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# A Novel Approach For CBIR Using Multi-feature Extraction And SVM Classification

Bhavik M. Patel [1] Prof. U. K. Jaliya[2] Prof. Kanubhai G. Patel[3]

[1]M.E. Pursuing, [2]Professor Computer Department, [3]Professor IT Department
B.V.M. Engg. College, VVNagar-388120, Gujarat, India

**Abstract-** Content based image retrieval (CBIR) great deals with the problem of searching for digital images from large databases. CBIR is also known as Query By Image Content (QBIC). CBIR works on basis of extracting low level features of an image such as color, texture and shape and compares similarity measures with feature database for finding relevant image retrieval from large database. In this paper, we have proposed a novel approach of image retrieval on the basis of multi feature extraction using HSV histogram, log-gabor filter, wavelet transformation and SVM (Support Vector Machine) classification. In the proposed system texture feature extracted using log gabor for invariant scale and rotation image retrieval. Wavelet transformation is used to extract the local feature of images for most important part of the image. A SVM (Support Vector Machine) classifier can reduce the semantic gap between low level image features and high level image concept and learned from training data of relevance images and irrelevance images marked by user. In experimental result we have demonstrate the Graphical and statically result that our proposed method outperform the other existing methods.

**Keywords**---*CBIR* (Content Based Image Retrieval), *Low level feature extraction, Scale and rotation invariant, Log Gabor filter, DWT, Support Vector Machine (SVM)*

## I. Introduction

Now a day we have many multimedia devices for digital images such as camera, audio/video player, cellular phone and so on. Digital images are widely used in many applications likes fashion, architecture, finger print recognition, criminal investigation, medicine etc [8]. Different from traditional search engine, in CBIR search will analyse the actual contents of the image rather than the metadata such as keywords, tags, and descriptions associated with the image. Here "Content-based" means use of low level features of images like colors, shapes, textures, or any other information that can be derived from the image itself [11].

In CBIR, retrieval of image is based on similarities in their contents, i.e. textures, shapes colors etc. which are considered the lower level features of an image. These low level features are extracted from the database images and stored in feature database. Also low level features extracted from the query image and compare both features using various distance measure [1]. If the distance of query image feature vectors and images in the database is least distance, the matching image in the database is to be considered as a match to the query and displayed as result.

In this paper, a novel approach for CBIR using multi feature (HSV Histogram, Log Gabor, and Wavelet Transformation) extraction and Support Vector Machine. A SVM can afterwards be used to group together and classify images that may semantically similar but quite distant in the low level feature space [12].

 

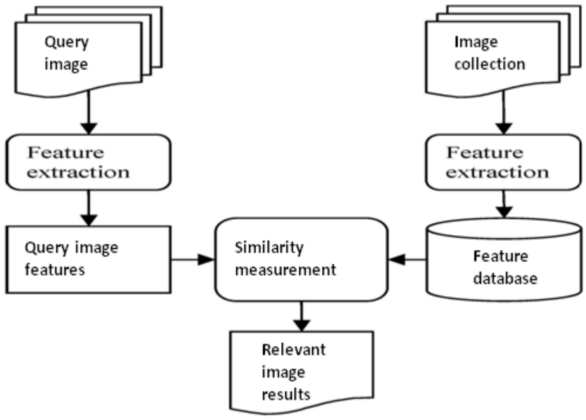


**Fig 1: Architecture of CBIR System [1][8]**

The paper is organized as follow. In Section II, low level image feature extracting using HSV histogram. In Section III, texture feature extracted using scale and rotation invariant Log Gabor filter. In section IV, wavelet transformation is used to extracting most important part of the image. In section V, SVM classify the train dataset of multi feature extraction. In Section VI, Proposed algorithm is given with each step of method.

In CBIR system, a feature can capture image visual property for regions or objects. Feature extraction which is a process to extract the image's features based on color, texture, shapes etc to a distinguishable extent.

