Content Based Image Search and Retrieval Using HSV Model

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ABSTRACT

In past decades content based image retrieval is an interesting research work in the field of image processing. The images are retrieved by simple keyword search, but in case of content based image retrieval the visual content in the images are considered for effective retrieval. The HSV color space model's performance is evaluated in terms of accuracy with precision and recall values. In this paper in color images, the distribution of the color in the image is identified and the HSV based color space image retrieval system is introduced. The result achieved by our proposed work performs well when comparing with other existing methods.

Keywords
Content based, Color space, Image retrieval.

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Introduction

The research work in the area of content based image retrieval have started earlier during 1990's and now a days it is increasing because of the growth of multimedia based systems. In the fields of crime prevention, designing graphics and biometrics requires that the developers will manage more number of images and access them with efficiently. For accessing the image with large number of datasets it takes more amount of time. For increasing the accuracy the content based image retrieval is used.

An automated method has provided by content based image retrieval to retrieve the image based on the features or content in the image. By extracting the content from the query image, the content based image retrieval system matches the extracted content to the database images. For a given image the system should match all similar images according to the given input image from the database. This can be achieved by extracting the features from the image like shape, color or texture features [11]. By using any one of the features, the images between the database and the query image is compared. The similarity between the query images is identified by similarity algorithm, to calculate the degree of similarity between the query image and the database images. The images which are similar to the query image is identified with the image features and the rank is given to the matched images according to the maximum similarity measure.

From the visual content, the content based image retrieval try to index and retrieve the images from the database. The low level features that are extracted from the image, that represents color, shape or texture is compared with the visual content of the input image [10]. More researchers relied heavily on text-based retrieval, before CBIR has widely used to retrieve the images certain image retrieved systems [6] such as query by image content and visual seek has developed, but uses the low-level features to specific image retrieval technique. The content based image retrieval and text based retrieval have their own properties advantages and limitations. Hence by combining the techniques, some of the limitations can be reduced. In existing work the retrieval is in the form of image-based queries or text based so a system with more integration is highly required [3] for content based image retrieval.

II. Existing image retrieval techniques

Extracting the features and image matching are the two fundamental steps in content based image retrieval. To a distinguishable extent, the features extraction process is used to extract the image features. The features rectors consist of image features of color, shape and texture information that is extracted from the input image. Both the data base images and the query images are taken and the features are extracted. The query image and data base image are compared for image matching and also it includes the similar images which have the matched features from the database.

To increase the retrieval accuracy multiple feature are used to describe the image instead of retrieving an image by using a single feature vector. To search an image by using the color and texture increases the retrieval accuracy rather than using only color features for retrieval. The two features i.e., color and texture indicates more feature towards the matching process. In this work we concentrate on the algorithm and strategies to retrieval images by combined color and texture feature vectors to increase the accuracy of image retrieval.

Content based image retrieval has classified into four types. Content based, text based, composite and interactive methods. In case of indexing the file name, caption of the image, content in the image, and alternate tags for the images are included and stored in the database. The visual features are extracted and search operation is performed with the database image when it has been performed by query and the content based image retrieval system considers the query image and the images from the database with its collection of features and rank the relevant images according to the query image and any target image towards the similarity measure that are determined from the features. The images which have low level features are used to compute the similarity between the images [5,9].

Fig.1. Two images under different illumination conditions with its separated hue, saturation and value components. The first image is the original image.

Extraction of feature

The content based image retrieval HSV color space of the images has evaluated in the database. Two different color images with their hue, saturation and value are shown in Fig.1. A color space has defined with the three basic components have the color ranges from 0-360, saturation of the color ranges from 0-100% and purity value refers to the brightness of the color and it ranges from 0-100%. The hue is the angular dimension, starts with red primary at 0, passes through green primary at 120º, and the blue primary at 240 º, and then back to red at 360 º [8-9].

