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# Content based Image Retrieval using Color, Texture, Shape and Active Re-Ranking Method

**R. Bulli Babu*, V. Vanitha and K. Sai Anish**

Department of Electronics and Computer Engineering, KL University, Guntur District - 522502, Andhra Pradesh, India; babuklu123@kluniversity.in, vanithavalluripalli@gmail.com, saianish5263@gmail.com

## Abstract

**Background/Objectives**: The most effective and efficient tool for managing large image database is Image Retrieval. Content Based Image Retrieval is strategy for recovering images based on the content of the image. Color, Shape, Texture are said to be Content of an image. **Methods/Statistical Analysis**: The necessity for Content Based Image Retrieval has been increasing over a decade in different domains such as Data mining, Medical Imaging, Education, Crime prevention etc. It is still an research area where research is going on how to recover the images based on their content. The existing system has a flaw that is image retrieving is based on the keywords presented along with the image. **Findings**: The images retrieved based on the keywords are inaccurate and it also consumes more time. In this technique we present query image as an input and we get related images as the output which match the content of the query image. Here, the findings are not only based on the color, texture and shape but also trace the underlying points of the image. At first the pictures are recovered based on the color, then took after by texture and finally tracing the underlying graphical structure. **Application/Improvements**: The proposed system is efficient in recovering images based on the content of the image presented as query. Retrieving images based on underlying graphical structure will help in removal of many irrelevant images and makes the system efficient.

**Keywords:** Content based Image Retrieval, Color, Ranking, Shape, Texture

## 1. Introduction

Content based Image Retrieval is generally called as Query by Image Content. The term 'content based' refers to the analysis of the image given as query. The term content may refer to the texture, color, shape or some other element that can be referred from the image itself. The digital photography had made many advances which helped in storing the large amounts of high quality images and also helped in increasing the networks speed[1]. An image retrieval system refers to a PC framework that helps in searching and recovering images from a huge database of images. Retrieval of images is separated into two sorts of retrieval systems that is Text based Image Retrieval and Content based Image Retrieval[2]. Most of the engines present depends on text based image retrieval where image retrieving is based on the keywords displayed along with image. This type of search gives the images which are irrelevant also as a search and also if the keyword is not accurate with query image we get all the irrelevant images as a search[3]. It is time consuming process. These problems are overcome by the Content Based Image Retrieval System which recovers the image taking into account the semantic of the image.

In CBIR large image database is subjected to extract the features such as texture, shape and color. These are coordinated and related images are obtained from the large image database[4]. The query image can be of any format. The features of the query image are obtained by subjecting it to feature extraction process. These features are contrasted with the features stored in the database and separation

*Author for correspondence

between them is calculated and ranked according to their similarity so that more relevant images are displayed to the user. The image extraction is based on visual features[5] and then ranking them using ranking models.

We consider visual features because consider an example if the entered query image is sunset then color plays the primary role for image extraction but if the query image is building the shape plays a primary role than the color again if the entered query image is related to snow then texture plays a vital role then color and shape because the system should be able to find the difference between cotton and snow. Ranking is required for the similarity calculation and to get the accurate images.

In the proposed system the images are retrieved based on the content. Content refers to the features of the image for example colour, texture and shape which are considered as the essential prerequisites for retrieving the images. Content based image retrieval turned out to be a proficient technique to recover images. In this system we not only consider the primitive features but also underlying graphical structure of the image is traced using Re-Ranking model[6]. This Figure 1 illustrates the process of Image Retrieval.

## 2. Analysis of Design

The search starts with presenting image as a query and extracting the images taking in account the features of the query image. Shape, Color, Texture are the considered features of the image.

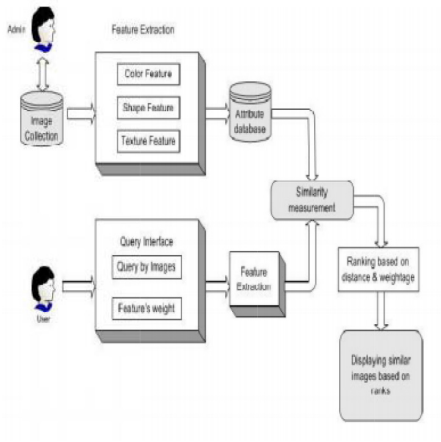


**Figure 1.** Illustrates the process of image retrieval.

### 2.1 Color

Color is one of the most vital component by which humans can easily perceive the diverse images[7]. Color is a property where the light gets reflected to the eye and procedures the data to the brain. Color is utilized by us consistently to differentiate between numerous items, places furthermore we can discover the time. The strategy used to compute the color is development of histogram for every image stored in the database which demonstrates the extent of color present within the image in pixels. The color histogram for each picture is then stored in the database. While entering the query image user can specify the color proportions or color histogram is calculated for the query image. The methods used to extract color feature are color histogram and color correlogram.

