Fusion-Based Method for Content Based Image Retrieval

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Abstract: ***The content-based image retrieval (CBIR) has gained the substantial attention during the past few years, with many potential practical applications,. The CBIR system utilizes the visual features of an image such as color, texture and shape to retrieve the related images. The system extracts the features of a query image, searches the database for images with similar features, and exhibits relevant images to the user in order of similarity to the query. The proposed system uses the color features and the texture features to retrieve the related images. Both the color features and the texture features are combined to retrieve more accurate results. Hence a fusion based model is developed which uses hue saturation and value (HSV) to extract the color features and Gabor wavelet to extract the texture features. The experimental results show that by using both color and texture feature for retrieval can significantly improve the performance of the CBIR systems.***

IndexTerms – CBIR, Color, Texture, HSV, Gabour Wavelet.

I. INTRODUCTION

As per the survey carried out, content-based image retrieval (CBIR) has gained much attention for its potential applications in multimedia management. It is motivated by the explosive growth of image records and the online accessibility of remotely stored images. With the advancement in internet and multimedia technologies, a huge amount of multimedia data in the form of audio, video and images has been used in many fields like medical treatment, satellite data, video and still images repositories, digital forensics and surveillance system. This has created an ongoing demand of systems that can store and retrieve multimedia data in an effective way. Many multimedia information storage and retrieval systems have been developed till now for catering these demands. The most common retrieval systems are Text Based Image Retrieval (TBIR) systems, wherein the search is based totally on computerized or manual annotation of photos. A conventional TBIR searches the database for the similar text surrounding the image as given in the query string. The commonly used TBIR system is Google Images. The text based systems are fast as the string matching is computationally less time consuming process. However, it is sometimes difficult to express the whole visual content of images in words and TBIR may end up in producing irrelevant results. In addition annotation of images is not always correct and consumes a lot of time. In order to find out the different way of searching and overcoming the limitations that has been imposed by TBIR systems more instinctive and user friendly content based image retrieval systems (CBIR) were developed. A CBIR system uses visual contents of the images described in the form of low level features like color, texture, shape and spatial locations to represent the images in the databases. The system retrieves similar images when an example image or sketch is presented as input to the system. Querying in this way eliminates the need of describing the visual content of images in words and is close to human perception of visual data.

II. PROPOSED WORK

The proposed project is a fusion-based model which is designed to retrieve the related images. It uses the content-based image retrieval technique to retrieve the images. The visual features such as color and texture are extracted automatically from the query image. The results of both the features are combined or fused to retrieve more accurate results.

III. SYSTEM DESIGN AND DISCUSSION

This is the block diagram showing different stages of the system

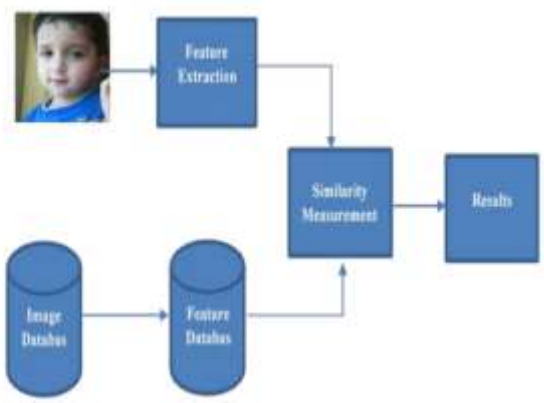

Figure 1 Block diagram of CBIR system

The Figure 1 shows the block diagram of the system. The input to the system is the query image given by the user. The system takes the query image from the user and extracts the color and texture features of that query image. These color and texture features are combined or fused and then they are compared with the visual features of the images in the database. Based on their similarity the related images are extracted from the database.

The following are the stages involved in the system:

1. Feature Extraction: In this stage the color and texture features of the query image are extracted which will be further used for matching with the visual features of the images in the database. The color and texture features are fused to retrieve more accurate images. The feature extraction is done automatically and hence no human intervention is required.
2. Similarity Measurement: In this stage the extracted features of the query image are matched with the visual features of those in the database. It is matched based on the fusion of color and texture features.
3. Results: In this stage after matching the extracted features the related images are retrieved from the database.

