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Evaluation of Content Based Image Retrieval Technique using an Efficient Hybrid Model

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Abstract—*Due to vast enhancement in the field of visual technology, there are various sets of images. In order to reduce the complexity in retrieval of relevant images CBIR (Content Based Image Retrieval) technique can be used. CBIR using only color feature does not result in required output. So in this paper we introduced the concept of hybrid model which deals with color, texture along with shape features which gives an efficient output. A set of images are used to test the accuracy and the precision of each methods. Using Euclidean distance and Manhattan distance, similarity between query image and all the other images in database are calculated. Then the calculated distance values are arranged in ascending order. Based on this, required images are retrieved. Experiment results shows that Hybrid model method had high accuracy and precise output compared to Color Histogram. Future work will be made to add one more feature (shape features) in order to get better results.*

Keywords*: CBIR, Euclidean distance, Gabor Wavelet Transform, HSV Histogram.*

1. INTRODUCTION.

Any image from a set of database can be retrieved using two methods: Text based image retrieval and Content based image retrieval. In text based image retrieval all the images in the database are named based on the details of the image. Then the images similar to the query image are retrieved from the database based on the text given to images in it. This method of image retrieval requires a lot of human effort to name the images. So another method of image retrieval i.e. content based image retrieval came into existence. It was found by IBM. In this method all the images in the database are analyzed and a matrix containing properties of all the images is formed. Then query image is analyzed for its properties. The image properties[9] are now compared to the database images properties stored in the matrix. Then the relevant images are retrieved. The steps that are to be followed in the system realization are Image acquisition, Feature Extraction and Similarity Matching. The advanced feature in this CBIR techniques is SVM [7].

Features that are used include texture[4], spatial relationships, color and shape. Choosing the correct feature method contributes towards the accuracy of CBIR systems[12]. Shape does not mean shape of image but it refers to a particular region of interest in the image. Color feature extraction is the widely used technique since it does not depend on the size of the image.

2. FEATURES EXTRACTION.

Feature extraction is the method of analyzing the image and acquiring the required data from it.

2a. Color based[2].

Image Color is widely used general visual image feature for CBIR system due to its invariance to image scaling and rotation. It is represented by its three color component values like RGB (red/green/blue), HSV[3] (hue/saturation/value). The color features that can be used in CBIR are:

a. ***Color histogram:*** Color histogram[11] is the representation of the distribution of colors in an image. In other words it is the number of pixels for each quantized color bin located in three different color components.

b. ***Color moments:*** Color moments are measures that characterize color distribution in an image. They are mainly used in color indexing purposes.

c. ***Color coherence vectors (CCVs):*** Color coherence vector is power full color-based image retrieval.

d. ***Color correlogram:*** It is a color descriptor that characterizes both spatial correlation and color distributions of pixels.

2b. Texture based[13].

Texture is the powerful visual feature used in computer vision and pattern recognition. It is used for identifying visual patterns with properties like homogeneity that cannot result from the presence of only a single color or intensity. Commonly used texture features are

- Co-occurrence matrices, for capturing the spatial dependence of gray levels.
- Run-length matrices, for quantifying the coarseness of texture in specified directions.

- Wavelet transform coefficients.
- Gabor filters, as orientation and scale tunable edge and bar/line detectors.
- Fourier power spectrum.

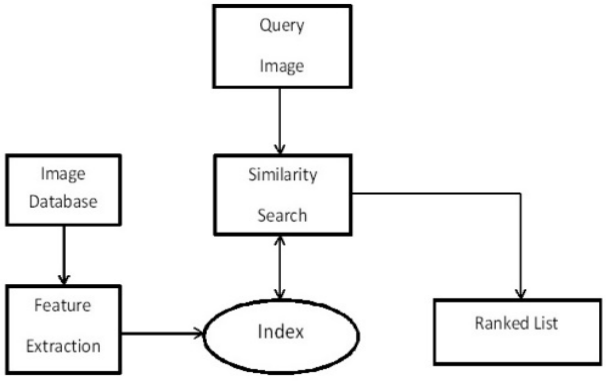

Figure 1: Basic CBIR Model.