In order to decrease the number of colors for image retrieval, the quantization of the number of colors into several bins is performed. To quantize the color space into 166 colors J.R smith [13] designed a scheme. A non-uniform scheme is designed by Li [12] to quantize into 72 colors. This proposed work given a scheme to produce 15 non-uniform colors. To transfer from RGB to HSV the below formula is used.

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

$$S=1-\frac{3}{R+G+B}(\min(R,G,B)) \quad (2)$$

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

where R, G, B represents the red, green and blue components with the value range between 0-255. For obtaining the value of H from 0 º to 360 º and the value of S and V from 0-1, the formula is used.

$$V = 1/3\ (R+G+B) \quad (4)$$

$$H = ((H/255*360) \bmod 360 \quad (5)$$

$$V = V/255 \quad (6)$$

$$S = S/255 \quad (7)$$

To retrieve the images the following steps are used

Step 1: Load the input image

Step 2: Resize the input image into [256,256]

Step 3: Perform RGB to HSV conversion operation

Step 4: Generate the histogram with hue and saturation value

Step 5: Quantization of the number of colors into several bins

Step 6: The values of the image are stored and perform the above steps to store the image in database.

Step 7: Give the query image

Step 8: Perform the steps 2-6 to know the quantized HSV values of the query image.

Step 9: Find the Manhattan distance of the query image by comparing it with the database images.

Step 10: Order the distance values to perform the indexing operation.

The experimental results have includes 500 trained images which includes natural scenarios, flowers, animals. The results are shown in Fig 3., Fig.4. and Fig.5. respectively. The performance of the results can be identified by using the precision and recall values. The recall values represent the ability of the system to retrieve the relevant images and precision values represent the ability of the system to retrieve the relevant images.