IV. METHODOLOGY USED

1. Color Features

Color is the most commonly used feature of an image. The perceived color at any pixel of an Image is obtained by mixing three preliminary colors in appropriate proportion. The three dimensional color provides more discriminating information than the single dimensional gray level values. Before extracting color descriptor a proper color space must be determined first. Commonly used color spaces for image retrieval application are RGB, HSV and opponent color space. There is no agreement over which color space is best but one of the desirable characteristic of color space for image retrieval task is its uniformity. Uniformity means that the physical distance between any two color pair in the color space must be equal to the perceived distance between them. Some commonly used color descriptors are color moments, color histogram

1.1 *Color Space*

A color space is defined as a model for representing color in terms of intensity values. Typically, a color space defines a one- to four-dimensional space. A color component, or a color channel, is one of the dimensions. A color dimensional space (i.e. one dimension per pixel) represents the gray-scale space. The following two models are commonly used in color image retrieval system.

- ***RGB Color model***

The RGB color model which consists of the primary colors Red, Green, and Blue. This system defines the color model that is used in most color CRT monitors and graphics. They are considered the "additive primaries" since the colors are added together to produce the desired color.

- ***HSV Color Model***

The HSV stands for the Hue, Saturation, and Value based on the artists. Hue varies from 0 to 1.0; the corresponding colors vary from red, through yellow, green, cyan, blue, and magenta, back to red, so that there are actually red values both at 0 and 1.0. As saturation varies from 0 to 1.0, the colors hues vary from unsaturated shades of gray to fully saturated no white component. As the value, or the brightness, which varies from 0 to 1.0, the corresponding colors become increasingly brighter.

1.2 *Histogram-Based Image*

The color histogram image is built by counting the number of pixels of each color. Retrieval from the image databases using color histograms has been checked in [tools, fully, automated]. In the developments of the extraction algorithms follow a similar progression: (1) selection of a color space, (2) quantization of the color space, (3) computation of histograms, (4) derivation of the histogram of the distance function, (5) identification of indexing shortcuts. These steps may be crucial towards developing a successful algorithm.

2. Texture Features

There is no specific definition of texture however one can define texture as the visual pattern that has properties of homogeneity not resulting from the presence of only a single color or intensity. Various techniques for texture analysis have been investigated in the field of computer vision and pattern recognition. The texture extraction techniques can be classified into two categories: statistical and structural. Statistical approaches use intensity distribution of image to extract statistical parameters representing texture of image. The often used these statistical methods which include Fourier power spectra, Co-occurrence matrices, Shift-invariant principal component analysis (SPCA), Tamura feature, Wold decomposition, Markov random field, Fractal model, and Multi-resolution which filters the techniques such as Gabor and wavelet transform. Structural methods, including morphological operator and adjacency graph, describe the texture to recognize the structural primitives and their placement rules. They tend to be most effective when applied to textures that are very regular.

2.1 *Gabour Wavelet*

Elements of a family of mutually similar Gabour functions are called wavelets when they are created by dilation and shift from one elementary Gabor function (mother wavelet), i.e.

$$g_{\alpha,\xi,a,b}(x) = |a|^{-1/2} g_{\alpha,\xi}\left(\frac{x-b}{a}\right)$$

For $a \in R+$ (scale) and $b \in R$ (shift). By convention, the mother wavelet has the energy localized around $x = 0$ as well as all of the wavelets are normalized $\|g\| = 1$. Although the Gabour wavelets do not form orthonormal bases, the discrete set of them form a frame.

V. RESULTS AND DISCUSSION

Login screen

Figure 2 Login page for admin.

Figure 2 shows the Login page for admin. The admin can access the system only on entering the valid username and password. The username and password is set as admin and admin respectively to provide authorized access for administration. After entering the valid username and password click on Login button, this will take the admin to home page.

