ISSN:0975-9646
GAuri Deshpande et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (3) , 2011, 1018-1021

Image Retrieval with the use of Color and Texture Feature

Gauri Deshpande[1], Megha Borse[2],
[1]*Electronics and telecommunication Department, Pune University*
[2]*Cummins College of Engineering For Women, Karvenagar Pune Maharashtra, India.*

***Abstract*— In case of large image database, text based image retrieval is proven to be insufficient. For large data base assigning the labels to each image using text is extremely time consuming. It is applicable for only one language at a time. Different users can assign different labels to the same image. To overcome these drawbacks, content based image retrieval method is used. There are two types of features i.e. High level features and Low level features. These features are nothing but the actual contents present in that image. Extracting these features image can be retrieved. In some cases, one feature is insufficient to retrieve the proper image. Hence a new method is proposed which uses two features i.e. *color* and *texture* to retrieve the images. For low level feature *color*, RGB space is converted into HSV space and YCbCr space, for getting the better results. For image retrieval using *texture* co-occurrence matrix is used. The low level features to be used depend upon the applications. For natural images color feature will give better result while for textured images co-occurrence matrix will gives better result.**

Keywords- RGB; HSV; YCbCr; co-occurrence matrix; Euclidian distance, cityblock distance

I. INTRODUCTION

In Content Based Image Retrieval (CBIR) the term *Content-based* means that the search will analyze the actual contents (features) of the image. In the image two types of features are present, Low Level Features and High Level Features. It is difficult to extract high level features like emotions, or different activities present in that image. But they give relatively more information about objects and scenes in the images that are perceived by human beings. So, generally low level features like *color, texture, shape* are used for retrieval of the image. These features are extracted from the query image; the same features are extracted from the images present in the data base. After comparing these features, images closer to our query image are retrieved. A query image is the image to be compared, rough sketch drawn or symbolic description the information. Now a day's, retrieval of the images based on CBIR technique has applications in many areas like medical field, satellite communication, security etc. In this paper section II elaborates the block diagram. In section III introductions of different color spaces are given. Methods for retrieval of the images using low level features are elaborated in section IV. In section V different methods of similarity measurement are explained. Proposed method is elaborated in sections VI followed by results is given in section VII. Section VIII is conclusion which is followed by the references.

II. BLOCK DIAGRAM OF CBIR

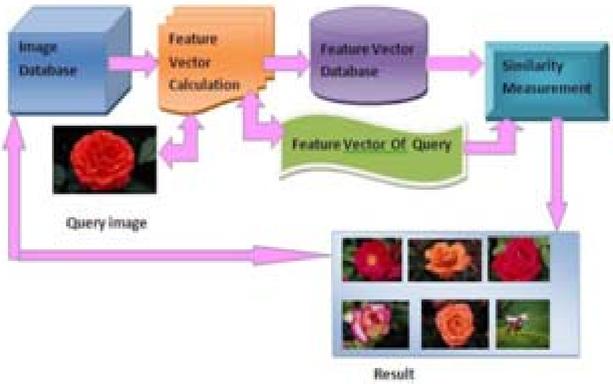

Fig. 1. Block Diagram of CBIR

Fig.1. [2] represents the block diagram of the CBIR system. There is large number of images present in the data base. Initially query image is given, and then low level features like *color, texture*, or *shape* are extracted from the query image. Then feature vector is calculated. The same features are extracted from the images present in the data base. The database is made to store the feature vectors calculated for the images present in the database. After that similarity measurement is done. And the top closest images to our query image are retrieved.

III. DIFFERENT COLOR PACES

A color space is defined as a model for representing color in terms of intensity values. A color space is a method by which we can specify, create and visualize the color. Three important color space RGB, HSV, YCbCr models are briefly elaborated as follows.

A. RGB COLOR SPACE

The RGB color model is composed of the primary colors Red, Green, and Blue. They are considered as the 'additive primaries' since the colors are added together to produce the desired color. The diagonal from origin (0, 0, 0) black to point (1, 1, 1) white which represents the grey-scale. Zero intensity for each component gives the darkest color and full intensity of each gives a white. When the intensities for all the components are the same, the result is a shade of gray, darker or lighter depending on the intensity.

Application:-This color model that is used in most color CRT monitors and color raster graphics.

B. HSV COLOR SPACE

The HSV [6] stands for the Hue, Saturation, and Value. It is also known as HSB (hue, saturation, **b**rightness).

