Multi Feature Content Based Image Retrieval

Rajshree S. Dubey
M.Tech (CSE) Student
BIST
Bhopal, India

Rajnish Choubey
Astt.Prof. CSE
TCT
Bhopal, India

Joy Bhattacharjee
Astt.Prof. CSE
TCT
Bhopal, India

Abstract-**There are numbers of methods prevailing for Image Mining Techniques. This Paper includes the features of four techniques I,e Color Histogram, Color moment, Texture, and Edge Histogram Descriptor. The nature of the Image is basically based on the Human Perception of the Image. The Machine interpretation of the Image is based on the Contours and surfaces of the Images. The study of the Image Mining is a very challenging task because it involves the Pattern Recognition which is a very important tool for the Machine Vision system. A combination of four feature extraction methods namely color Histogram, Color Moment, texture, and Edge Histogram Descriptor. There is a provision to add new features in future for better retrieval efficiency. In this paper the combination of the four techniques are used and the Euclidian distances are calculated of the every features are added and the averages are made .The user interface is provided by the Mat lab. The image properties analyzed in this work are by using computer vision and image processing algorithms. For color the histogram of images are computed, for texture co occurrence matrix based entropy, energy, etc, are calculated and for edge density it is Edge Histogram Descriptor (EHD) that is found. For retrieval of images, the averages of the four techniques are made and the resultant Image is retrieved.**

Keywords-component; Content Based Image Retrieval (CBIR), Edge Histogram Descriptor (EHD),Color moment ,textures, Color Histogram.

I. INTRODUCTION

Content Based Image Retrieval (CBIR) is a technique which uses visual contents, normally called as features, to search images from large scale image databases according to users' requests in the form of a query image [12][15][20]. Content-based image retrieval (CBIR) is therefore proposed, which finds images that have visual low-level image features similar to those of the query image example, such as color histogram, texture, shape, and so forth. Since visual features are automatically extracted from images, lot of human effort can be saved and subjectivity can be avoided in building the image databases for CBIR systems Using a Content Based Image Retrieval (CBIR) [3][1][6][7] images can be analysed and retrieval automatically by automatic description which depends on their objective visual content. Content based retrieval of visual data requires a paradigm that differs significantly from both traditional databases and text based image understanding systems. Firstly, image content is no longer represented only by texual descriptor thus, Retrieval should be based on similarity defined in terms of Visual features [23] [24].

In this paper apart from the usual features like color histogram, color moment and texture, a new feature extraction algorithm called edge histogram is introduced. Edges convey essential information to a picture and therefore can be applied to image retrieval. The edge histogram descriptor captures the spatial distribution of edges [18][9]. Our model expects the input as Query by Example (QBE) and any combination of features can be selected for retrieval. The focus of this paper is to build a universal CBIR system using low level features. These are mean, median, and standard deviation of Red, Green, and Blue channels of color histograms. Then the texture features such as contrast, energy, correlation, and homogeneity are retrieved. Finally the edge features that include five categories vertical, horizontal, 45 degree diagonal, 135 degree diagonal, and isotropic are added [18].

II. RELATED WORK

An content based image retrieval system is a computer system for browsing searching and retrieving images from a large data base of digital images Image Retrieval. A lot of work already has been done in this area. In many areas of commerce, government, academia, and hospitals, large collections of digital images are being created. Many of these collections are the product of digitizing existing collections of analogue photographs, diagrams, drawings, paintings, and prints. Usually, the only way of searching these collections was by keyword indexing, or simply by browsing. Digital images databases however, open the way to content-based searching**.** [4] Multimedia information retrieval as a broader research area covering video-, audio-, image-, and text analysis has been extensively surveyed

Local features based methods proved good results [22]. For a successful CBIR, note that the indexing scheme to be efficient for searching in the image database. Recent retrieval systems have incorporated users' relevance feedback to modify the retrieval process in order to generate perceptually and semantically more meaningful retrieval results. The works shown in [19] was mixture of color, texture, and edge density for MPEG-7 standards and where as in [13] the edge histogram was used. A similar kind of approach was done in [8], [10] based on edge density for detecting people in images. In [11], [14], color and texture features were used for image retrieval.

