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IMAGE RETRIEVAL USING COLOUR AND TEXTURE ANALYSIS

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ABSTRACT: Large image databases are difficult to browse with text search, if the user wants to search images which have a similar color content[3]. Content based image retrieval (CBIR) has been one of the most important research areas in computer science for the last decade. A retrieval method which combines color and texture feature is proposed in this paper. According to the characteristic of the image texture, we can represent the information of texture by Multi Wavelet transform.We choose the color moments in RGB color space as the color feature.The experimental results show that this method is more efficient than the traditional CBIR method based on the single visual feature and other methods combining color and texture[1].

Keywords: Content Based Image Retrieval,Discreet Wavelet Transform,.Multi-Wavelet Transform

I. INTRODUCTION

Application of World Wide Web(www) and the internet is increasing exponentially and with it the amount of digital image data accessible to the users.A huge amount of image databases are added every minute and so there is need for effective and efficient image retrieval systems. Research on content-based image retrieval has gained tremendous momentum during the last decade. A lot of research work has been carried out on Image Retrieval by many researchers,expanding in both depth and breadth.The term Content Based Image Retrieval (CBIR)seems to have originated with the work of Kato for the automatic retrieval of the images from database, based on the color and shape present. Since then, the term has widely been used to describe the process of retrieving desired images from a large collection of database, on the basis of syntactical image features (color, texture and shape). The techniques, tools and algorithms that are used, originate from the fields, such as statistics, pattern recognition, signal processing, data mining and computer vision.There are many features of content-based image retrieval but four of them are considered to be the main features. They are color, texture, shape, and spatial properties. Spatial properties, however, are implicitly taken into account so the main features to investigate are color, texture and shape.Though there are many techniques of search this paper will focus on color and texture features for CBIR. The main motivation of the present work is to use the Multi Wavelet decomposition scheme and color moments, which yield improved retrieval performance.

II. COLOUR

Color feature is one of the most widely used features in low level feature. Compared with shape feature and texture feature, color feature shows better stability and is more insensitive to the rotation and zoom of image. Color not only adds beauty to objects but also more information, which is used as powerful tool in content-based image retrieval.
The mean,variance and standard deviation of an image are known as color moments.[6]

$$mean = \sum_{i=1}^{n} \sum_{j=1}^{m} x_{ij} / mn$$

$$variance = \frac{1}{nm} \sum_{i=1}^{n} \sum_{j=1}^{m} \left(X_{ij} - mean\right)^2$$

$stddev = \sqrt{variance}$, where X_{ij} is the Pixel value of the i^{th} row and j^{th} column.

For very large data sets,color moments can be computed using color histogram as follows:[6]

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$$mean = \sum_{i=o}^{255} i * h(i) / \sum_{i=o}^{255} h(i)$$

$$\text{var}iance = \sqrt{\frac{\sum_{i=o}^{255} h(i) * (i - mean)^2}{\sum_{i=o}^{255} h(i)}}$$

Where h is the histogram of the image.

The basic concept behind color moments lays in the assumption that the distribution of color in an image can be interpreted as a probability distribution.Moreover,it has better spatial information than the above mentioned methods.

III. MWT

In recent years, the wavelet transform emerged in the field of image/signal processing as an alternative to the well-known Fourier Transform (FT) and its related transforms, namely, the Discrete Cosine Transform (DCT) and the Discrete Sine Transform (DST).In the Fourier theory, a signal (an image is considered as a finite 2-D signal) is expressed as a sum,theoretically infinite, of sines and cosines, making the FT suitable for infinite and periodic signal analysis.For several years, the FT dominated the field of signal processing,however,if it succeeded well in providing the frequency information contained in the analysed signal;it failed to give any information about the occurrence time.This shortcoming,but not the only one, motivated the scientists to scrutinise the transform horizon for a “messiah”transform. The first step in this long research journey was to cut the signal of interest in several parts and then to analyse each part separately.The idea at a first glance seemed to be very promising since it allowed the extraction of time information and the localisation of different frequency components. This approach is known as the Short-Time Fourier Transform (STFT). The fundamental question, which arises here, is how to cut the signal?

The best solution to this dilemma was of course to find a fully scalable modulated window in which no signal cutting is needed anymore.This goal was achieved successfully by the use of the wavelet transform[3].