Loading the dataset

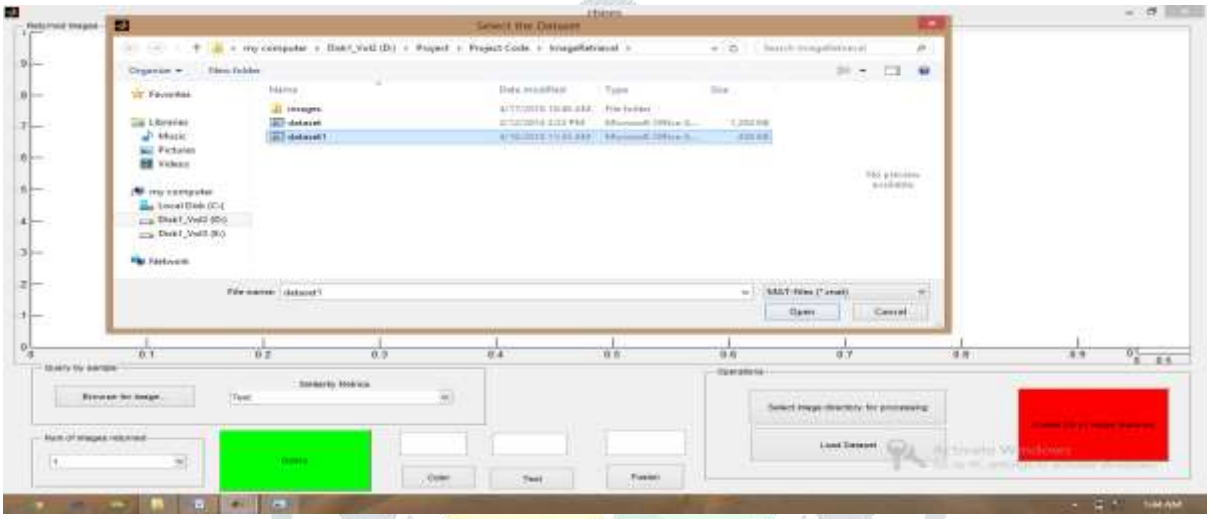

Figure 3 Loading of the dataset.

Figure 3 shows loading of dataset. Dataset contains the features of the images that are stored in our database. Initially we need to load the dataset, as the features of the images present in our database. This dataset will be used for similarity measurement.