Hue – Hue represents dominant color. That means Hue describes the actual wave length of the color by representing the color name. For example red, blue or yellow etc.

Saturation – Represents relative purity of color. It indicates the amount of white light added to a pure color. For example Blood red is the pure color i.e. it is 100% saturated. While pink is less saturated because the amount of white color present in the original color is more.

Value – The Value represents intensity of a color, which is decoupled from the color information in the represented image. The hue and saturation components are intimately related to the way human eye perceives color resulting in image processing algorithms with physiological basis.

Application – HSV space is used by artists because it is often more natural to think about a color in terms of hue and saturation.

C. YCbCr COLOR SPACE

YCbCr is a scaled and offset version of the YUV color space where Y represents luminance (or brightness), U represents color, and V represents the saturation value [3]. Here the RGB color space is separated into a luminance part (Y) and two chrominance parts (Cb and Cr). After conversion from RGB to YCbCr color space, it will separate RGB components into luminance and chrominance information.

Application – 1.YCbCr used in color and black & white television to separate out the luminance information than the color signal.

2. YCbCr is also used to reduce storage space and bandwidth.

3. As human eye is more sensitive to luminance than the color signal, some of the color information is thrown without loss of picture quality. Thus it is the good example of compression.

IV. METHODS FOR RETRIEVAL OF THE IMAGES USING LOW LEVEL FEATURES

There are different methods of image retrieval using low level features *color, texture, and shape.* In this paper two low level features *color* and *texture* are used. Converting the color images from RGB into another color spaces like gray, HSV, YCbCr, CMY and processing these images give better results according to application for which they are used. In this paper two methods are explained in detail for color. In the first method RGB image is converted into HSV and in the second method RGB image is converted into YCbCr. After this conversion feature vectors are calculated and depending on the similarity measurement the top closest images to our query image are retrieved. Another low level feature, texture is used for retrieval of the images. In this texture based method co-occurrence matrix is used. In order to use a good color space for a specific application, color conversion is needed between color spaces.

Retrieval of the images using low level feature, *color*

1. *RGB TO HSV CONVERSION*

As shown in the fig.2, the hue of the point P is the measured angle between the line connecting P to the triangle centre and line connecting RED point to the triangle centre. The saturation of the point P is the distance between P and triangle centre. The value (intensity) of the point P is represented as height on a line perpendicular to the triangle and passing through its centre.

Where, R, G and B represent red, green and blue components respectively with values between 0-255.

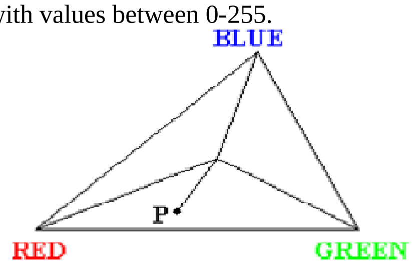

Fig 2. conversion of RGB into HSV

The convergence formulae are as follows:-

$$H = \cos^{-1}\left\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{\sqrt{(R-G)^2+(R-B)(G-B)}}\right\}$$

$$S = 1 - \frac{3}{R+G+B}[\min(R,G,B)]$$

$$V = \frac{1}{3}(R+G+B)$$

2. *RGB TO YCBCR CONVERSION*

Bitmap images use the R-G-B planes directly to represent color images. But medical research proved that the human eyes have different sensitivity to color and brightness. The eye is more sensitive to changes in brightness than changes in color. Thus there came about the transformation of RGB to YCbCr. [3] The difference between YCbCr and RGB is that, YCbCr represents color as brightness and two color difference signals. In YCbCr, the Y is the brightness (luma), Cb is blue minus luma (B-Y) and Cr is red minus luma (R-Y). While RGB represents color as red, green and blue. The transformation of RGB color model to YCbCr color model can be derived as,

$$Y = (77/256)R + (150/256)G + (29/256)B + 16$$

$$Cb = -(44/256)R + (87/256)G + (131/256)B + 128$$

$$Cr = (131/256)R + (110/256)G + (21/256)B + 128$$

Texture

Texture [1] is defined as structure of surfaces formed by repeating a particular element or several elements in different relative spatial positions. Generally, the repetition involves local variations of scale, orientation, or other geometric and optical features of the elements. Image textures are defined as images of natural textured surfaces and artificially created visual patterns. It contains important information about the structural arrangement of the surface. E.g. clouds, leaves, bricks, fabric, etc. It also describes the relationship of the surface to the surrounding environment. It is a feature that describes the distinctive physical composition of a surface. In low level feature *texture* co-occurrence matrix is used for retrieval of the images. The following subsection elaborates in brief definition, calculation about co-occurrence matrix.

