

Image Retrieval using Hybrid Technique

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Abstract - To retrieve important images from a dissimilar collection by using visual queries as search arguments are the arduous and substantial open problems. In this paper the writers have mentioned the designs and implementations of a simple yet very effective Content-Based Image Retrieval (CBIR) system. The colors, textures and the shapes features are the vital parts of this system. With the three main consequent searching steps the searching becomes multilevel. Such propounded systems are very unique as they consider one feature at each step and use the results of the previous step as the input for the next coming step in multilevel pattern whereas in the earlier methods all the features are combined at once for the single-level search of an average CBIR system. The propounded method is very simple and comfortable to adopt. The retrieval grade of the propounded method is valued using bi-benchmark datasets for an image classification. The above system of methods shows very good results in terms of amelioration in retrieval qualities, when compared with the literature. In proposed work we get accuracy like between 68.15 % to 94.86% in used different features.

Keywords - Content-Based Image Retrieval, Image Features, Feature Representation, Image Searching, Recall, Precision.

I. INTRODUCTION

The collections of digital images are growing rapidly in the past years and resulted in diversity because of the revolution in technology and internet and accessibility of capturing images in a device. Ever since the innovation the operative and productive tools are in demand in order to search, browse or retrieve images. It is a problematic task for CBIR as for as the images of general database is concerned. Various types of techniques have been developed for searching and representing in general-purpose search engines.

Following are some concerns that has to be taken care of, in the development of CBIR systems; the selection of features which could be used to take out the properties of images, the process of extraction and presentation of image features and ultimately arbitrating the similarity in measures in order to retrieve images visually. Such types of problems have been dealt in many ways and literature has been blessed with so many techniques [16].

The colors, textures and the shapes features are very crucial and they are used to retrieve same visual images from database-imaging. The majority of systems have used just one or two features while on the contrary few systems made use of all sorts of features [1]. Features which are efficient when it comes to differentiating, the images must be selected in accordance with the type of the dataset. Every feature will be applicable for the

collection of general images as its nature is heterogeneous (i.e. there could be natural images, color images and object images) and to delineate and differentiate the difference between images, one or two features will not be sufficient. CBIR has mainly two ways of image representation; global and local representations. Local representation is used more than global representation [1, 3, and 4] as the former brings out better results. The case doesn't end here. To achieve robustness a wide range of CBIR systems and applications are coffered with the use of local representation. Such local features extractions rely upon in finding landmark points or segmenting the images into particular regions.

No exact image segmentation method is found which can be applied in the general image collection. The global representation takes out the features from whole image without the requirement of sub-division or search keys of interest of the image. Here it shows how better results are achieved even with global representation. The size of the feature database is kept sensibly small here.

A similarity measure must be justified just after the representation. Various similarity procedures such as matching of the region and histogram are being used in the local representation [1, 5, and 6]. Although, for the global representation [2] regardless of the selected similarity measure a single-level simple sequential search has turned out to be the only choice in the typical CBIR.

Questioning by shapes textures and colors or by one of the amalgamation of these features is propounded in many systems [2, 3, 5] with the use of single-level sequential searching. In this single-level sequential search, features are combined to produce one or different feature vectors. Then the features are made use of the same level with or without waiting to search. It appears that the multi-level sequential search is not been measured yet, although it is very easy and demonstrates better reclamation results. From the zenith of our knowledge there is more to be studied in multi-level sequential search to ameliorate the results which are to be retrieved.

The aim of this research is to build up a novel trouble-free CBIR system to attain sufficient accuracy in image categorization and retrieval with the use of global representation. As far as literature is concerned using the global representation makes it hard to attain improved performances. Conversely, creators of this paper disagree with this statement and explain that even the global representation could be used to get better retrieval performances through the addition of latest methods. Empirical evaluation is executed on two subsets of the typical Corel dataset to authenticate the recital of this technique in contrary to other independently authenticated techniques. This propounded approach is explained in more detail later in this paper. The rest of the paper is arranged as follows. Section 2 describes an outline of the propounded CBIR system. Section 3 offers details of the experiment and the results acquired. Section 4 deals with conclusions drawn from the research findings.