## II. Color Feature (HSV Histogram)

Color Histogram technique is a very simple and low level method. It is the most commonly used descriptor in image retrieval. The color histogram is easy to compute and effective in characterizing both the global and the local distribution of color image [2]. To create a color histogram, first step is partition into color space, but color space is too large so color space is quantized into number of bins, where each of color bins represent a range of color values. The number of cells in the image that falls in each of these ranges is counted to get the color histogram. Color histograms can be built in various color spaces such as RGB, HSV, YCbCr, etc. are used in CBIR systems [10].

As a color space, we choose the HSV (Hue, Saturation, and Value) space. HSV color space is more suitable since it separates the color components (HS) from the luminance component (V) and is less sensitive to illumination changes [13].

## III. Texture Feature

Although there is no strict definition of the texture of an image, it is easily perceived by humans and believed to be a rich source of visual information about the nature and three dimensional shapes of physical objects [5]. Texture property is one of the most widely used visual features in content base image retrieval systems. Texture features are extracted using Log Gabor feature. These methods are explained in following sections.

### Log Gabor Feature

Gabor filters have been found appropriate for textural processing for several reasons: they have tuneable orientation and radial frequency bandwidths, tuneable center frequencies, and optimally achieve joint resolution in space and spatial frequency [5][10].

Gabor filter give the best co-occurring localization of spatial and frequency information. However they have two main limitations.

- The maximum bandwidth of a Gabor filter is limited.
- Gabor filters are not optimal if one is looking for broad spectral information with maximal spatial localization.

An alternative to the Gabor function is the Log-Gabor function, it can be constructed with arbitrary bandwidth and the bandwidth can be optimised to produce a filter with minimal spatial extent [14].

Log-Gabor wavelets, firstly proposed by D. Field [3], are defined in the frequency domain due to the singularity in the log function at origin. They always have a null DC component and can be optimized to produce filters with minimal spatial extent. They can be divided into two components: radial and angular filters [15][16].

$$G(\rho,\theta) = e^{-\frac{\log^2(\frac{\rho}{u_0})}{2\log^2(\frac{\sigma_\rho}{u_0})}} e^{-\frac{(\theta-\theta_0)^2}{2\sigma_\theta^2}} \quad 1$$

Where $G(\rho,\theta)$ represents the polar coordinates, $u_0$ is the center frequency, $\theta_0$ is the orientation angle, $\sigma_\rho$ Determines the scale bandwidth and $\sigma_\rho$ Determines the angular bandwidth [15][16].

## IV. Wavelet Transformation

We are using wavelet transformation (DWT) to extract the local feature of an image. We transform image using wavelet transformation to four sub band frequency images. First one is low frequency which same with the source called approximation (LL), second one is high frequency called Horizontal detail (LH), third one is high frequency called vertical detail (HL) and fourth one is horizontal and vertical detail (HH) [17]. From this four sub band frequency, we combine the two high sub band frequencies with coiflets base function in our proposed method to make signification point and edge to extract the most important information from the image.

## V. SVM Classification

Neural networks, decision trees, and support vector machines (SVM) are some of the supervised learning techniques, which learn the high level concepts from low level image features [1].SVM Predication speed and memory usage are good with compare to other supervised learning algorithms such as tress, Navie Bayes and Nearest Neighbour [18]. When data is classify there are many hyper planes which can be fit in to classify the data but which one is the best is the right or correct solution [19]. Support vector machine (SVM) has been promising method for data classification and regression [19]. SVM has following two properties.

***Margin Maximization*** : SVM has Margin Maximization properties to find the best hyper plane separating relevant and irrelevant vectors, maximization the size of the margin between both classes [7][19].

***Kernel trick*** : Using Kernel trick, SVM deals a nonlinear classification efficiently which implicitly translate the input space into another high dimensional feature space [19].

 

## VI. Proposed System

We choose the database provided by Wang for testing our proposed method. In Wang database images are divided into 10 classes and each class containing 100 images. It is most often use for CBIR systems.

Method:
**Part I: Extract Color Feature (**HSV Histogram)
***Step 1*** convert image RGB to HSV color space
***Step 2*** Feature extraction of Query image using HSV color histogram. Quantize each H, S, V equivalently to 8x2x2 bins.
***Step 3*** Construct the feature vector using HSV histogram matrix of size 8x2x2 that gives single 32 dimensional feature vector.

