International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459 (Online), Volume 5, Special Issue 2, May 2015)
International Conference on Advances in Computer and Communication Engineering (ACCE-2015)

Efficient CBIR Technique Using Color, Texture and Shape Features in Sketches

K. Sumana[1], Anargha Remesh[2]

[1]*M.Tech(CSE), IV Sem & the Oxford College of Engineering, Bangalore*
[2]*Asst. Professor, Dept. of CSE & the Oxford College of Engineering, Bangalore*

sumana_nani19@yahoo.com, Anargha.remesh@gmail.com

***Abstract*— - Image processing is any form of signal processing for which the input is an image, the output of the image processing may be either an image or a set of characteristics or parameters related to image. Image search tools such as Google image and yahoo. Images are with keyword or names and then retrieved using text based search method. By analyzing introduces content based image retrieval using input as a sketch. Sketch based image retrieval system can be used as digital libraries, crime prevention.**

***Keywords* – Texture, Gabor filter.**

I. INTRODUCTION

Image retrieval techniques are useful in many image processing applications. content based image retrieval system work with whole image and searching is based on comparison of query. general techniques for image retrieval are color, texture and shape. these techniques are applied to get an image from the image database. they are not concerned with the various resolutions of images, size and spatial color distribution. hence all these methods are not appropriate to the art image retrieval. although this approach content based image retrieval has advantage in effective query processing, it is inferior in expressive power and the user cannot represent all intended features in query. Before the spreading of information technology a huge number of data had to be managed, proceeds and stored. In case of texts search flexibly using keywords, but if images, cannot apply dynamic methods. Two questions can come up. The first is who yields the keywords. And the second is an image can be well represented by keywords. Purpose is to develop a content based image retrieval system, which can retrieve using sketches in frequently used databases.

II. IMAGE RETRIEVAL SYSTEM

Content based means that the search analyzes the contents of the image rather than the metadata such as keywords, tags or descriptions associated with the image.

The term "content" in this context might refer to colors, shapes, texture or any other information that can be derived from the image itself. Most image retrieval systems support one or more of the following options:

- Search by sketch
- Search by text

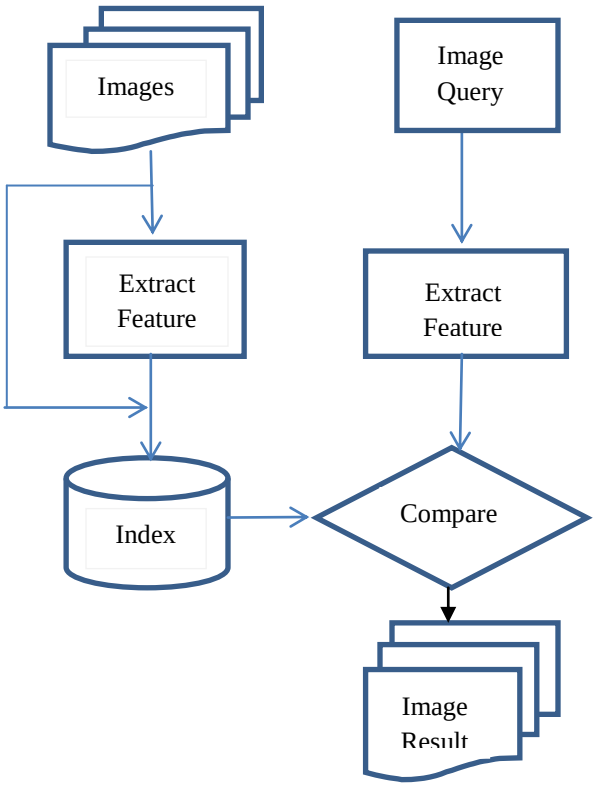

Fig. 1. Content based image retrieval system

III. PROPOSED METHOD

In this block diagram Fig. 2. Query image color, texture and shape feature are extracted and compared with the features of the image in the database