Image uploading

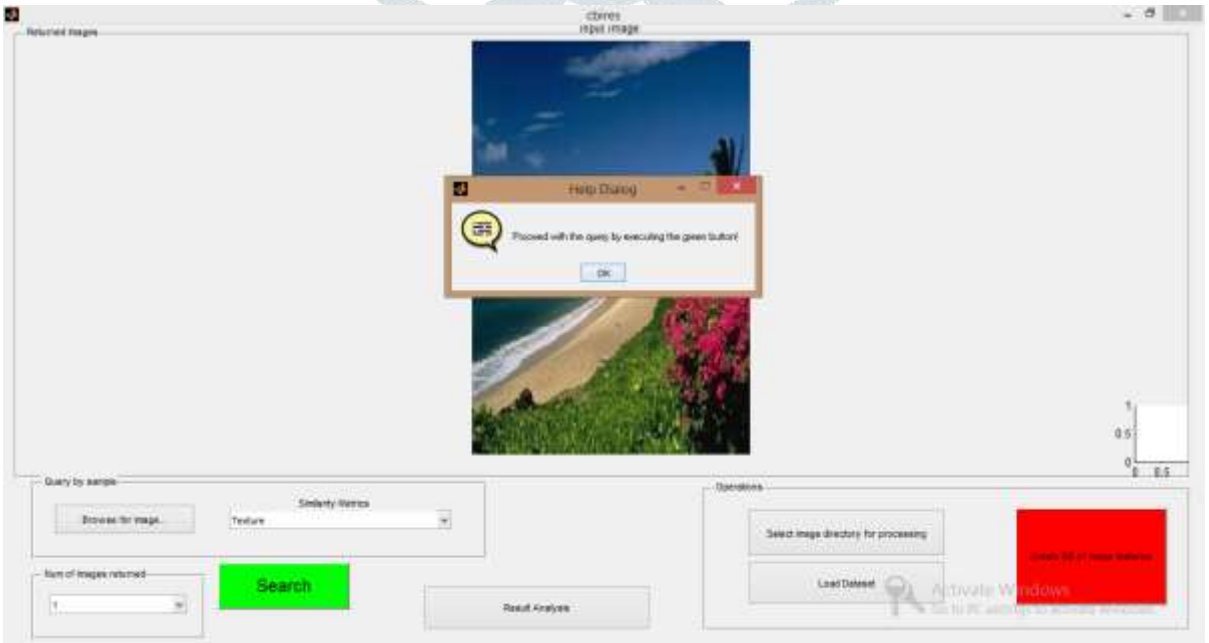

Figure 4 Query Image Upload

Figure 4 shows uploading of a query image. Here, we upload the image as a query in order to retrieve the similar images, to query image. We click on the browse for image button to choose an image as query, from the database that contains images.

Result based on color

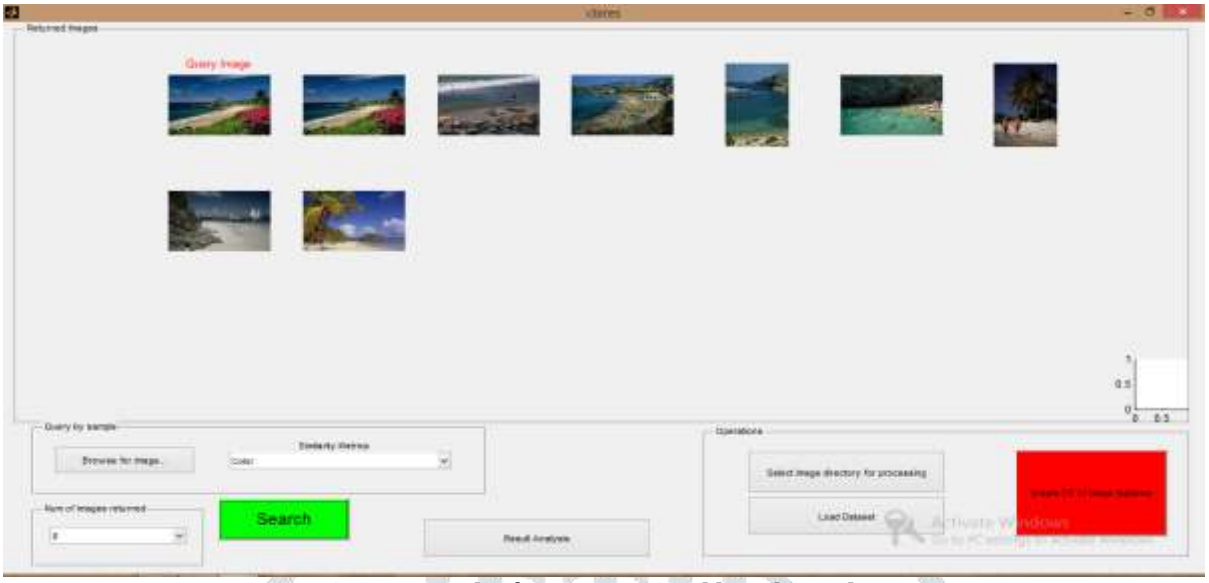

Figure 5 Result of images retrieval based on color.

Figure 5 shows result of images retrieved based on color feature. After uploading the image as query we can search images related to the query image based on color, texture or fusion of color and texture. The above figure shows retrieved images based on color.

