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# Visual Feature Based Image Retrieval Using Color and Texture

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**ABSTRACT**
The purpose of this paper is to describe the research and solution to the problem of designing Visual Feature Based Image Retrieval system. Due to the enormous increase in image database sizes, as well as its vast deployment in various applications, the need for VFBIR development arose. The increased need of visual feature based image retrieval technique can be found in a number of different domains such as Data Mining, Education, Medical Imaging, Crime Prevention, Weather forecasting, Remote Sensing and Management of Earth Resources. The structure of the final software application is illustrated.

**KEYWORDS**
Image Retrieval**,** Color Histogram, Color Spaces, Quantization, Similarity Matching, Precision and Recall.

## 1.INTRODUCTION

**VFBIR** or **Visual Feature Based Image Retrieval** is the retrieval of images based on visual features such as colour, texture and shape.[1] Reasons for its development are that in many large image databases, traditional methods of image indexing have proven to be insufficient, laborious, and extremely time consuming [2]. These old methods of image indexing, ranging from storing an image in the database and associating it with a keyword or number, to associating it with a categorized description, have become obsolete [4]. In VFBIR, each image that is stored in the database has its features extracted and compared to the features of the query image. It involves two steps:

- **Feature Extraction:** The first step in the process is extracting image features to a distinguishable extent.
- **Matching:** The second step involves matching these features to yield a result that is visually similar.

The rest of the paper is organized as follows: In section 2, a brief review of the related work is presented. The section 3 describes the color feature extraction. The section 4, presents the texture feature extraction. The proposed method is given in section 5 and section 6 describes the performance evaluation of the proposed method. Finally the experimental work and the conclusions are presented in section 7 and section 8 respectively.

## 2. PREVIOUS WORK

Different methods have been proposed for image retrieval. Decades ago there were image retrieval systems based on keywords and context which was time consuming and laborious as well[2]. Then came image retrieval systems based on visual features like color, texture etc. These image retrieval systems have retrieving ability with only one feature. In this paper we have proposed a visual feature based image retrieving system with two features simultaneously i.e. color and feature.

## 3. COLOR FEATURE EXTRACTION

Color extraction and comparison were performed using color histograms and the quadratic distance algorithm, respectively.

## 4. TEXTURE FEATURE EXTRACTION

Texture extraction and comparison are performed using an energy level algorithm and the Euclidean distance algorithm, respectively.

## 5. PROPOSED TECHNIQUE

Flowchart for the visual feature based image retrieval is as follows:

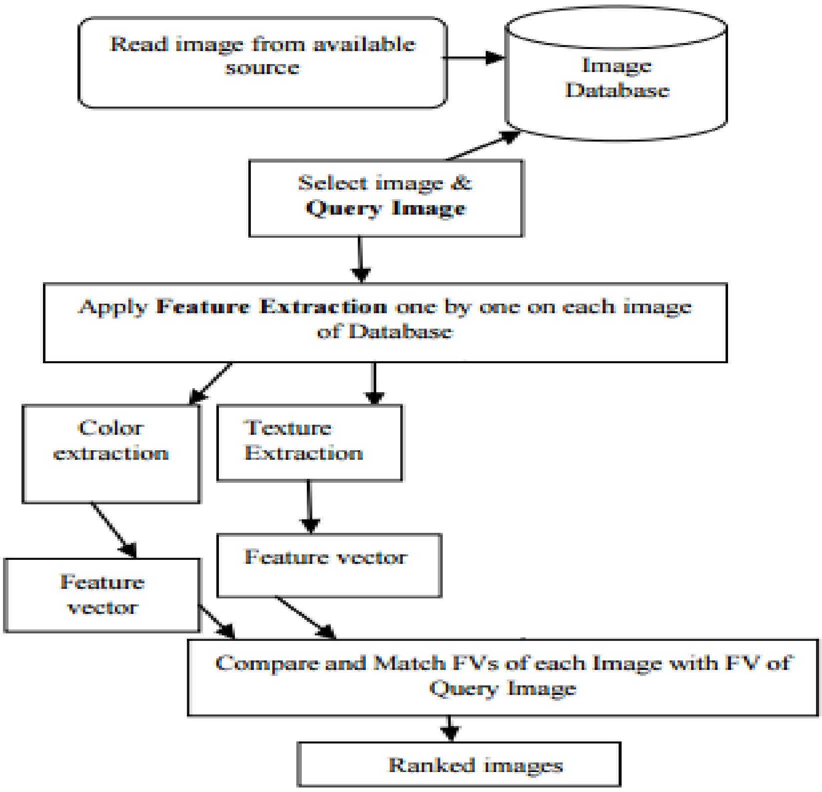


**Figure 1 : Flowchart for VFBIR**

### 5.1 Color Histogram

**Step 1**. Convert RGB color space image into HSV color space.
**Step 2**. Color quantization is carried out using color histogram by assigning 8 level each to hue, saturation and value to give a quantized HSV space with 8x8x8=512 histogram bins.
**Step 3**. The normalized histogram is obtained by dividing with the total number of pixels.
**Step 4**. Repeat step1 to step3 on an image in the database.
**Step 5**. Calculate the similarity matrix of query image and the image present in the database.
**Step 6**. Repeat the steps from 4 to 5 for all the images in the database.
**Step 7**. Retrieve the images.