#### *2.1.1 Color Histogram*

Color histogram indicated by RGB color space and HSV color space.

#### *2.1.2 RGB Color Space*

This is the most popular color space and abbreviated as Red-Green-Blue. This space comprises of essential color mixes of light red, green and blue. This histogram is most utilized histogram as a part of computer graphics and joins red blue and green color to form a new color. To form a new color the proportions of one of the RGB components must be varied.

#### *2.1.3 HSV Color Space*

Hue, Saturation and Value is the shortened form of HSV. As, Hue modifies from 0 to 1.0, the relating hues adjusts from red through different hues, for example, yellow, blue, green, fuchsia, cyan and again achieves 1to red, so that there are genuine estimations of red at both 0 and 1.0. As the saturation changes from 0 to 1.0, the comparing shades of hue will likewise adjust from unsaturated shades of dim and reaches to completely soaked no white part. The proportional hues turn out to be more brighter as the value, or brightness, fluctuates from 0 to 1.0

#### *2.1.4 Proposed Algorithm*

Step A: The RGB color space of the query image is converted to HSV color space.
Step B: The HSV color space is quantized by passing Hue, Saturation and Values through 8 levels each to generate 8*8*8=512 Histogram pins.

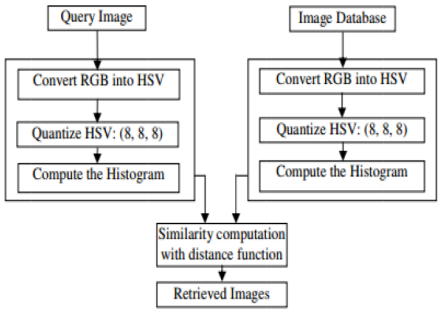


**Figure 2.** Illustrates the algorithm for color retrieval.

Step C: Histogram is computed for query image
Step D: The step 1 and step 2 are repeated for the images stored in the database.
Step E: Histogram is computed for every one of the pictures in the database.
Step F: Similarities are calculated between query picture and pictures in database.
Step G: Required images are retrieved
This algorithm is shown in Figure 2.

## 2.2 Texture

The ability to retrieve images based on texture helps to make the difference between the similar colors for example consider a query image which consists of both sky and sea which are blue in color or image that consists of grass and leaves so retrieving images based on texture helps in making difference between those similarities. It describes how the picture is composed physically[8]. The technique used to retrieve image based on texture is wavelet transform technique. Wavelet means nothing but small wave. Wavelet change is a procedure of turning a signal to series of wavelets. It transforms the picture into multi scale representation with both spatial and frequency attributes. The main objective is to compute the pixel power of the pictures. In this technique the image is divided into 4-sub bands each of various frequency that is low-low, low-high, high-low, high-high. After getting the sub-band on which the frequencies are concentrated most and used for further processing. The energies of that sub-band is obtained. Within the range of energies, the distance between the exhibited query picture and every picture is ascertained. The pictures with lesser separation distance are placed at the top most place.

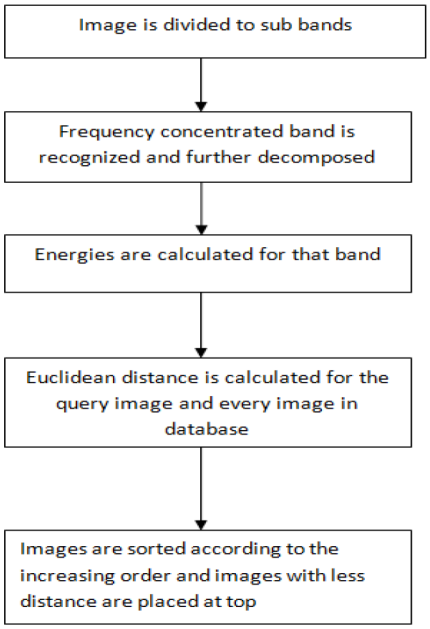


**Figure 3.** Illustrates the algorithm for texture retrieval

### *2.2.1 Proposed Algorithm*

The algorithm for Texture Retrieval is illustrated in Figure 3.