Multiwavelets were defined using several wavelets with several scaling functions.Multiwavelets have several advantages in comparison with scalar wavelet.The features such as compact support, Orthogonality,symmetry,and high order approximation are the base features for this transform. 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).Thus Multiwavelets offer the possibility of superior performance and high degree of freedom for image processing applications, compared with scalar wavelets. The study of Multiwavelets was initiated by Goodman, Lee and Tang. The special case of Multiwavelets with multiplicity 2 and support (0, 2), was studied by Chui and Lian. When a multi resolution analysis is generated using multiple scaling functions and wavelet functions, it gives rise to the notion of Multiwavelets . A Multiwavelet with ‘r’ scaling functions and ‘r’ wavelet functions is said to have multiplicity ‘r’. When r = 1, with one scaling function and one wavelet function, the Multiwavelet system reduces to scalar wavelet system. In Multiwavelet transforms they have two or more scaling functions and wavelet functions.

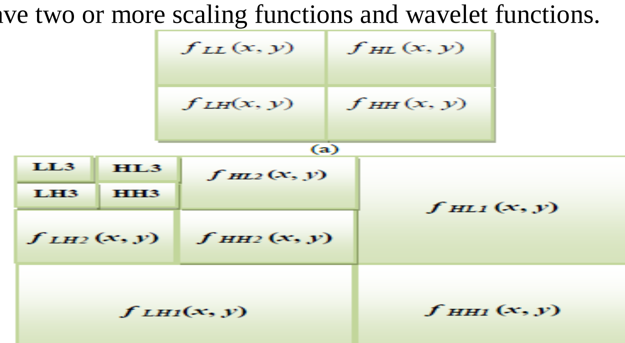

Figure 1:The Concept Of Wavelet Transform

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IV. PROPOSED ALGORITHM

The basic steps involved in the proposed CBIR system includes

A. Texture feature extraction:
1.Start
2.Accept the input image from database.
3.Resize input image.
4.Convert rgb image into gray image.
5.Perform 4 level decomposition of input image i.e compute the approximation coefficient matrix cA and coefficient matrix cH,cV and cD upto 4 level.
6.Reconstruct approximation and details at level 4 using upcoef2.
7.Then calculate mean using mean function.
8.Calculate standard deviation vector.
9.Save this texture feature vector as a . mat file.

B. Color feature extraction:
1. Load the image.
2. Separate R, G, and B spaces from the image.
3 .Calculate colour moment of each colour space:Calculate row-wise mean and column-wise mean of each colour space followed by standerd deviation of each.
4.Calculate colour feature vector.
5.Save this colour feature vector as a. mat file.

C. Combined feature
Form the combined feature vector by concatenating the color feature and texture feature vectors

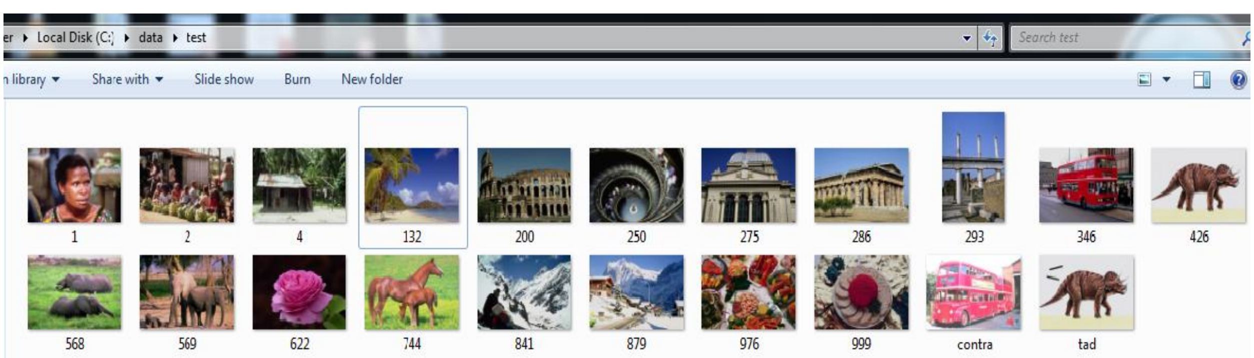
D. Apply query image and calculate the combined feature vector as given in steps A to B.