**Part II: Extract Texture Feature (**Log Gabor Filter)
***Step 1*** convert image RGB to gray scale.
***Step 2*** By applying log gabor filters, Filters are constructed in terms of two components. We have used 4 scales and 6 Orientation

- The radial component, which controls the frequency band that the filter responds.
- The angular component, which controls the orientation that the filter responds. The two components are multiplied together to construct the overall filter.

***Step 3*** Calculate energy and magnitudes of for each and every filtered image and store in feature vector that gives 48 single dimensional feature vectors.

**Part III: Wavelet Transformation** (DWT using Coiflets base function)
***Step 1*** Convert image from RGB to gray image and HSV image then Decomposition using wavelet transformation.
***Step 2*** Make absolute for every Wavelet coefficients, WCnew = | WCold |.
***Step 3*** Combine Vertical Detail and Horizontal Detail, CVdHd(i,j) = Max(Vd(i,j),Hd(i,j)).
***Step 4*** Choose significant points on CVdHd(i,j) to extract important information in image.
***Step 5*** Calculate 1$^{st}$ and 2$^{nd}$ Moment from Combine Vertical and Horizontal Detail that gives 20 + 20 dimension feature Vector.
Thus Features are calculated using each and every image and resulted feature vector are stored in feature database.

**Part IV:** Perform **SVM classification** of the images.
***Step 1*** from all classes label the feature vectors of images
***Step 2*** Train SVM according to the label attached to the feature vectors.
***Step 3*** Find the query image class label which it belongs.
***Step 4*** Perform classifications of the images.
Retrieve the first n similar images to the input image by proposed method and calculate the precision.

## VII. Experimental Results

In CBIR, to evaluate the retrieval images effectiveness, we have used the most commonly performance measure are Precision and Recall. Precision is defined by the ratio of number of retrieval relevant images to the total number of retrieved images [4].

$$\textbf{Precision} = \frac{\textbf{Number of retrieval relevant images}}{\textbf{Total number of retrieval images}}$$

Recall is defined by the nu... ...ved to total number of relevant images in database.

$$\textbf{Recall} = \frac{\textbf{Number of relevant images retrieved}}{\textbf{Total number of relevant images in DB}}$$

We have use a novel approach of multiple feature extraction using HSV Histogram, Log Gabor feature and Wavelet transform and then SVM classification. Here by using these formulae we can retrieve appropriate images from the database with more accuracy rather than each individual approach and Existing system. Hence, Using Multi-feature extraction and SVM Classification each feature adds its unique advantages so that accuracy is better with compare to individual feature. A Novel approach of multi features extraction using HSV histogram, Log Gabor features and Wavelet transform gives a single 32 + 48 + 40 = 120 dimensional feature vector.