Co-occurrence Matrix

While calculating the co-occurrence matrix [1] the image is first converted into gray scale, and then co-occurrence matrix is calculated called as GLCM (Gray Level Co-occurrence matrix). Co-occurrence matrix describes spatial relationships between grey-levels in a texture image. Each element *P* with position (*i*, *j*) in GLCM indicates the relative frequency at which two pixels of grey level *i* and *j*.

$$p(i,j) = \frac{\#\{(P_1,P_2) \in I \mid P_1 = i \,\&\, P_2 = j\}}{\#I}$$

GLCM is a square matrix. It has same number of rows and columns as quantization level of the image. While calculating the GLCM it is necessary to specify the size of the GLCM. If necessary mention the offset i.e. angle. To estimate the similarity between different gray level co occurrence matrices, many statistical features extracted from them, like Contrast, correlation, Energy, homogeneity etc.

V. METHODS USED FOR SIMILARITY MEASUREMENT

There are different methods for similarity measurement. In this paper two methods are used. First is Euclidian Distance Measurement and second is City Block Distance Measurement.

1. Euclidian Distance

Similarity Measurement is done using Euclidian Distance between an image P, which present in the data base and query image Q can be given as the equation below.

$$ED = \sum_{i=1}^{n} \sqrt{(Vpi - Vqi)^2}$$

Where, Vpi and Vqi be the feature vectors of image P and query image Q respectively with size n.

2. City Block Distance

The *City block distance* is always greater than or equal to zero. The measurement would be zero for identical points and high for points that show little similarity.

In 2-D, the city block distance is

$$d(a,b) = \sum_{i=1}^{n} |bi - ai|$$

where *a* and *b* are vectors

with *a*= (*a*1,…,*an*) and *b*=(*b*1,…,*bn*)

VI. PROPOSED METHOD

In the proposed method we are retrieving the images using low level features *color* and *texture.* While retrieving the images using *color* feature, the RGB image is converted into HSV and YCbCr. Then feature vectors are calculated in the form of HSV and YCbCr. Then the similarity measurement is done using Euclidian distance and city block distance. Then the top closest images are retrieved.

In case of low level feature *texture* using co-occurrence matrix Energy, Contrast, Correlation, Homogeneity these four features are calculated. Then feature vector calculation is done. On the basis of similarity measurement using Euclidian distance the top closest images are retrieved.

ALGORITHM OF PROPOSED METHOD

- Data base is generated for natural images as well as textured images.
- Give Query image as a input
- Feature vector is generated for the query image.
- Feature vectors are generated for the images present in the data base and stored
- For natural images RGB image is converted into HSV and YCbCr images and accordingly feature vectors are calculated.
- For textured images contrast, correlation, energy and homogeneity these four features are calculated using co-occurrence matrix.
- Similarity measurement is done using Euclidian distance and City Block distance between the query image and the images present in the data base.
- The top closest images, to query image are retrieved from the images present in the data base.

VII. RESULTS

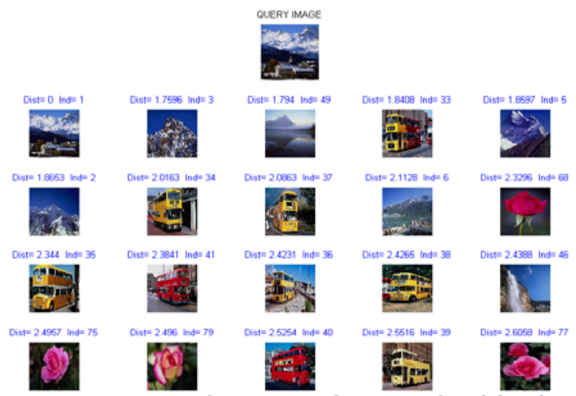

Fig.3. Images retrieved using HSV color space and Euclidian distance measurement

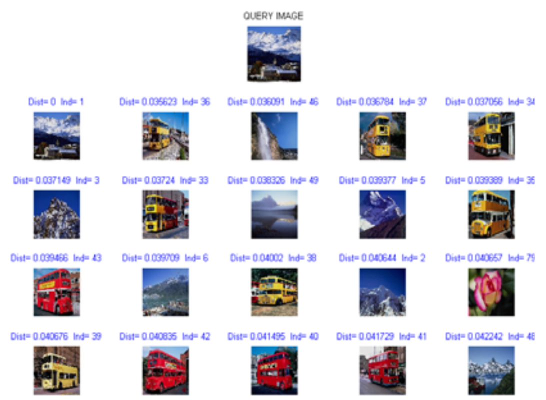

Fig.4.Images retrieved using HSV color space and City Block distance measurement

Fig.5. Images retrieved using YCbCr color space and Euclidian distance measurement