II. PROPOSED CBIR SYSTEM

The following section demonstrates the framework of a multistage CBIR system. Image Indexing: illustrates images that are to be reserved by the database and their low level features are shown along with their measurements.

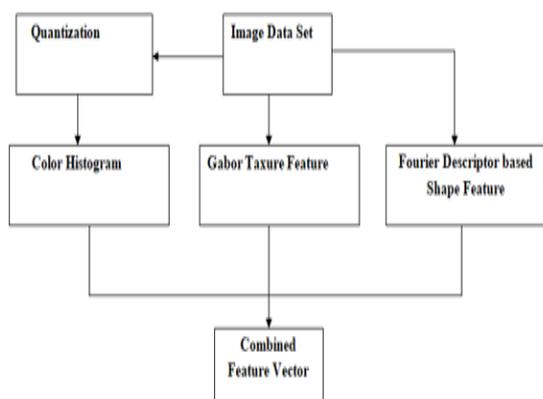


Figure 1 Content Based Image Indexing.

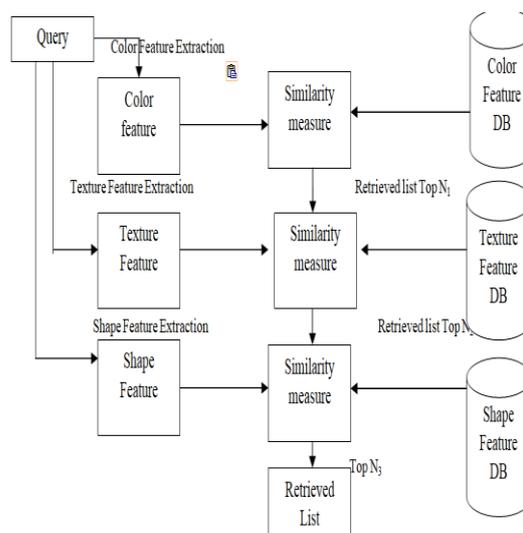


Figure 2 An Overview of the Proposed Multi-Step Sequential Searching Process.

For construction of a feature vector, texture information is gathered from numerous pixels in each histogram bin. Gabor texture features are stored in the database after calculation. According to the centroid distance, Fourier descriptor computation is used to fabricate a shape feature vector. The vector which is indexed in the database is a combination of three feature vectors. Primary key is used as a sequential counter for reserving the feature vector in the relational database table. (Table 2.1) the initial counter value is assumed to be one and is increased by one whenever an image feature vector gets accumulated in the database.

Table 1 Structure of database Index Color Feature Texture Feature Shape Feature Image Path/Name

Index	Color Feature			Texture Feature			Shape Feature			Image Path/Name
	C1	C2	Cn	T _{n+1}	T ₂	T _m	S _{m+1}	S ₂	S _q	
1	egg1.jpg
2
.....
.....

The nomenclature of all images in a database is different; no two images can share a common name. All image features namely color, texture and shape are described using their own components.

1. Image Retrieval- the query content ion and retrieval process is divided into three stages. The indices of the retrieved image are found by the proposed process soon after the retrieval ends. As in the indexing phase, color feature vector of described image is computed. Using the histogram intersection distance (S1), the feature vector is equated only with color

feature of all other images (M). The output images are ranked in augmenting order of their distance with the query image. Top N (<M) images which are closer to the query image, are now retrieved and presented as output of I stage as intermediate result RC. An array reserves the indices of these images. Using the index as variable in the SQL theory, the texture feature is retrieved using this array. A cell array then reserves the retrieved set of vectors. This, in turn, gets transformed into the format as returned by the database cursor. This leads to an apparent reduction of the database to N images. This removes impertinent images and constricts the range of images to be searched in the next level.