III. PROPOSED CBIR MODEL

The proposed CBIR framework is shown in Figure. The images are kept in a database called Image Database. [2]

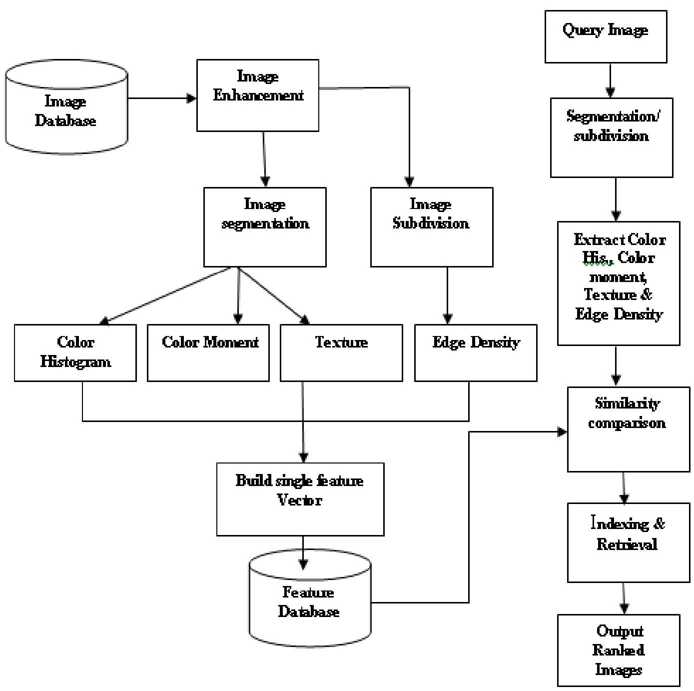


Fig. 4.3 Proposed CBIR Framework

A combination of four feature extraction methods namely color Histogram, Color moment texture, and edge histogram descriptor. There is a provision to add new features in future for better retrieval efficiency. Any combination of these methods, which is more appropriate for the application, can be used for retrieval. This is provided through User Interface (UI) in the form of relevance feedback.

A Color Histogram

Color histogram is a representation of the distribution of colors in an image. For digital images, a color histogram represents the number of pixels that have colors in each of a fixed list of color ranges that span the image's color space, the set of all possible colors. The color histogram can be built for any kind of color space, although the term is more often used for three-dimensional spaces like RGB or HSV. For monochromatic images, the term intensity histogram may be used instead. For multi-spectral images, where each pixel is represented by an arbitrary number of measurements (for example, beyond the three measurements in RGB), the color histogram is *N*-dimensional, with N being the number of measurements taken. Each measurement has its own wavelength range of the light spectrum, some of which may be outside the visible spectrum. This is the most commonly used color feature in CBIR [27][25]. Color histogram has been found to be very effective in characterizing the global distribution of colors in an image, and it can be used as an important feature for image characterization. To define color histograms, the color space is quantized into a finite number of discrete levels. Each of these levels becomes a bin in the histogram. The color histogram is then computed by counting the number of pixels in each of these discrete levels. There are many different approaches to quantize a color space to determine the number of such discrete levels [27][26].

B. Color Moment

This is a compact representation of the color feature to characterize a color image [25]. It has been shown that most of the color distribution information is captured by the three low-order moments. The first-order moment (μ) captures the mean color, the second-order moment (σ) captures the standard deviation, and the third-order moment captures the skewness (θ) of color. These three low-order moments ($\mu_c, \sigma_c, \theta_c$] are extracted for each of the three color planes, using the following mathematical formulation.

$$\mu_c = \frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} p_{ij}^{c},$$

$$\sigma_c = \left[\frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} (p_{ij}^{c} - \mu_c)^2 \right]^{\frac{1}{2}}$$

$$\theta_c = \left[\frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} (p_{ij}^{c} - \mu_c)^3 \right]^{\frac{1}{3}}$$

Where p_{ij}^{c} is value of the c^{th} color component of the color pixel in the ith row and j*th* column of the image. As a result, we need to extract only nine parameters (three moments for each of the three color planes) to characterize the color image. Weighted Euclidean distance between the color moments of two images has been found to be effective to calculate color similarity [26].