Fig.6. Images retrieved using YCbCr color space and City block distance measurement

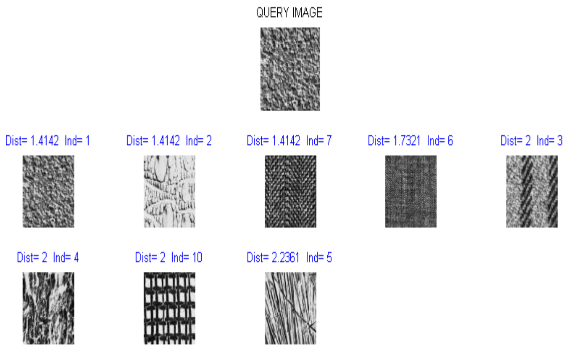

Fig.7. Images retrieved using co-occurrence matrix for texture feature and Euclidian distance measurement

TABLE I RETRIEVAL TIME USING *COLOR* FEATURE

Input image: - Query image

Method used for retrieval of the image	***Number of images retrieved from database***	***Time required for the retrieval***
using HSV color space and Euclidian distance	20	26.750000 seconds.
HSV color space and City Block distance	20	26.734000 seconds.
YCbCr color space and Euclidian distance	20	12.375000 seconds.
YCbCr color space and City block distance	20	14.156000 seconds.

TABLE II RETRIEVAL TIME USING TEXTURE FEATURE

Input image: - Query image

Method used for retrieval of the image	***Number of images retrieved from database***	***Time required for the retrieval***
co-occurrence matrix for texture feature and Euclidian distance measurement	08	7.765000 seconds.

VIII. CONCLUSION

Depending upon the application area we are using the CBIR method for the retrieval of the images. Only one feature is insufficient for proper retrieval of the image, so in the proposed method along with the low level feature *color* and another low level feature *texture* is used. Also, while using the *color* feature we are using different color spaces. So for particular application like artistic view HSV color space will give better results or for database containing images having blue or red color will give better results. As shown in the table 1. the time required for retrieval of the images using HSV color space is more than the time required for retrieval of the images using YCbCr color space. In case of textured images co-occurrence matrix will give better results because textured surface is formed by repeating a particular element or number of elements.

ACKNOLEDGEMENT

I would like to thank our Principal Dr. Mrs. M. B. Khambete for her kind support. I would also like to thank our Head Of Department Mr. S. V. Kulkarni for his kind co-operation and valuable guidance.

REFERENCES

[1] Jing Zhang, Gui-li Li, Seok-wun He, "Texture-Based Image Retrieval by Edge Detection Matching GLCM", The 10th IEEE International Conference on High Performance Computing and Communications.

[2] N S T Sai, "New Feature Vector for Image Retrieval:Sum of Value of Histogram Bins", 2009 International Conference on Advances in Computing, Control, and Telecommunication Technologies 9

[3] Padmashri Suresh RMD.Sundaram Aravindhan Arumugam, "Feature Extraction in Compressed Domain for Content Based Image Retrieval", 2008 International Conference on Advanced Computer Theory and Engineering.

[4] R.Vijaya Arjunan and Dr.V.Vijaya Kumar ,"Image Classification in CBIR systems with color histogram features", 2009 International Conference on Advances in Recent Technologies in Communication and Computing

[5] Sanjoy Kumar Saha; Amit Kumar Das, "CBIR using Perception based Texture and Colour Measures.", Proceedings of the 17th International Conference on Pattern Recognition

[6] Youngeun An and Muhammad Riaz and Jongan Park, "CBIR based on adaptive segmentation of HSV color space", 2010 12th International Conference on Computer Modelling and Simulation.

[7] Zhen-Hua Zhang, Yi-nan Lu, Wen-Hui Li, GangWang, " Segmentationbased image retrieval", Proceedings of the Sixth International Conference on Machine Learning and Cybernetics, Hong Kong, 19-22 August 2007.HSV color space", 2010 12th International Conference on Computer Modelling and Simulation.