The second stage witnesses the Gabor texture feature calculation of the chosen image. This is solely equated with texture feature vectors of the output images of the first stage. This makes use of the Euclidean distance (S2). Top P (< N) images that are close to query image in terms of texture are presented as output (RT) of II stage. The P image indices are retrieved by formulating a query using the path of retrieved image. An array reserves these indices and uses them to fabricate a database for shape feature.

In the third stage, example image's shape feature vector is taken out and equated against the shape feature of images that were the inferences of the second level. Top K (< P) images that are most similar to query image are the final output of the system. The system's accuracy can be altered on comparing images. This propounded process of retrieval can produce better results.

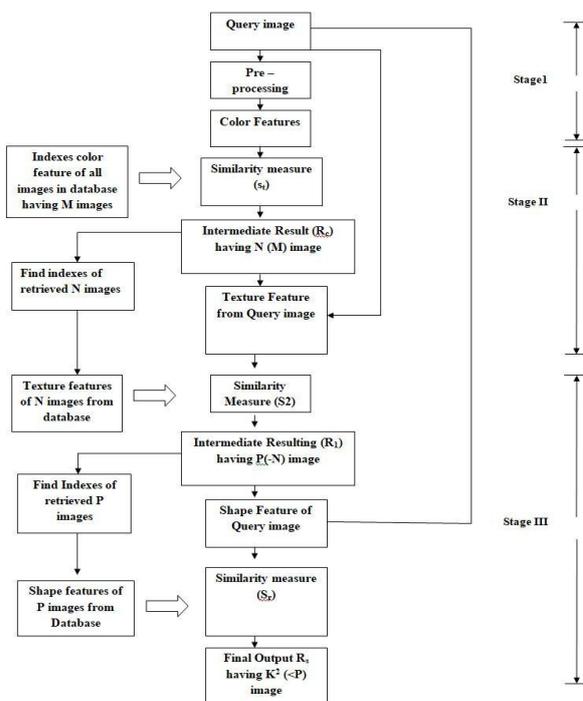


Figure 3 Proposed model of image retrieval.

2. Feature Extraction: The most commonly used low level features for color; texture and shape are incorporated for indexing images in the database. This shall ensure the efficacy of the proposed matching methods. This section discusses the details of feature extraction process and similarity measure used at each stage.

Stage I : The most widely used low level feature in a CBIR is color. It remains unaffected by rotation, scaling and other image conversions. The color histogram is responsible for depicting this feature. For the precise computation of color histogram, quantization of chosen color spaces is necessary. Here, HSV (Hue, Saturation, and Value) color space is used as is more uniform than the other color spaces.

In stage I, Global color histogram of query image is compared with pre calculated histogram data of all other images in the database making use of histogram intersection distance. Computation of global color histogram is done using the steps given below:

Step 1. Transform images from RGB to HSV color space.

Step 2. Apply non-uniform quantization method as given below:

$$H = \begin{cases} 0 & h \in [340, 20] \\ 1 & h \in [20, 50] \\ 2 & h \in [50, 75] \\ 3 & h \in [75, 140] \begin{cases} 0 & s \in [0, 0.2] \\ 1 & s \in [0.2, 0.65] \\ 2 & s \in [0.65, 1] \end{cases} \\ 4 & h \in [140, 160] \\ 5 & h \in [160, 195] \\ 6 & h \in [195, 285] \begin{cases} 0 & v \in [0, 0.2] \\ 1 & v \in [0.2, 0.7] \\ 2 & v \in [0.7, 0.1] \end{cases} \\ 7 & h \in [285, 305] \\ 8 & h \in [305, 340] \end{cases}$$

Step 3. Plot HSV color histogram of 81 bins.

Step 4. Save each bin value in database to form a color feature vector.

Step 5. Compute similarity using histogram intersection distance.