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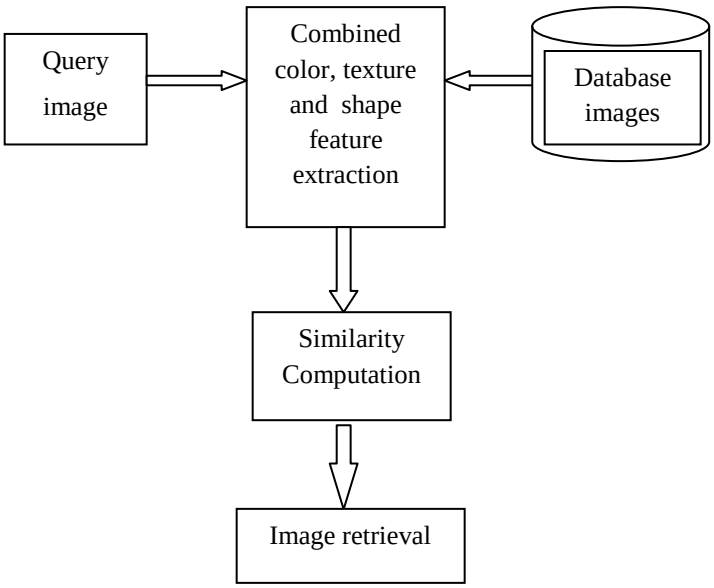

Fig. 2. Color, texture and shape to retrieve image

A. Color feature

Color feature extraction involves analyzing the absolute color value of each pixel. Color is generally represented by the color distribution of the image. Color distribution is a statistical feature and techniques such as moments and color histogram are commonly used.

The first order (mean), the second (standard deviation) and the third order color moments have been proved to be efficient and effective in representing color distribution of images.

The first three moments are defined as:

$$\mu_i = \frac{1}{N}\sum_{j=1}^{N} f_{ij}$$

$$\sigma_i = \sqrt{\frac{1}{N}\sum_{j=1}^{N}\left(f_{ij}-\mu_i\right)^2}$$

$$S_i = \sqrt[3]{\frac{1}{N}\sum_{j=1}^{N}\left(f_{ij}-\mu_i\right)^3}$$

Where f_{ij} is the value of the i-th color component of the image pixel j, and N is the number of pixels in the image.

Color histogram

In image retrieval systems color histogram is the most commonly used feature. The main reason is that it is independent of image size and orientation. Also it is one of the most straight-forward features utilized by humans for visual recognition and discrimination.

To extract the color feature first apply RGB to HSV conversion. The HSV values of pixel can be transformed from its RGB representation according to the following formula:

$$H = \frac{\cos^{-1}\left(\frac{1}{2\left[(R-G)+(R-B)\right]}\right)}{\left[(R-G)2+(R-B)(G-B)\right]^{\wedge}\left(\frac{1}{2}\right)}$$

S = 1-[3[min(R,G,B)]/R+G+B]

V = [R + G + B] / 3

Color Autocorrelogram

A color Correlogram is a table indexed by color pairs, where the k-th entry for (i, j) specifies the probability of finding a pixel of color j at a distance k from a pixel of color i in the image. Let I represent the entire set of image pixels and Ic(i) represent the set of pixels whose colors are c(i). Then, the color Correlogram is defined as:

$$\gamma_{i,j}^{k} = \Pr\left[\, p2 \in I_{c(j),} \square\, p1 - p2 \mid = k \,\right]$$

$$p1 \in I_{C(i),}\, p2 \in I$$

Where i, j Î {1, 2, …, N}, kÎ {1, 2, …, d}, and | p1 – p2 | is the distance between pixels p1 and p2.

B. Texture feature and shape feature

By convolving the specified image with Gabor filter, a group of filtered images is acquired. Each one of this image depicts the image property at definite scale and at a definite orientation. Gabor features can be computed from each filtered image and are used to retrieve images.

