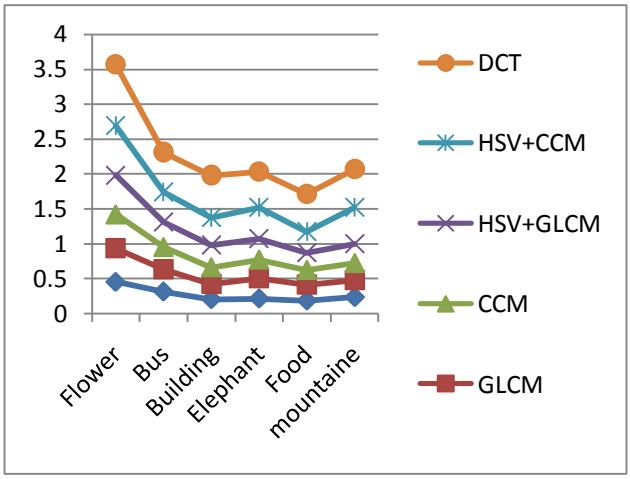

Fig. 5The average recall of different methods.

V. *CONCLUSION*

CBIR is an applicable technique to find the similar images from a large image dataset. Increasing the size of the dataset is a challenge of average reduction of precision, and recall value and speed of retrieval performance is increased. This paper proposed a new technique based on multi-features, Curvelet Transform (DCT) and color histogram of color spaces to improve the CBIR system performance of image retrieval. In this method we are used an average of Red, Green, Blue Plaines to generate intensity plans considering separately minimum, maximum and different planes to generate DCT planes to test the proposed method. The second contribution is the application of curvelet transform on CBIR and to produce a new texture features combined with color features. In future the rotation and scale invariance will be investigated to further improve the performance of curvelet retrieval.

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