The output images of stage I are sorted as per their distance with the query image and top N images of the sorted result known as RC are taken as input to the next stage thus reducing the database images to be compared at each stage.

Stage II : In stage II, Image retrieval is done using Gabor texture feature. Gabor filter (or Gabor Wavelet) is widely employed to draw texture features from the images for image retrieval [Manjunath et al. (2001)], and has been shown to be very efficient. Fundamentally, Gabor filters are a group of wavelets. In this, each wavelet captures energy at a particular frequency and direction. Expanding a signal using this criterion provides a localized frequency description, thereby capturing local features energy of the signal. Texture features can then be drawn from this group of energy

distributions. The scale and orientation feature of Gabor filter makes it helpful especially for texture analysis [Sebe and Lew (2000)]. The output images of this step are sorted in accordance to their distance with the query image. The output images of stage II are sorted as per to their distance with the query image and top $P(<N)$ images of the sorted result known as RT are taken as input to the next stage.

Stage III : The third stage includes drawing and comparison of the query image on the basis of Fourier descriptor. These descriptors are based on complex coordinates and the centroid distance is largely used in the retrieval process that is shape based. The Fourier descriptor that is centroid distance based has been found out to be more accurate. This is so because of its immunity for translation, rotation and scaling.

The fourier descriptor is computed using an object with the largest dimension. The following procedure is followed for obtaining Fourier descriptor based shape feature:.

Step 1 Image is transformed from RGB to Grayscale

Step 2. Grayscale is changed to binary

Step 3. Boundaries of all connected Regions are searched in the image.

Step 4. The boundary coordinates of the largest connected object are segregated.

Step 5. To regularize the shape boundary, polygon fitting algorithm is used.

Step 6. One dimensional shape signature of the boundary coordinate is calculated based on Centroid distance.

Step 7. Calculate Fourier transform of the shape signature.

Step 8. Original part of the Fourier coefficient is removed to make it invariant to rotation.

Step 9. Magnitude values of fourteen Fourier coefficients are used and made scaling Invariant. Thus, the feature vector is obtained.

Step 10. Equate this feature vector with pre-computed shape feature vector of P images of Stage II using distance function.

Images are arranged in ascending order with respect to their distances with query image and top K ($<N$) images having close resemblance with the query image are presented as final output of the system. We represent this output as Rs.

III. EVALUATION

For evaluation and comparison of the system the Wang dataset [15] (1st dataset) of 1000 images is used. The Wang dataset of 1000 images is a subset which selects manual images from the Corel image database and it was previously utilized in CBIR as a typical dataset for assessment purposes. Hence, such datasets are suitable

to be re-used during this evaluation, since it provides a baseline to compare with other tested approaches which are independently developed. Each of this consists of 10 classes with 100 images and they are of African people and villages, Beaches, Buildings, Buses, Dinosaurs, Elephants, Flowers, Horses, Mountains and glaciers, and Food. These images are JPEG with the resolution of 384x256 or 256x384.

1. Data Set Oliva and Torralba dataset [16] (2nd dataset) is used for further corroboration. It consists of 2688 images characterized into eight categories, categorized as Coast and beach (360), Open country (410), Forest (328), Mountain (374), Highway (260), Street (292), City centre (308) and Tall buildings (356). These images are JPEG with the resolution of 256x256. It was possible to evaluate quantitatively and compare the performance, as these datasets are well classified, The measures which are used to evaluate the propounded CBIR system are accuracy and recall. And they are the most common evaluation measures in information retrieval. To visually summarize the performance further the confusion matrix for each dataset is computed. Precision is the fraction of retrieved images that are relevant to the query and it is defined as equation (2).

$$\text{Precision} = \frac{|{\text{Relevant images}} \cap |{\text{Retrieved images}}|}{|{\text{Retrieved images}}|} \quad (1)$$

Average Precision P (c) is taken for each class as equation (2), where $p(i)$ is the Average Precision of 1th query image and N is the number of image used for evolution.

$$p(c) = \frac{1}{N} \sum_{i=1}^N p(i) \quad (2)$$

When $N=20$ top lists are 100 and 50 accordingly, when $N=100$ top lists are 200 and 150 consequently. While evaluating, retrieved images are measured as correct matches, only if they are in the same class as the query image.

