An Integrated Approach to Image Retrieval

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Abstract: Image retrieval has been one of the most interesting and vivid research areas in the field of computer vision over the last decades. Content Based Image Retrieval (CBIR) basically is a technique to perform retrieval of the images from a large database which are similar to image given as query.CBIR systems are used in order to automatically index, search, retrieve, and browse image databases.

Every image is very rich in the information hence if you use different features in an image for comparison purpose then the performance of system will improve. In this paper we are extracting color feature by using RGB, HIS extraction also this color feature is integrated with texture extraction. For extracting Texture wavelet transform is used. We have compared different techniques as well as the combination of different features and compared the results. By using an integrated approach of image retrieval the the efficiency of system is increased. We have also compared the effect of different matching techniques on the image retrieval .

***IndexTerms* - CBIR, TBIR, Feature Extraction, Image Retrieval, Similarity Measurements.**

I. INTRODUCTION

As processors become increasingly powerful, and memories become increasingly cheaper, the deployment of large image databases for a variety of applications have now become realisable. Databases of art works, satellite and medical imagery have been attracting more and more users in various professional fields for example, geography, medicine, architecture, advertising, design, fashion, and publishing. Interest in the potential of digital images has increased enormously over the last few years, fuelled at least in part by the rapid growth of imaging on the World-Wide Web. Users in many professional fields are exploiting the opportunities offered by the ability to access and manipulate remotely-stored images in all kinds of new and exciting ways [1], [2].The problems of image retrieval are becoming widely recognized, and the search for solutions an increasingly active area for research and development. Problems with traditional methods of image indexing [3] have led to the rise of interest in techniques for retrieving images on the basis of automatically-derived features such as colour, texture and shape and the technology now generally referred to as Content-Based Image Retrieval (CBIR). After a decade of intensive research, CBIR technology is now beginning to move out of the laboratory and into the marketplace, in the form of commercial products like QBIC [4] and Virage [5]. However, the technology still lacks maturity, and is not yet being used on a significant scale. In the absence of hard evidence on the effectiveness of CBIR techniques in practice, opinion is still sharply divided about their usefulness in handling real-life queries in large and diverse image collections [6].

II. . CLASSIFICATION OF IMAGE RETRIEVAL SYSTEM

Current image retrieval techniques can be classified according to the type and the nature of the features used for indexing. Detailed Classification of complete medical retrieval system is given in fig. 1.

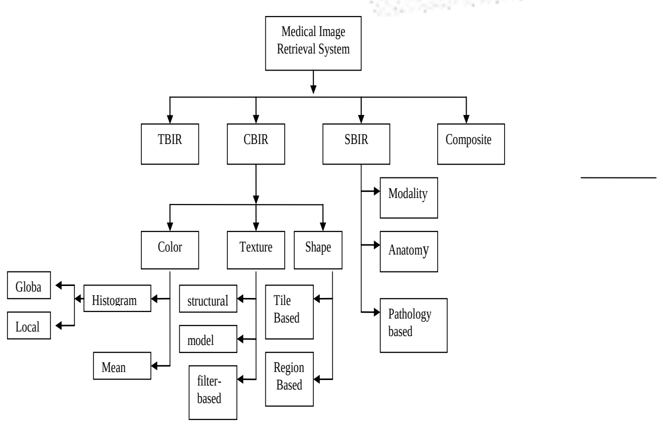

Figure1. Detailed Classification of Image Retrieval System

2.1. Text Based Image Retrieval

In this system images are indexed by text, known as the metadata of the image, such as the patient's ID number, the date it was produced, the type of the image and a manually annotated description on the content of the image itself. This kind of system, when used in image retrieval, is known as text-based image retrieval (TBIR). In these systems, keywords from lab reports and associated text from images are used as indexing and querying items. This is the current system used by most hospitals for organizing medical images known as Picture Archiving and Communication System (PACS).A number of commercial systems employ this approach, such as Google Images (images.google.com) and Flickr (www.flickr.com).

Although this approach can offer much flexibility in query formulation, image retrieval based only on text information is not sufficient, since it can not capture the visual content such as color, texture, or shape etc. The amount of labor required to manually annotate every single image, as well as the difference in human perception when describing the images, which might lead to inaccuracies during the retrieval process. Hence, there is a need for a better system. Problems with text-based access to images have shifted the focus of the researchers to content based medical image retrieval.

2.2 Content Based Image Retrieval

A growing interest in the area of CBIR is found in recent years due to the hope that the above-mentioned problems might be solved. It is a central issue in CBIR to identify a set of salient image features for indexing and similarity evaluation. Color, shape, texture and spatial relationships among segmented objects are typical features employed for image indexing. Some researches combine two or more of these features to improve retrieval performance.