Result based on texture

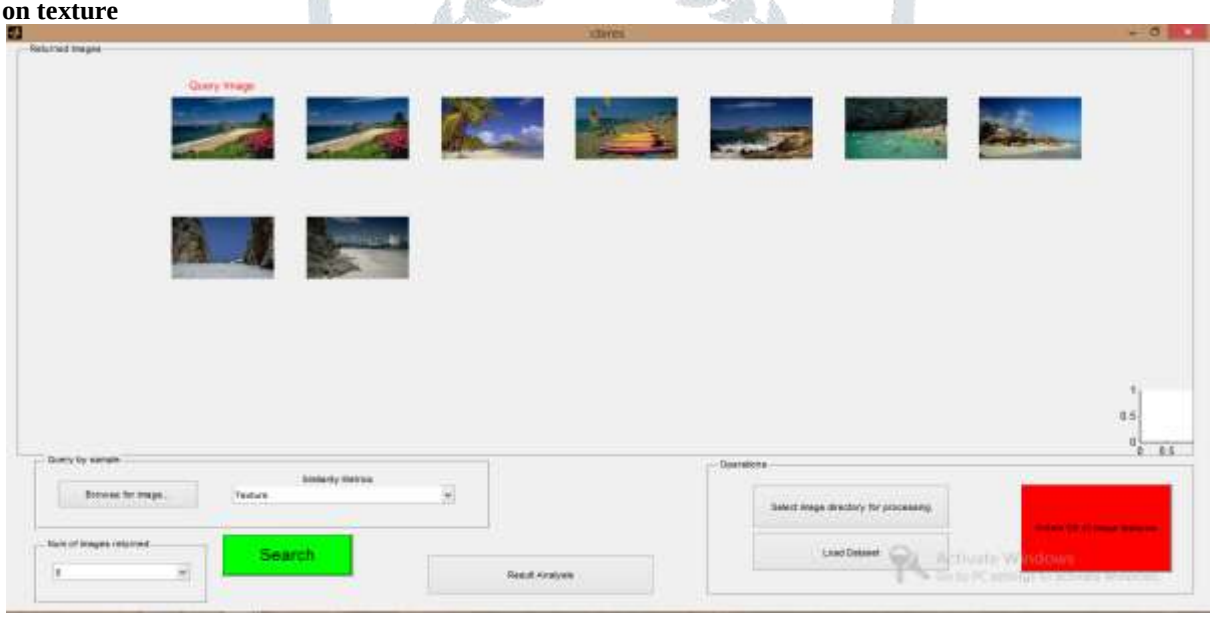

Figure 6 Result of images retrieved based on texture.

Figure 6 shows result of images retrieved based on texture feature. After uploading the query image we can search images that are similar to the query image based on texture feature. The above figure shows retrieved images based on texture.

Result based on fusion of color and texture

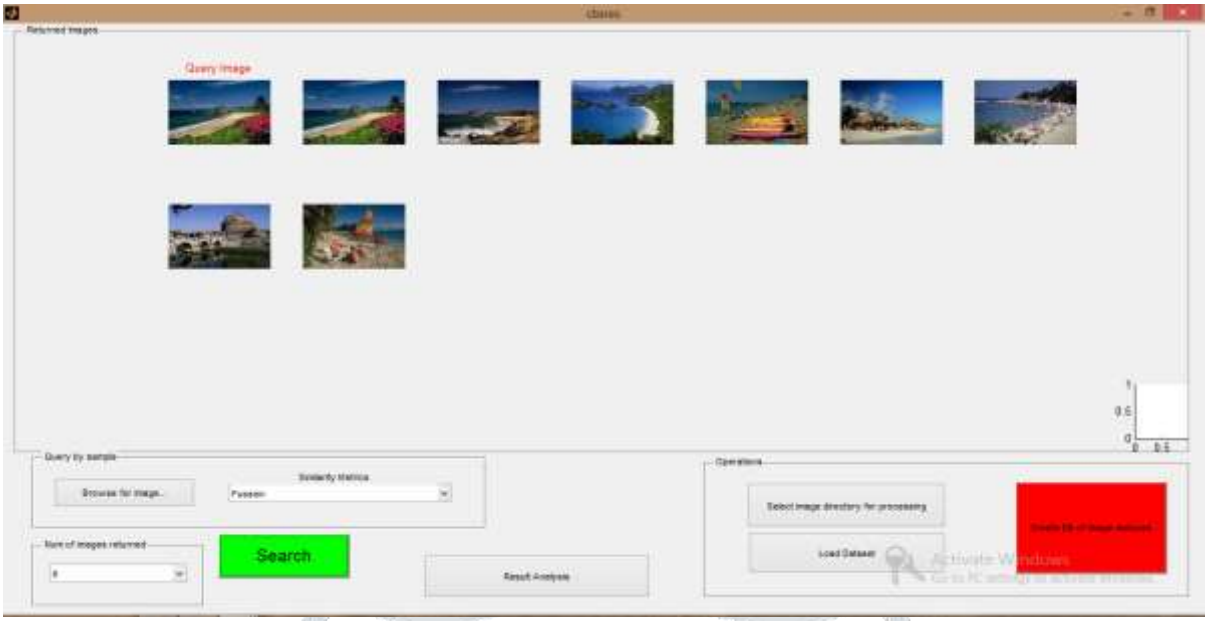

Figure 7 Result based on fusion of color and texture.