## 2.3 Shape Retrieval

Retrieving images based on the shape is basic requirement at the primitive level. Shape of the natural objects can be primitively recognized. The number of shapes present in the each image is recognized for all the images stored in the database. Then we retrieve images which are close to the shapes that are present in the query image. There are 2 types of shape features those are global features and local features[9]. Global features incorporate viewpoint proportion, circularity and minute invariants where as local features incorporate arrangements of sequential limit sections.

In the proposed framework the shape recovery depends on division to get the appropriate information of the system. It begins with segmenting the image into 5 classes based on the brightness. The 3 factors: Mass, centroid and dispersion are figured for every class and put away in the vector. For retrieving images the vectors of the pictures in the database and the query image are contrasted and the applicable pictures are acquired.

### 2.3.1 Proposed Algorithm

Step A: Image presented as a query is studied.
Step B: The gray scale of image is obtained by converting it from RGB space.
Step C: The extent and number of classes that are available in the picture are ascertained.
Step D: The pixels, centroid and dispersion of every class is computed.
Step E: Centroid of every class of query image is contasted with the centroids of each class with the image in the database and that class is extracted out.
Step F: Compare that classes mass and dispersion with respective class.
Step G: Increase the count if it satisfies certain threshold.
Step H: Consider second class and repeat steps 6-8 till all classes get over.
Step I: Take another image from the database and repeat the comparison.

## 2.4 Active Re-Ranking Method

In this method the underlying graphical structure is traced using mutli modular graph. As illustrated in the Figure 4.

### 2.4.1 Proposed Algorithm

Step A: Query image is presented.
Step B: For the query image the modular graph is constructed.
Step C: The above step is repeated for every one of the pictures which are available in the database.
Step D: The similarity between the graph of query image and graphs of database images are contrasted.
Step E: The images that has more accurate with the query image are retrieved.

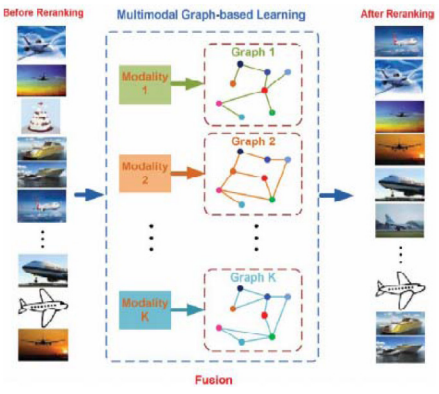


**Figure 4.** Illustrates the active re-ranking method.

# 3. Results and Discussion

## 3.1 Performance Measure

The image retrieval algorithm performance can be evaluated by using precision and recall[10].
Where,

Recall = relevant retrieved/All relevant
Precision = relevant retrieved/All relevant

The results are illustrated in the Figure 5, Figure 6, Figure 7, Figure 8.

**Figure 5.** Illustrates the image retrieval based on shape and texture.

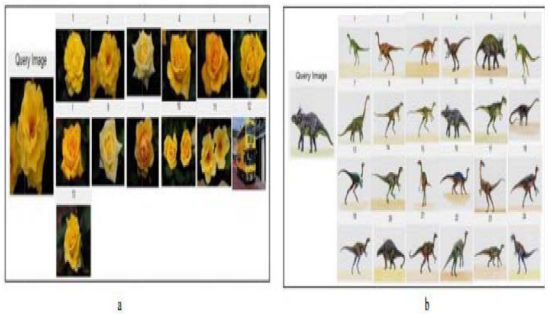

**Figure 6.** Illustrates the image retrieval based on color.

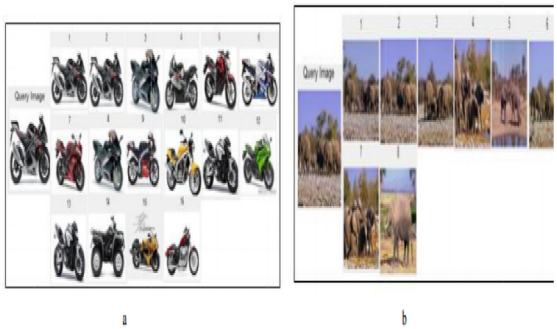

**Figure 7.** Illustrates the image retrieval based on color shape and texture.

**Figure 8.** Illustrates the image retrieval based on ranking

## 4. Conclusion

It been understood that text based image retrieval is not productive to recover images in view of query images. Content based Image Retrieval adopted demonstrated to be the better method for retrieval of images. Majority of the methods use only either one of the techniques that is color texture, shape based image retrieval or ranking methods. The proposed system consists of combination of both that is first we get images based on color, shape and texture and then we rank them for better image retrieval.

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