2. Implementation - We use to MATLAB R2015 (a) to simulation. Initially collect images and apply following steps.

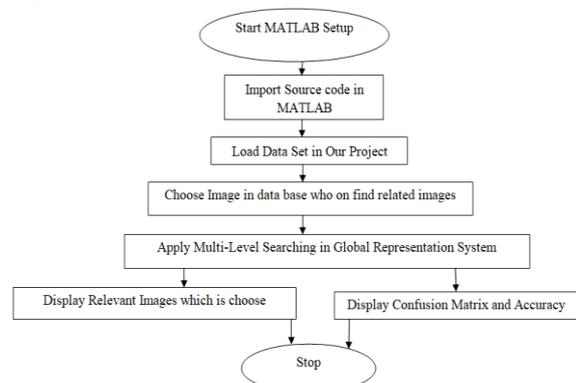


Figure 4 Process of Source Code Execution.

Initially run code on MATLAB and view result options then load data set in program and choose number of images which display in screen during apply proposed algorithm.

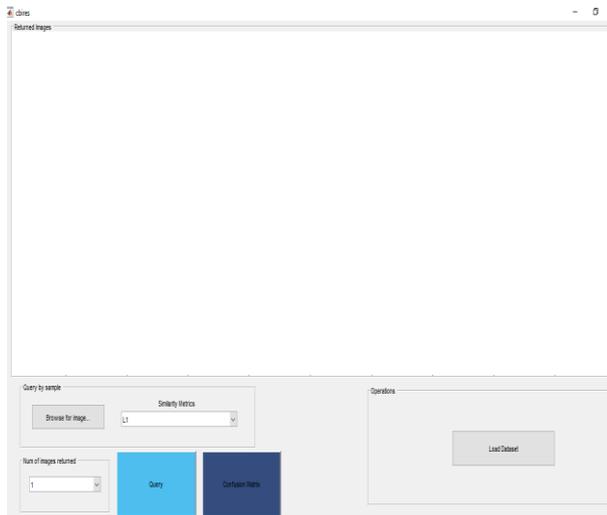


Figure 5 Display Option for Choosing Operation.

When search image in our data base, after apply proposed method then get more images related to searching images.

Retrieval Image

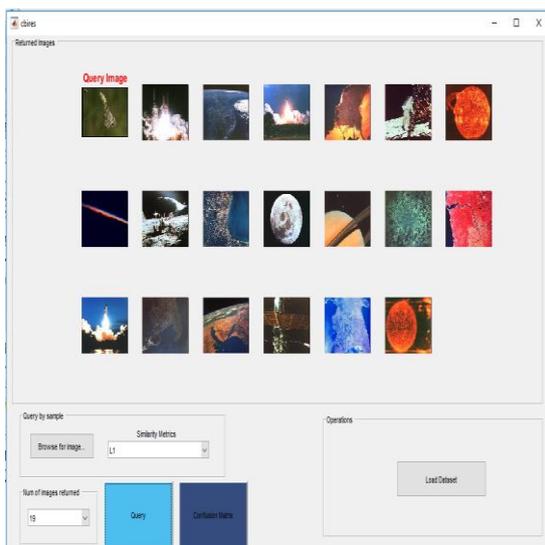


Figure 6 Result get Similar Images after Apply Proposed Algorithm.

In this figure display all related images which we choose. Display total no of 15 similar images.