E.Calculate similarity between the computed combined feature vector of test image and feature vector of all images in database using Euclidean Distance.

F. Retrieve all relevant images to query image based on minimum "Euclidean distance".

V. EXPERIMENTAL RESULTS

A.Considering the following test images from each category and storing them in a separate folder.



B.Wang database comprising of 1000 images sub-divided into 10 categories.The screenshot has images alongwith their .mat files.The images are of the size 256 ×384 or 384× 256

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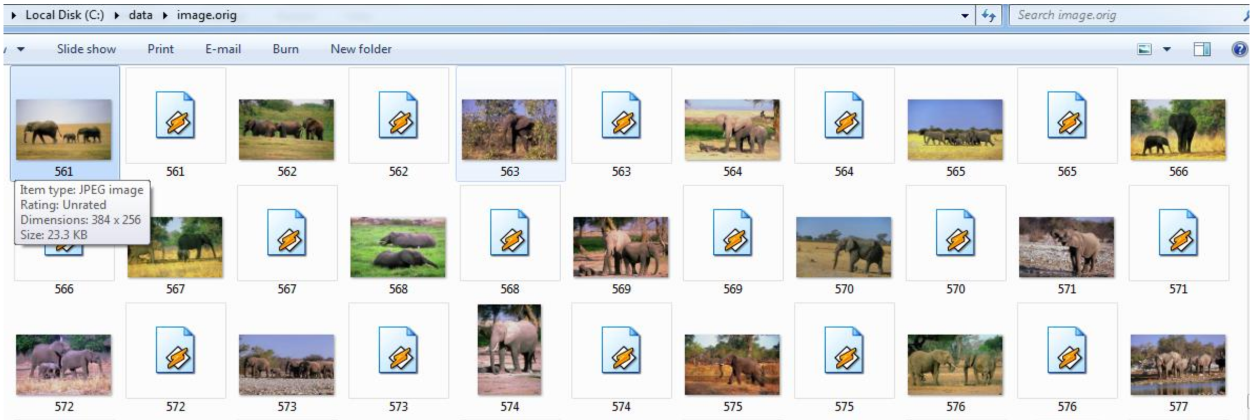

C.Test image

D.Retrieval images using only texture feature extraction for given test image:

E.Retrieve images using only colour feature extraction for given test image:

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F.Retrieval images using both texture and colour feature extraction for given test image:

G.Retrieving images by proposed method after changing its colour content.

a.Test Image

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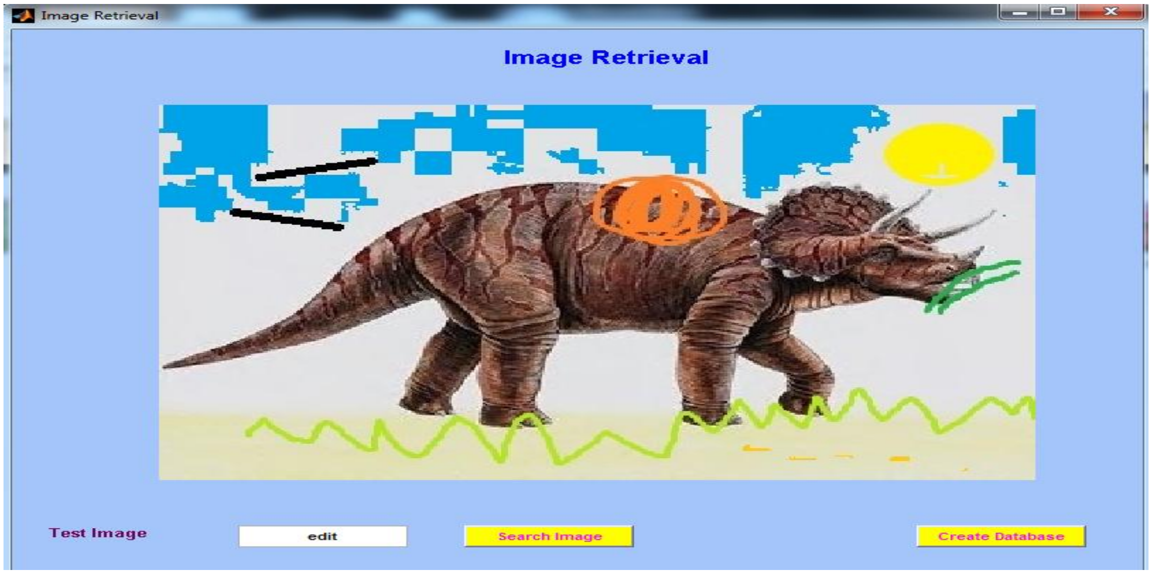