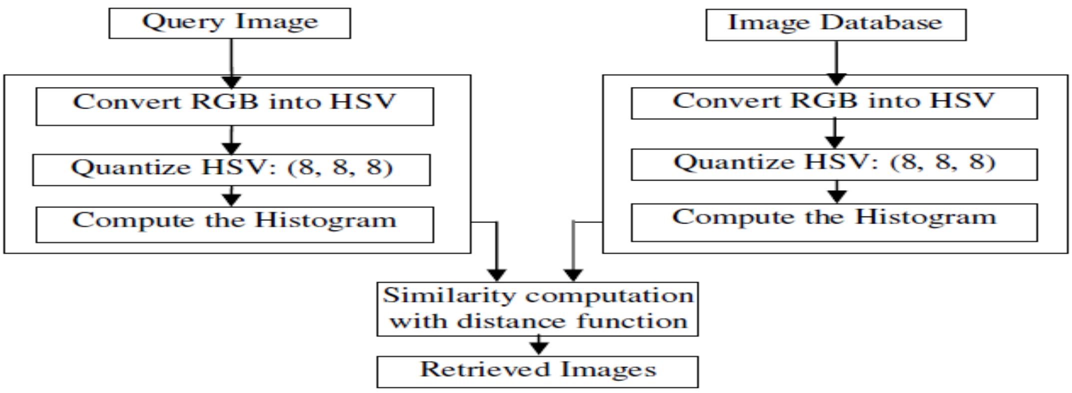


**Figure 2. Block diagram of proposed Color Histogram**

**5.2 Pyramid-Structured Wavelet-Based Color Histogram (WBCH).**

**Step1**. Extract the Red, Green, and Blue Components from an image.

**Step2**. Decompose each Red, Green, Blue Component using pyramid-structured Wavelet transformation at 1st level to get approximate coefficient and vertical, horizontal and diagonal detail coefficients.

**Step3**. Combine approximate coefficient of Red, Green, and Blue Component.

**Step4**. Similarly combine the horizontal and vertical coefficients of Red, Green, and Blue Component.

**Step5**. Assign the weights 0.003 to approximate coefficients, 0.001 to horizontal and 0.001 to vertical coefficients (experimentally observed values).

**Step6**. Convert the approximate, horizontal and vertical coefficients into HSV plane.

**Step7**. Color quantization is carried out using color histogram by assigning 8 level each to hue, saturation and value to give a quantized HSV space with 8x8x8=512 histogram bins.

**Step8**. The normalized histogram is obtained by dividing with the total number of pixels.

**Step9**. Repeat step1 to step8 on an image in the database.[11]

**Step10**. Calculate the similarity matrix of query image and the image present in the database.

**Step11**. Repeat the steps from 9 to 10 for all the images in the database.

**Step12**. Retrieve the images. Query Image Image Database Convert RGB into HSV Quantize HSV: (8, 8, 8) Retrieved Images Compute the Histogram Similarity computation with distance function Convert RGB into HSV Quantize HSV: (8, 8, 8) Compute the Histogram