3. SIMILARITY MEASUREMENT.

Generally in CBIR we need to compare[6] two images and check whether they are similar or not. To achieve this, it is necessary to have certain techniques by which one can statistically evaluate if both images are similar or not. So for this reason similarity measurement is done. Once we extract the required features, we compare the extracted feature for similarity. The similarity between the two images is given by how close the extracted features are of the two images.

3a. Euclidean Distance: This similarity metric is widely used because of its simplicity. If the distance value is less, then the two images are similar. The Euclidean distance between two points p= (p1, p2…pn) and q= (q1, q2…qn), in Euclidean n-space[5] is given as

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \mathrm{d}(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

3b. Manhattan Distance: It is the distance between two points in Euclidean space with fixed Cartesian coordinate system. The distance between the points is the sum of absolute differences of their Cartesian coordinates. The Manhattan distance[10] between the point P_1 with coordinates (x_1,y_1) and the point P_2 at (x_2,y_2) is

$$|x_1 - x_2| + |y_1 - y_2| .$$

4. EXISTING MODEL.

In the existing work[8]only color features are extracted in order to retrieve the relevant images related to query image. The color feature used in the existing work is HSV histogram. HSV histogram refers to converting the RGB image into HSV image[1] and then finding the histogram of

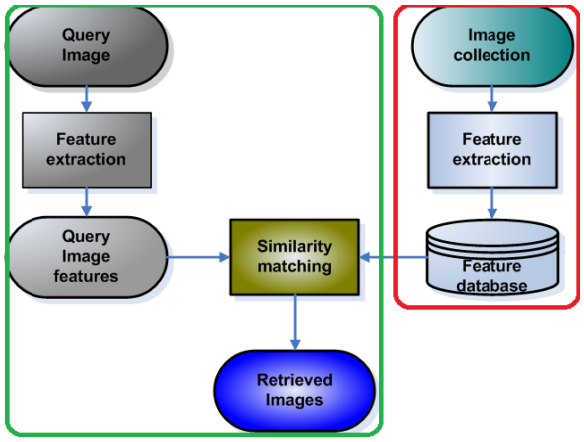

Figure 2: Block diagram of Existing model.

an image. After converting the image into HSV we divide the image into three planes H,S and V. Finally the no of Quantization levels are specified to each plane and values are stored in the form of a matrix. Now the histogram of an image is calculated. Finally, these values are compared with the values of query image and the required output is obtained. The following figure shows the output of the existing methodology by using only color features.

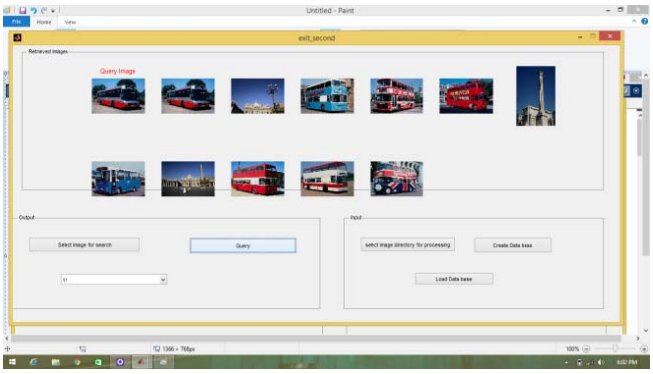

Figure 3: Existing system output.

5. PROPOSED WORK.

Proposed work is evaluated by using the MATLAB Software. As only color features are considered in existing model the output is not efficient. In order to overcome this in the proposed method texture features and shape features are obtained along with the color features In addition to HSV histogram technique. Another type named color correlogram technique is used in order to extract color features. Gabor wavelet transform is used in order to extract texture features. Texture features include mean square energy and mean amplitude. In the similar way these values are stored in the

matrix for the comparing with query Image values. The distance methods are used for comparing query image with database images. The distance methods used in our work Include both Euclidean and Manhattan distance. This is the overview of our proposed work which describes the main terms and techniques used.