For a given image $I(x,y)$ with size $P \times Q$, Gabor wavelet transform is given by a convolution

$$T_{de}(x,y) = \sum_{s}\sum_{t} I(x-s, y-t)\, F_{de}^{*}(s,t)$$

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Where, s and t are the filter mask size variable, d and e specify the scale and orientation of the wavelet respectively with $d = 0,1,\ldots D-1$, e = $0,1,\ldots E-1$, D is the number of scales, E is the number of orientations, and F_{de}^{*} is the complex conjugate of F_{de} which is a class of self similar functions generated from dilation and rotation of the mother wavelet as given in. $F(x,y)=\frac{1}{2\pi\sigma_x\sigma_y}\exp\left[-\frac{1}{2}\left(\frac{x^2}{\sigma_x^2}+\frac{y^2}{\sigma_y^2}\right)\right]\exp(j2\pi Wx)\infty$

Where, W is the modulation frequency and $F(x,y)$ is a Gabor function. The Gabor function consists of a complex sinusoid modulated by a Gaussian. σ_x And σ_x are the spatial standard deviation of the Gaussian along x and y direction respectively.

The result of Gabor filter on an image produces some undesirable effects like double edge structure. The double edge structure can be converted into a single edge like structure by using morphological closing operation on the Gabor filter image. The structure of an image is affected by morphological operation. In morphology, the primary operations are erosion and dilation. The combinations of these primary operations are used to derive morphological closing and opening. The background region similar to that of the structuring element is preserved by morphological closing operation.

Closing of an image is performed by opening the complement of the image by the structuring element and taking the complement of the whole result. Closing of an image is expressed as

$$G_{de}(x,y)=\left(T_{de}^{c}\circ H\right)^{C}$$

Where, $G_{de}(x,y)$ is the morphological closed image, H is the structuring element and c represents the complement operation.

An array of magnitudes is obtained by convolving the Gabor filter on the image with certain scale. These magnitudes indicate the energy content at certain orientation and at certain scale of the images. In order to find out the images or areas with similar texture, texture feature based image retrieval is significant. The following mean μ_{de} and standard σ_{de} deviation of the magnitude of the transformed coefficients are used to describe the texture characteristic of the image.

$$\mu_{de}=\frac{\sum_x\sum_y|G_{de}(x,y)|}{P\times Q}$$

$$\sigma_{de}=\sqrt{\frac{\sum_x\sum_y\left(|G_{de}(x,y)|-\mu_{de}\right)^2}{P\times Q}}$$

The texture feature vector f for D scales and E orientations is expressed as

$$f=\left(\mu_{00},\sigma_{00},\mu_{01},\sigma_{01},.....\mu_{(D-1)},\sigma_{(E-1)}\right)$$

IV. Feature Similarity Measure

First the feature vectors are taken out. These constitute the feature vector representation. For regaining the specified number of more similar images, the similarity distance between the query image and each one of the image present in the database are computed.

The feature similarity is given by

$$D_t(q,t)=\sum\sum d(q,t)$$

Where

$$d(q,t)=\sqrt{\left(\mu^q-\mu^t\right)^2+\left(\sigma^q-\sigma^t\right)^2}$$

Where μ^q and σ^q denote the feature of the query image q, μ^t and σ^t denote the feature of the target image t.

V. Result Analysis

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Fig. 3. The retrieval has to be robust in contrast of illumination and difference of point of view

By giving sketch image as a query image then displaying output images are similar to the query image by extracting color, texture and shape features from query image and comparing it with features of images stored in database by using distance measure between query image features and the image features in the database.

In fig.3. By giving input sketch image dinosaur there are four different dinosaurs are given as output.

VI. CONCLUSION

The visual features most widely used in content based image retrieval are color, texture and shape information. Color usually represented by the color histogram, color correlogram and color moments under a certain color space. Texture and shape represented by Gabor wavelet, wavelet transformation.

The color histogram and the wavelet transform were found to yield the highest color, texture and shape retrieval results respectively.

Table. 1.
Retrieval Result

Query	Number of relevant matches	Total number of relevant matches in database	Number of retrieved	precision	Recall	No. of image selected
496.jpg	5	20	5	1	0.25	5
488.jpg	6	20	6	1	0.30	6
477.jpg	10	20	10	1	0.5	10
435.jpg	15	20	15	1	0.75	15
400.jpg	17	20	17	1	0.85	17
425.jpg	20	20	20	1	1	20

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