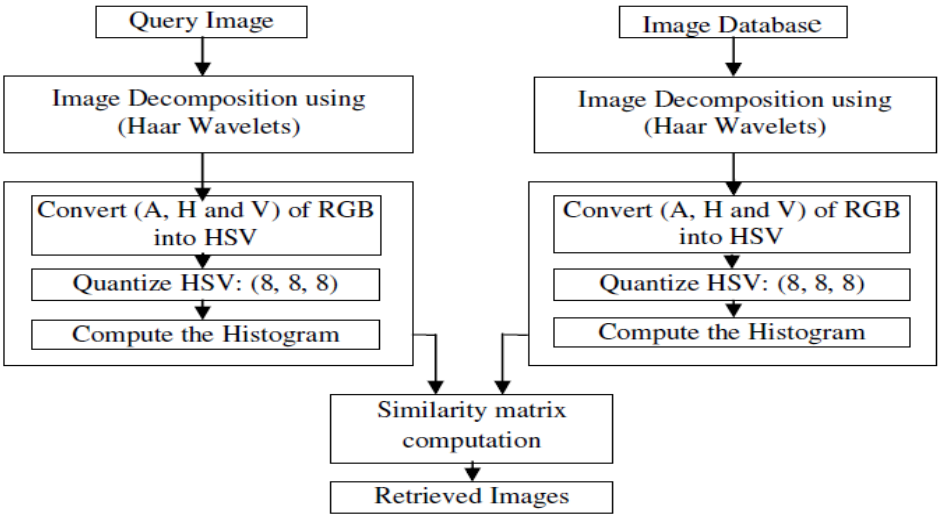


**Figure 3. Block diagram of proposed Wavelet-Based Color Histogram (WBCH). (A-approximate coefficient, H-horizontal detail coefficient, V-vertical detail coefficient).**

## 6. CONCLUSION AND FUTURE SCOPE

In this example, we selected **371.bmp** from the wang database[11]

**Figure 4: The query image: 371.bmp**

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## 7.1 COLOR EXTRACTION AND MATCHING

Using the color feature extraction algorithm described above, where the histograms of the query image and the images in the database are compared using the Quadratic Distance Metric, we obtained the following top 10 results:

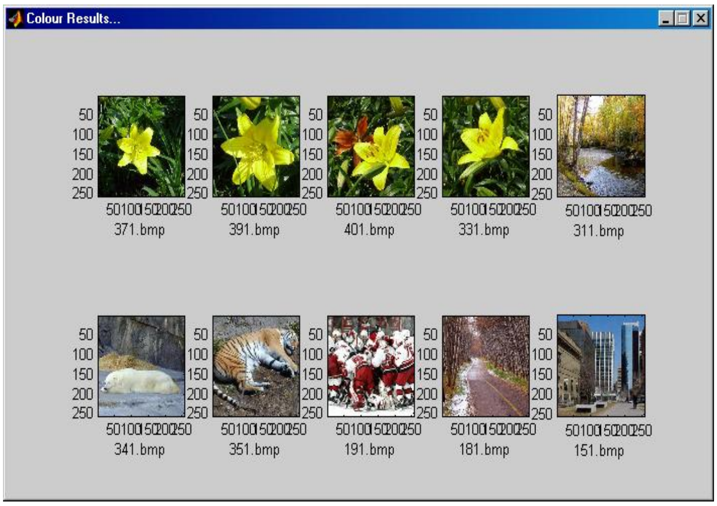


**Figure 5 : Color Results for the searching for 371.bmp**

The above results are sorted according to the quadratic distance. These are shown below:

| File Name | Color Distance |
|---|---|
| 371.bmp | 0 |
| 391.bmp | 3.3804 |
| 401.bmp | 4.3435 |
| 331.bmp | 5.0800 |
| 311.bmp | 5.9940 |
| 341.bmp | 6.6100 |
| 351.bmp | 6.9638 |
| 191.bmp | 7.0813 |
| 181.bmp | 7.1060 |
| 151.bmp | 7.1958 |

**Table 1 : Color distance between query and results**

## 7.2 TEXTURE EXTRACTION AND MATCHING

Using the texture feature extraction algorithm described above, where the energies of the query image and the color result images' sub-bands are compared using the Euclidean Distance Metric, we obtained the following top 4 results:

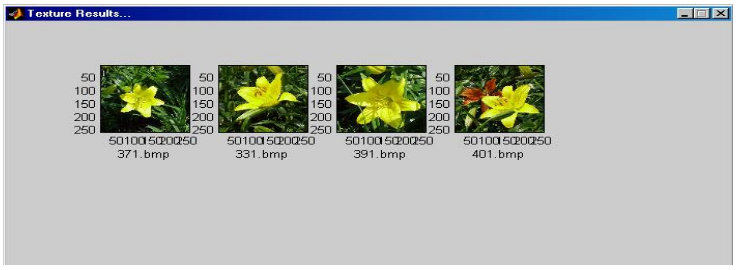


**Figure 6 : Texture Results for the searching for 371.bmp**

The results are sorted according to the Euclidean distance. These are shown below:

| File Name | Euclidean Distance |
|---|---|
| 371.bmp | 0 |
| 331.bmp | 1.1449 |
| 391.bmp | 2.4609 |
| 401.bmp | 2.6926 |

**Table 2 : Euclidean distance between query and results**

By observing the images in our database, we can actually say that the above results represent the closest matches to the query image chosen.

In the future, we propose a method that combines the shape and spatial features with the color and texture feature to represent the image. This will give good results. Also, segmentation is a method to extract regions and objects from the image. The segmented regions are used for similarity matching.

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