C Texture Feature

Several texture features such as entropy, energy, contrast, and homogeneity, can be extracted from the co-occurrence matrix of gray levels of an image [5]. The gray level co-occurrence matrix C(i j) is defined by first specifying a displacement vector $d_{x,y}$ = (6x, 6y) and then counting all pairs of pixels separated by displacement $d_{x,y}$ and having gray levels i and j. The matrix C(i j) is normalized by dividing each element in the matrix by the total number of pixel pairs. Using this co-occurrence matrix, the texture features metrics are computed as follows :

Practically, the co-occurrence matrix C(i, j) is computed for several values of displacement $d_{x,y}$, and the one which maximizes a statistical measure is used.

The autocorrelation function of an image is used to quantify the regularity and the coarseness of a texture. This function is defined for an image *I* as:

$$p(x,y)=\frac{\sum_{u=0}^{N}\sum_{v=0}^{N} I(u,v)I(u+x),(v+y)}{\sum_{u=0}^{N}\sum_{v=0}^{N} I^2(u,v)}$$

A texture is characterized by a set of values called energy, entropy, contrast, and homogeneity. The following formulas are used to calculate the features:

A] Entropy $=-\sum_i \sum_j C(i,j)\log C(i,j)$,

B] Energy = $\sum_i \sum_j C^2(i,j)$,

C] Contrast= $\sum_i \sum_j (i-j)^2 C(i,j)$,

D] Homogeneity= $\sum_i \sum_j \frac{C(i,j)}{1+|i-j|}$

D Edge Histogram Descriptor

A simple method to extract an edge feature in the image-block is to apply digital filters in the spatial domain [16] [17]. To this end, we first divide the image-block into four sub-blocks. Then, by assigning labels for four sub-blocks from 0 to 3, we can represent the average gray levels for four sub-blocks at (i,j)th image-block as a0(i,j), a1(i,j), a2(i,j), and a3(i,j) respectively. Also, we can represent the filter coefficients for vertical, horizontal, 45-degree diagonal, 135-degree diagonal, and non-directional edges as fv(k), fh(k), fd-45(k), fd-135(k), and fnd(k), respectively, where k=0,…,3 represents the location of the sub-blocks. Now, the respective edge magnitudes mv(i,j), mh(i,j), md-45(i,j), md-135(i,j), and mnd(i,j) for the (i,j)th image-block can be obtained as follows

IV ALGORITHM

The algorithm for content based image retrieval system using multiple Feature given as below

Step 1: Preprocessing

Input various object Images O_i Create B_m Block Matrix. Calculate Mean µ of Block Matrices. Concatenate all Block Matrices obtain.

Step 2: Feature Extraction

The four techniques are used and individually the pixel to pixel distances are calculated and averages are found out for the resultant Images. Rows denote the number of object in the images. There is a threshold value for which the matching image detected. The matching criteria for the matching of the images are taken at 80percent. Which can could he desired level of matching.

Step 3: Similarity Measurement

Calculate Euclidean Distance then get Euclidean (D)

$$D\,eucld\,(r,s)=\sqrt{\sum_{i=1}^{N}(r_i-s_i)^2}$$

(Where r and s represent the average values of feature vectors respectively)

While (Ti==Oi) // where Ti is the test (query) Image & Oi is the object images.

Repeat above procedure for n object images.

Now we have 'N' object image and its Euclidean distance matrices.

Step 4: Combining the Feature

The above said features are combined to match the image. In this work the above similarity is measured are taken then the averages are taken out for the final output. Which is given in the subsequent table/s below.

V. EXPERIMENTAL SETUP AND RESULTS

This chapter is used to explain result analysis.To get desired result,P-4,genuine intel CPU 2140@ 1.60 GHz with 512 MB RAM ,40GB hard Disk ,10 MBPS E.thernet Card,MatLab7.0P. Window-XP Operating System, Microsoft Office 2003 Pack are used.