Figure 7 shows result of image retrieval based on fusion of color and texture. Here we obtain the results based on fusion of both the color feature and texture feature. This fusion method of color and texture is used to retrieve the images more accurately then using color or texture feature separately. The above snapshot shows the results of image retrieval using the fusion based method of color and texture.

Accuracy percentage of the retrieval

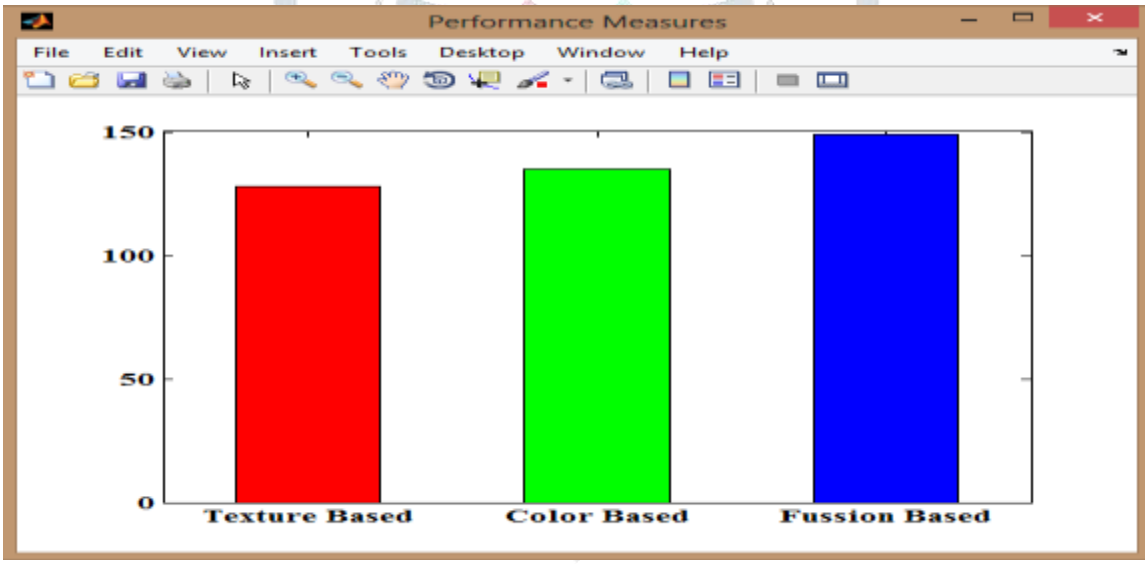

Figure 8 Accuracy percentage of the image retrieval.

Figure 8 shows accuracy percentage of image retrieval. This snapshot shows the accuracy percentage of the results based on color feature texture feature and fusion of both color and texture features. As it is seen that the accuracy percentage of fusion is high then compared to separate color color feature or the texture feature. This shows that the fusion model gives more accurate results and hence is more efficient.

V. CONCLUSION AND FUTURE WORK

Although CBIR has been a very active research area in the recent decades, many challenges are issued because of the complexity of images data. Many researchers have been done to develop some algorithms that solve some problems and achieve the accuracy when retrieving images and distinguishing between them. The proposed algorithms which uses images to extract the features and uses their features for analogy or similarity matching. However, most of the algorithms use the grayscales images.

This study implemented CBIR system that uses the combination of HSV color moment features and Gabor texture features. Experimental results for retrieving images showing the combination of color and texture features has higher retrieval accuracy than that of only color or texture features. Also this method approved the presented images by its features need size of storage media less than use the images itself. This study can be improved by considering additional attribute such as shape, region etc. Lastly GUI, web-based application and android-based application can be developed in this work.

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