The main goal in CBIR system is searching and finding similar images based on their content. To accomplish this, the content should first be described in an efficient way, e.g. the so-called indexing or feature extraction and binary signatures are formed and stored as the data. When the query image is given to the system The system will extract image features for this query. It will compare these features with that of other images in a database. Relevant results will be displayed to the user. Fast and accurate retrievals among the data collections can be done according to the content description of the query image.

There are many factors to consider in the design of a CBIR systems based on the domains and purposes, choice of right features, similarity measurement criteria, indexing mechanism, and query formulation technique. The most important factors in the design process is the choice of suitable visual features and the methodologies to extract them from raw images, as it affects all other subsequent processes.

By the nature of its task, the CBIR technology boils down to two intrinsic problems: (a) how to mathematically describe an image which can also be called as feature extraction.(b) how to assess the similarity between a pair of images based on their abstracted descriptions. Which can also be called as matching. [7]-[9]

In typical content-based image retrieval system the visual contents of the images in the database are extracted and described by multi-dimensional feature vectors. The feature vectors of the images in the database form a feature database. To retrieve images, users provide the retrieval system with example images or sketched figures. The feature vector of this query image is extracted. Then the extracted feature vector of query image is compared with the feature vector in the database. As a result of the query, similar images are retrieved according to their similarities between the feature vectors of the query example or sketch and those of the images in the database.

In this paper we have proposed a content-based image retrieval method based on an efficient combination of color and texture features. We use color histogram, histogram equalization, HSV histogram and compared the result as a color descriptors and discrete wavelet transform and statistical features as texture descriptors . Both color and texture features of images are extracted and stored as feature vectors in a database. During the retrieval process, the color and texture feature vector of the query image is computed and matched against those features in the database. We used Euclidean distance method, Canberra distance and city block distance method for similarity measurement and compared the result.

III. IMAGE RETRIEVAL USING COLOR AND TEXTURE FEATURE

Most of the early studies on CBIR have used only a single
feature among various color and texture features. However, it is hard to attain satisfactory retrieval results by using a single feature because, in general, an image contains various visual characteristics. Recently, active researches in image retrieval using a combination of color and texture features have been performed [10]–[12]. For an advanced CBIR, it is necessary to choose efficient features that are complementary to each other so as to yield an improved retrieval performance and to combine chosen features effectively without increase of feature vector dimension.Fig.2 is the block diagram of the proposed retrieval method. When an RGB query image enters the retrieval system, it is first transformed into HSV color image.

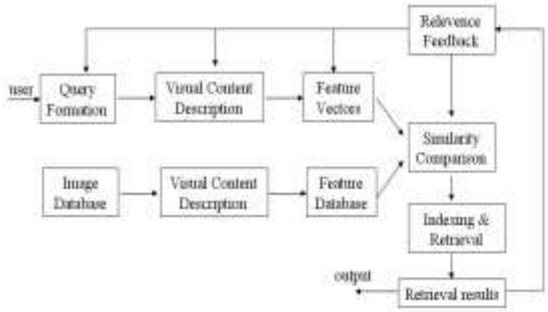

Figure2. Block Diagram of CBIR System

Then color feature is extracted and formed the color feature vector. Similarly the texture feature is extracted and formed the texture feature vector. After the color and texture feature vectors are extracted, the retrieval system combines these feature vectors, calculates the similarity between the combined feature vector of the query image and that of each target image in an image database, and retrieves a given number of the most similar target images.

3.1 Color Features

Several methods for retrieving images on the basis of color similarity have been described in the literature [13], but most are variations on the same basic idea. Each image added to the collection is analysed to compute a colour histogram which shows the proportion of pixels of each colour within the image

The colour histogram for each image is then stored in the database. At search time, the user can either specify the desired proportion of each colour (75% olive green and 25% red, for example), or submit an example image from which a colour histogram is calculated. Either way, the matching process then retrieves those images whose colour histograms match those of the query most closely. In this paper we have used the Global color histogram ,Local color histogram, HSV method for extracting the color feature and matched the result by using Euclidean distance, Canberra distance ,and city block distance method and showed the result.

3.2 TEXTURE FEATURE

In CBIR, texture features play a very important role in computer vision and pattern recognition, especially in describing the content of images. Texture features typically consist of contrast, uniformity, coarseness, and density. Importance of the texture feature is due to its presence in many real world images: for example, clouds, trees, bricks, hair, fabric etc., all of which have textural characteristics. Earlier methods[16],[17] for texture image retrieval suffer from two main drawbacks. They are either computationally expensive or retrieval accuracy is poor. Here we concentrate on the problem of finding good texture features for CBIR, which are efficient both in terms of accuracy and computational complexity. There are two main approaches for texture representations, statistical method and transform method. Here we have calculated mean and standard deviation of the query image and of the database image and compared the result. In this paper we have also used the DWT .The wavelet representation of a discrete signal X consisting of N samples can be computed by convolving X with the lowpass and highpass filters and down sampling the output signal by 2, so that the two frequency bands each contains N=2 samples. With the correct choice of filters, this operation is reversible. This process decomposes the original image into two sub-bands: the lower and the higher band. This transform can be extended to multiple dimensions by using separable filters. A 2D DWT can be performed by first performing a 1D DWT on each row (horizontal filtering) of the image followed by a 1D DWT on each column (vertical filtering). In order to form multiple decomposition levels, the algorithm is applied recursively to the LL sub band.