b.Retrieval result

Precision=(12/15)×100=80%

H.Retrieving image using proposed method after changing its texture content

a.Test Image

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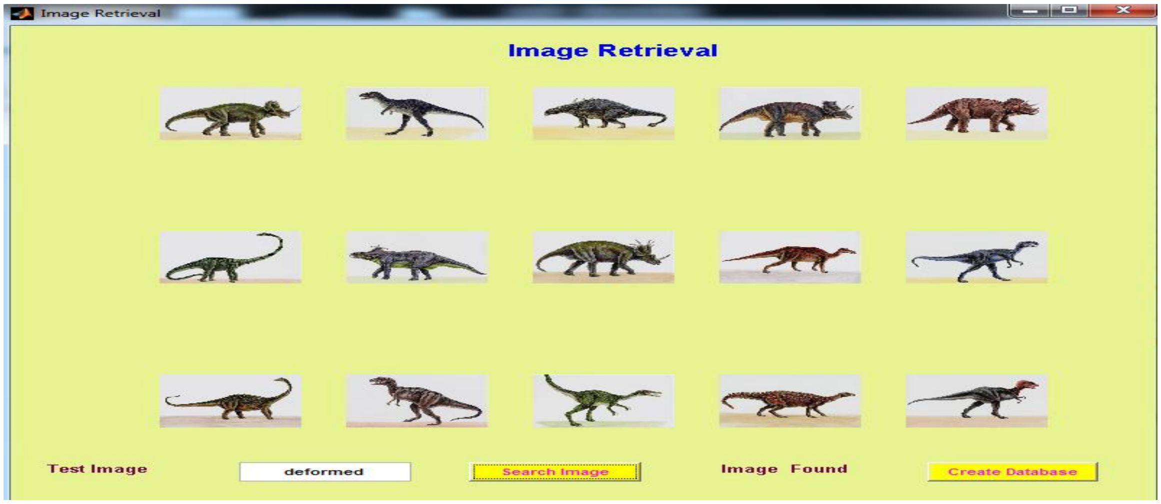
b.Retrieval result:



Precision=(15/15)×100=100%
We evaluate the retrieval accuracy for a query-based on the precision values defined as:
Precision=Nrel/Ncan
Where Nrel is the number of relevant images to the query in Ncan retrieved images.The overall accuracy is calculated by taking the average over precision values of all 10 queries.

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Table 4.1:Result Table

S.No.	Category	Presicion(using only texture)	Presicion(using only colour)	Presicion(using both colour and texture)
1.	Africa	20%	33.33%	26.66%
2.	Dinosaur	66.66%	93.33%	93.33%
3.	Beach	20%	60%	53.33%
4.	Bus	40%	26.66%	46.66%
5.	Elephant	33.33%	26.66%	40%
6.	Buildings	13%	40%	13%
7.	Flowers	40%	13%	60%
8.	Horses	26.66%	60%	33.33%
9.	Food	40%	40%	33.33%
10.	Mountains	33.33%	53.33%	66.66%
Efficiency		**33.2%**	**44.6%**	**46.66%**

From the above table,it can be clearly seen that maximum efficiency is obtained when both color and texture features are combined

VI. CONCLUSION

After the absolute analysis of the results obtained by various research following conclusion can be drawn.when only color is considered as retrieval parameter in CBIR gives approximately only 33.2% of average retrieval efficiency.Similarly when only texture features are considered as retrieval parameter we have obtained 44.6% of retrieval efficiency. The average retrieval efficiency obtained by this method is approximately only 46-50%.This shows that only texture or only color features are not sufficient to describe an image.But there is considerable increase in retrieval efficiency when both color and texture features are combined for CBIR.

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