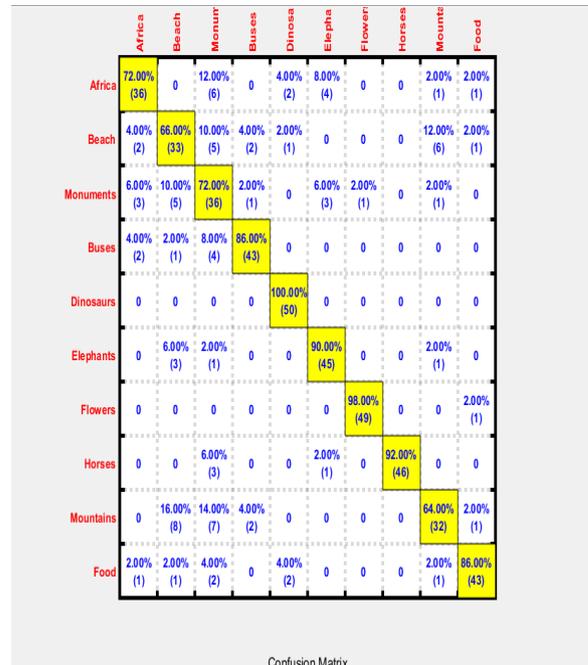


Figure 7 Confusion Matrix.

In below figure get 82.60% accuracy during apply proposed algorithm.

SVM (1-against-1):

accuracy = 82.60%

Confusion Matrix:

38	1	2	0	0	4	0	0	0	5
1	38	3	0	0	2	0	0	6	0
1	3	35	3	0	2	1	1	2	2
1	2	1	44	0	0	0	0	2	0
0	0	0	0	47	0	0	0	3	0
2	0	2	0	1	41	0	4	0	0
0	0	0	0	0	0	45	0	5	0
0	0	0	0	1	1	0	47	1	0
0	11	5	0	0	0	0	0	33	1
4	0	0	1	0	0	0	0	0	45

Predicted Query Image Belongs to Class = 9

Figure 8 Display Accuracy 82.6. %

IV. CONCLUSION

Using color texture and shape features for the representation this paper has presented a simple and easy yet very effective novel image retrieval approach based on multi-level sequential searching. This feature order is elected for a general purpose datasets and this can be altered in accordance with the dataset. This sort of approach is propounded to ameliorate the quality of retrieving for CBIR by using global representation. The propounded system is estimated and compared to

corroborate by using two standard datasets. According to the tentative results it is shown that the proposed CBIR approach outperforms the other existing systems in literature in terms of improvement in retrieval quality.

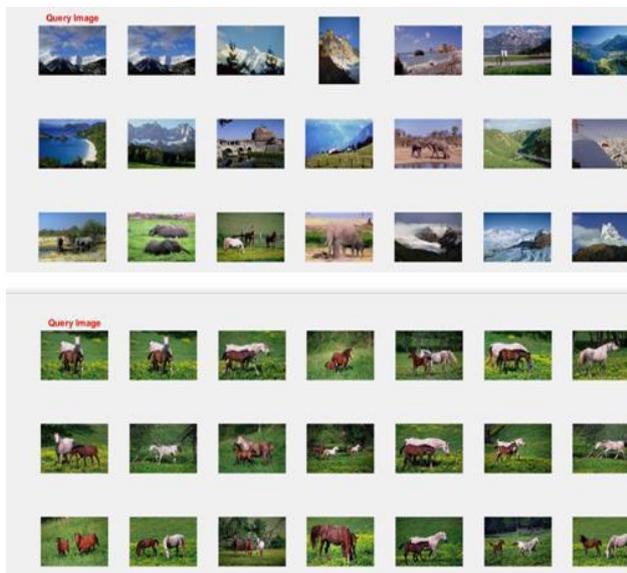


Figure 9 Example Images Covering Wang and Oliva Datasets.

Wang and Oliva datasets find out optimal settings to attain improved retrieval performances. In accordance with the results, it is shown that this propounded method outshines some representation techniques that are local on 1st dataset. This approach could be used not only for the global representation but also for the local representation. Performance can be ameliorated further by introducing appropriate feature weights.

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