To get the desired result,11 snaps are taken i.e. 1.jpg , 2.jpg , 3.jpg,4.jpg,5.jpg,6.jpg,7.jpg,8.jpg,9.jpg,10.jpg,11.jpg,12.jpg. Here 1.jpg is used for test image and rest 11 snaps are used for object images.we can use any snaps for test(query) as well as object image,but condition is this that image must be in .jpg extension.we can use other extension for same result but this project is usedto browse only.jpg images.we can give other extension by using minor changes

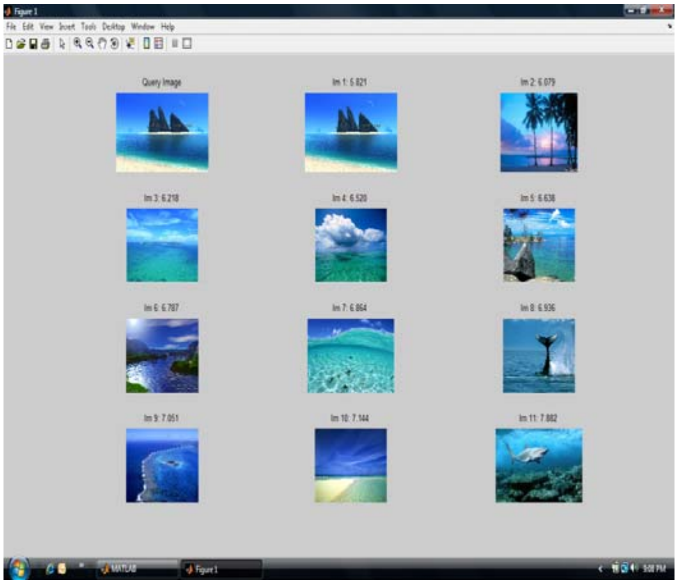


FIGURE I: Snapshot of result for query image " SEA .jpg"

Image	(CHS)	(EHS)	(TS)	(CMS)	Average
Image1	0.0582	0.0369	0.1947	0.0012	0.0582
Image 2	0.0608	0.0383	0.1951	0.0012	0.0608
Image3	0.0622	0.0341	0.1968	0.0012	0.0622
Image4	0.0652	0.0369	0.1972	0.0012	0.0652
Image5	0.0664	0.0371	0.2133	0.0012	0.0664
Image6	0.0679	0.0371	0.2008	0.0012	0.0679
Image7	0.0686	0.0356	0.1940	0.0012	0.0686
Image8	0.0694	0.0349	0.1929	0.0012	0.0694
Image9	0.0705	0.0366	0.2265	0.0012	0.0705
Image10	0.0714	0.0377	0.2238	0.0012	0.0714
Image11	0.0788	0.0383	0.2659	0.0012	0.0788

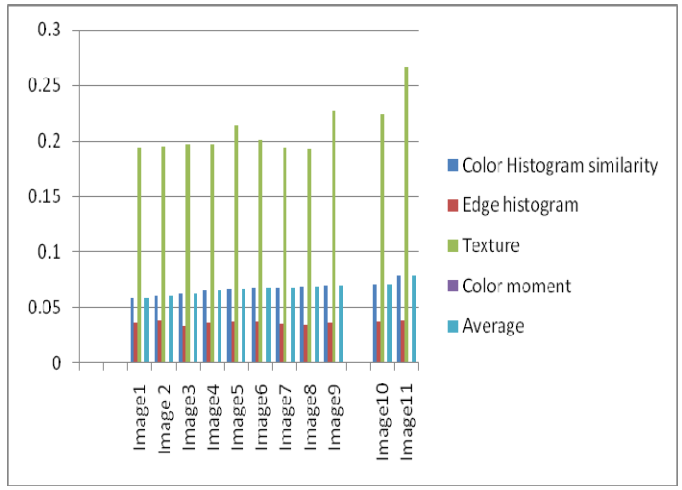
TABLE I: Calculation of Color Histogram, Texture, Edge detection and color Moments for the Query Image (Sea. Jpg)

*** (CHS)-Color Histogram similarity**

*** (EHS)-Edge histogram Descriptor similarity**

*** (TS)-Texture Similarity**

*** (CMS)-Color moment Similarity**



Graph show the similarity measure of different features of object image

VI. CONCLUSION AND FUTURE WORK

In this Paper, proposed a Multi feature model for the Content Based Image Retrieval System by combining the color Histogram, Color Moment, texture, and edge Histogram descriptor features or individually. Users were given options to select the appropriate feature extraction method for best results. The results are quite good for most of the query images and it is possible to further improve by fine tuning the threshold and adding relevance feedback. In this dissertation four different approaches are made color texture methods were investigated in two different color spaces, HSV the edge detection is made for the retrieval of the image. Histogram search characterizes an image by its color distribution, representation is that information about object location, shape, and texture is included. In this dissertation the Euclidian distances are calculated between the two pixels the matching images is made.

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