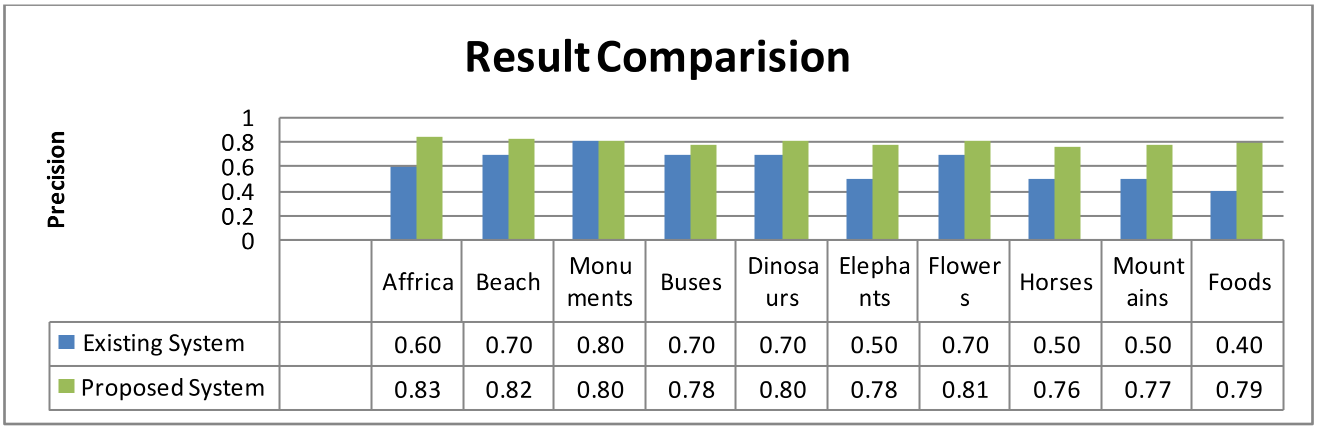


**Figure 2: Result Comparison of Existing and Proposed System**

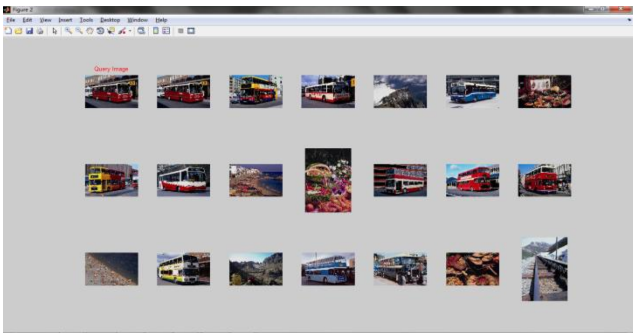

**Fig a. Result of HSV Histogram feature**

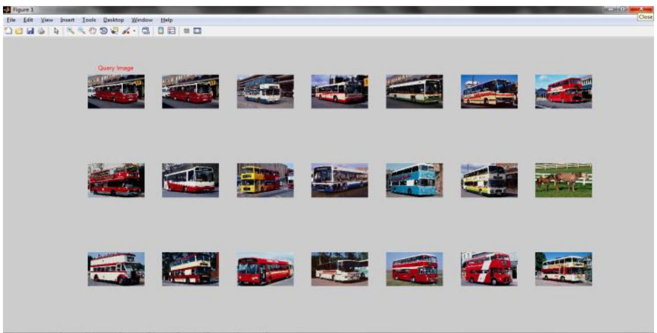

**Fig b. Result of Log Gabor feature**

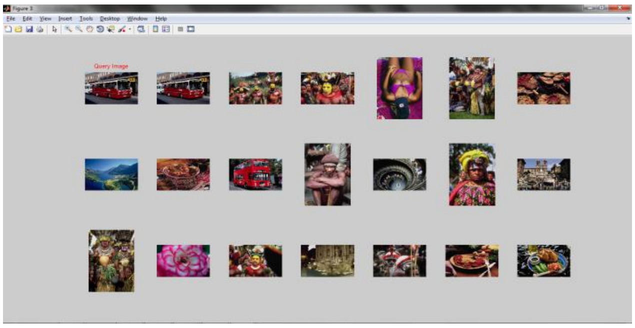

**Fig c. Result of Wavelet Transformation**

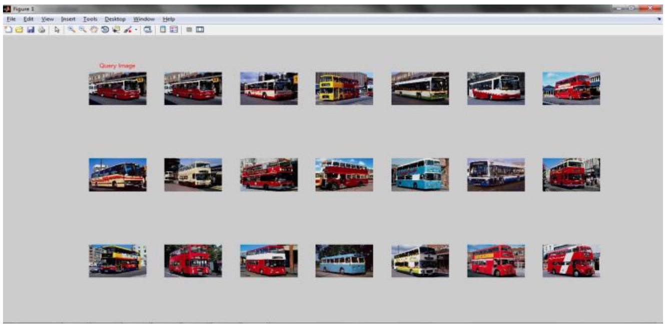

**Fig d. Result of Proposed System**

## VIII. Conclusion

In this paper we have proposed a Content Based Image Retrieval System using multi feature extraction (HSV Histogram + Log Gabor + Wavelet Transform) and Support Vector Machine based classification. The proposed system is giving better accuracy compared to existing method because each feature extraction adds its unique advantages and SVM to classify to retrieve the images gives higher retrieval accuracy of images from database.

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