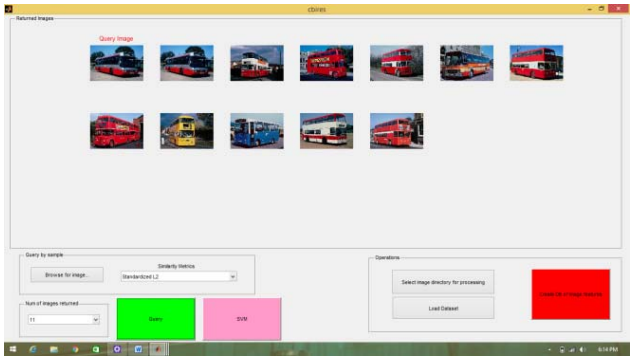

Figure 4: Proposed method output.

5a. Proposed Methodology.

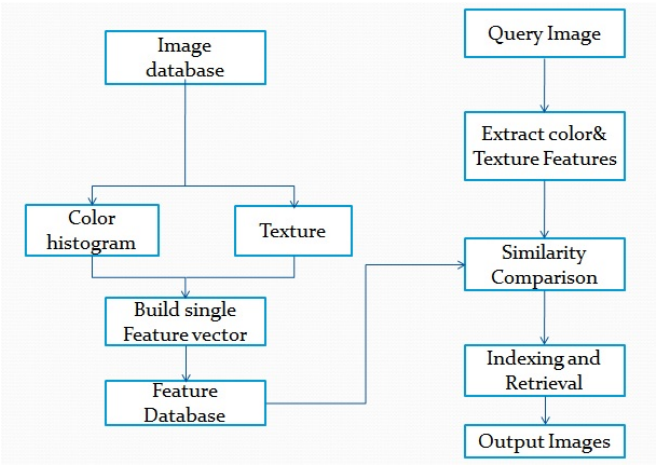

Figure 5: Block diagram of Proposed Method.

Steps involved:

- A database is created with different types of images.
- All the images in the database are resized to a unique size.
- For all the images color features like HSV Histogram, color correlogram, color moments and texture features like Gabor wavelets, wavelet transform are calculated.
- All the above calculated features are arranged in the form of matrix.
- Now for the query image all the features are calculated and formed in a row matrix.
- These values are now compared with the features of images in the database using difference formulas like Euclidean distance, Manhattan distance.
- The distance values are arranged in ascending order.
- The ordered images are displayed as the output.

Figure 6: Our database images.

SL. NO	TYPE OF IMAGE	NO OF IMAGES	SELECTION OF NO OF IMAGES TO BE RETRIEVED	EXISTING OUTPUT	PROPOSED OUTPUT
1	Bats	13	12	7	11
2	Pine Apple	24	10	7	10
3	Cauli Flower	29	10	5	9
4	Apple	25	10	7	9
5	Indian Flag	20	10	9	10
6	England Flag	13	10	8	10
7	Orange	16	10	4	9
8	Building	30	15	7	14
9	Bus	25	15	8	14
10	Dinosaur	28	15	10	15

Figure 7: Comparison of Proposed output with Existing output.

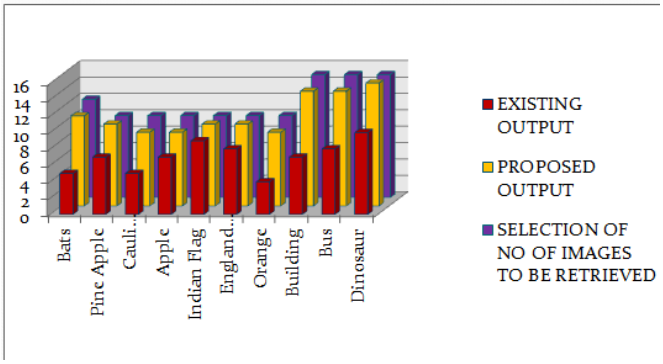

Figure 8: Performance chart.

6. CONCLUSION

In this paper we gave brief explanation about different types of image retrieval techniques. The necessity of these image retrieval techniques is due to the enormous growth in the volume of images in the web. In comparison of Text based retrieval to Content based retrieval, it is easy to retrieve a

image using CBIR as it uses comparison of different types of features of query image with database images. Here we used color and texture features of images. The features of query image are compared with images in database to obtain required output images. The method used here reduces computational time in searching images.

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