IV. MATCHING TECHNIQUES

Distance between two images has to be calculated to find if there is any match or not. Distance will help us in finding degree of matching for the entire data base. There are different distances available which are used and compared the performance of all these distances.

Euclidean distance method is calculated using equation

$$d = \sqrt{\sum_{i=1}^{n}(Xi - Yi)}^{2}$$

City Block Distance is calculated using equation

$$di_j = \sum_{k=1}^{n} | X_{ij} - X_{jk} |$$

Canberra Distance method is calculated using equation

$$d_{ij} = \sum_{k=1}^{n} \frac{| X_{ik} - X_{jk} |}{| X_{ik} | + | X_{jk} |}$$

V. EXPERIMENTAL RESULTS

Here we have selected the database of around the 150 images which contains the color as well as the texture images. We have selected some sample images in order to evaluate different extracted features. In our evaluation, a retrieved image is considered a match if and only if it is in the same category as the query image. In addition, the effectiveness of the extracted features has been measured by precision parameter. It is given by

$$P = \frac{(I_R)}{(I_T)}$$

Where I_R is number of relevant retrieved images.
I_T is the number of total retrieved images. I_F is the number of false images retrieved.
Precisions of 3 different images is calculated and compared using table no1 and shown in precision graph.

Table 1. Various Feature Matching Techniques For Three Different Images

Query Image	DWT	Std Deviation	Histogram Equalisation	RGB Histogram	RGB +DWT
1.jpg	70	50	10	80	93
285.jpg	60	20	10	70	90
21.jpg	50	50	20	60	95

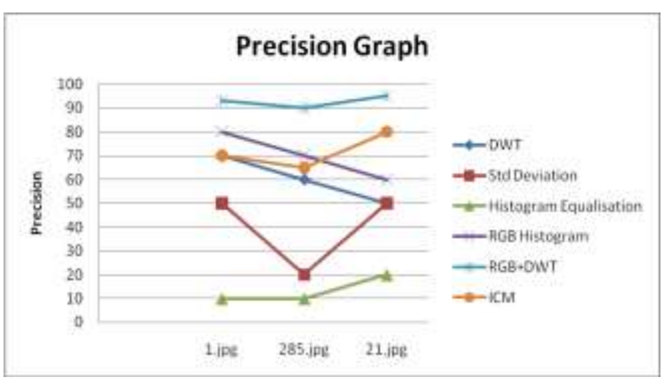

Figure 3. Precision Graph

For matching purpose here we have used different methods like Euclidean distance method, Canberra, city block distance and showed the result. The fig.4 and fig 5shows the result for two different query images.

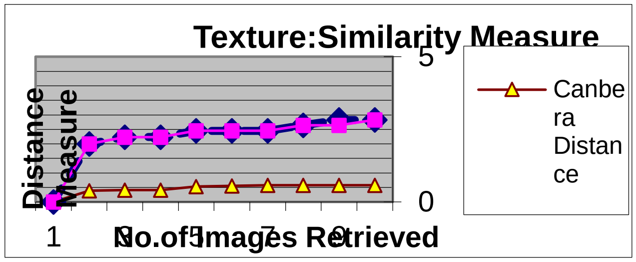

Figure4. Comparison of matching techniques for image1

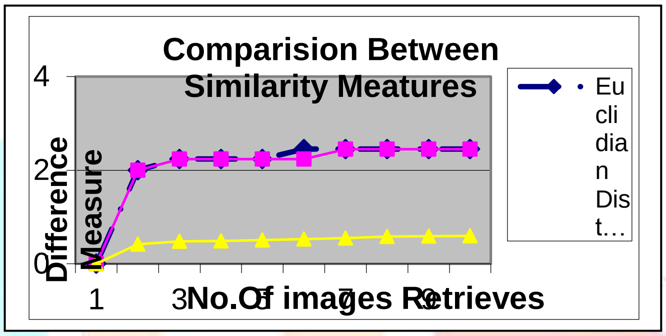

Figure5. Comparison of matching techniques for image2

Fig.4 and fig5 shows that Canberra distance method gives us better results i.e. the distances of the retrieved images is very less as compared to the other methods.

VI. CONCLUSION

Here we can conclude that single feature for the feature extraction is not sufficient to get good results. If we integrates different features then precision of the CBIR system is increased. This technique is useful in the era of large image database and to retrieve the exact query image from the database.

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