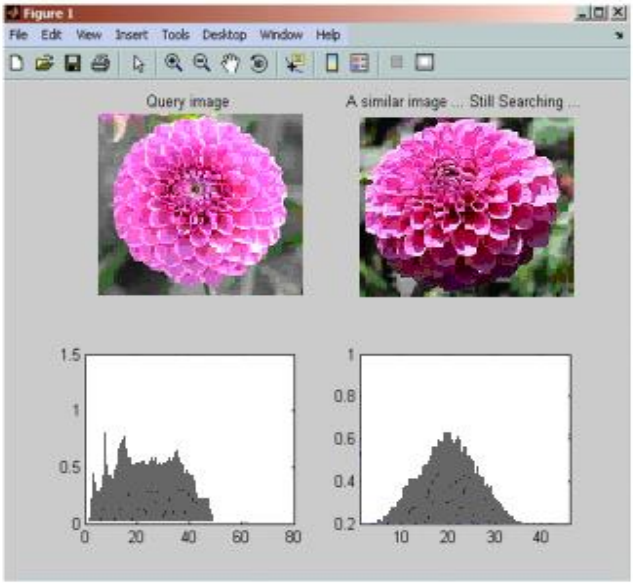

Fig.2. Image search with input image

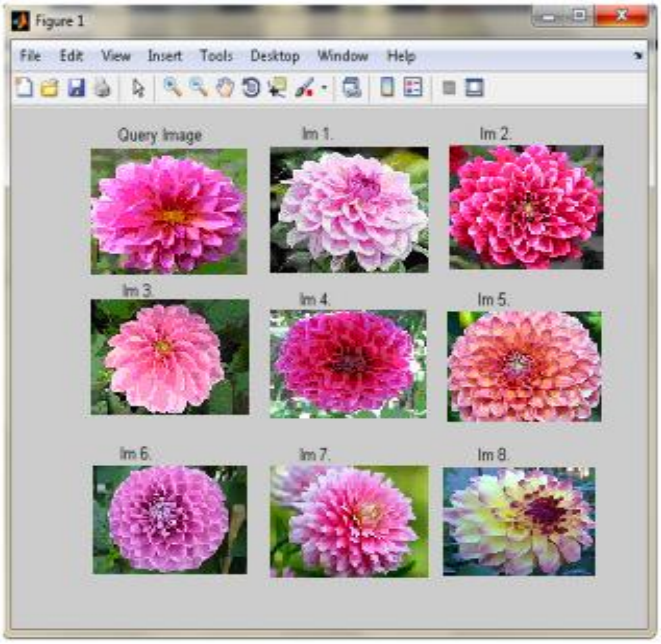

Fig.3. Retrieved image based on color

Fig.4. Retrieved image based on texture

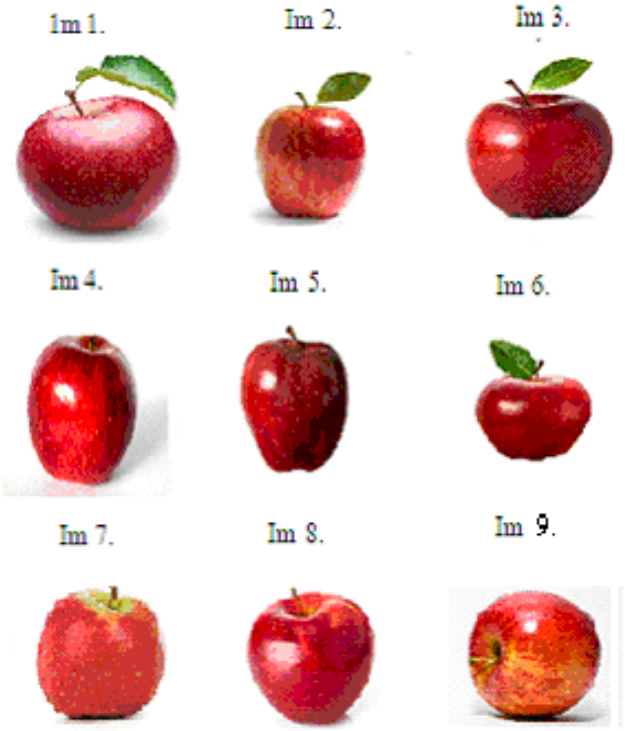

Fig.5. Retrieved image based on query

Precision = No of relevant images retrieved / Total number of images retrieved.
Recall = Number of relevant images retrieved / number of relevant images in the database.

Images	No of Image in database	No of retrieved images	No of relevant images	Precision	Recall
Flower	27	16	8	0.50	0.30
Car	23	15	10	0.67	0.43
Apple	19	12	7	0.58	0.37
Bike	25	11	9	0.82	0.36
Tree	20	10	5	0.50	0.25
Horse	16	8	3	0.38	0.19
Sky	34	21	11	0.52	0.32
Dove	31	18	10	0.56	0.32
Bus	28	15	6	0.40	0.21

Table.1. Precision and Recall values obtained for HSV Color Model

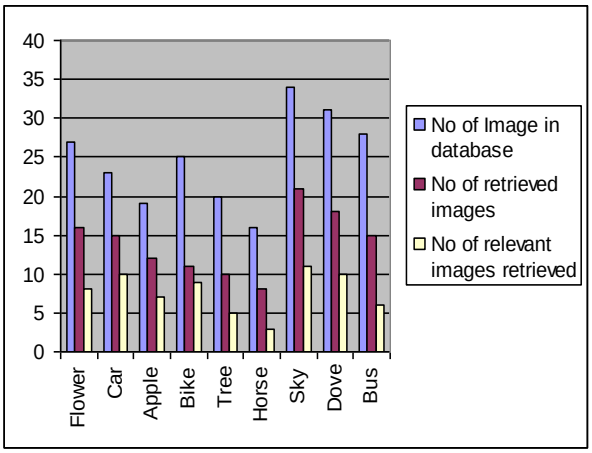

Fig.6. Precision and Recall values for Image retrieval

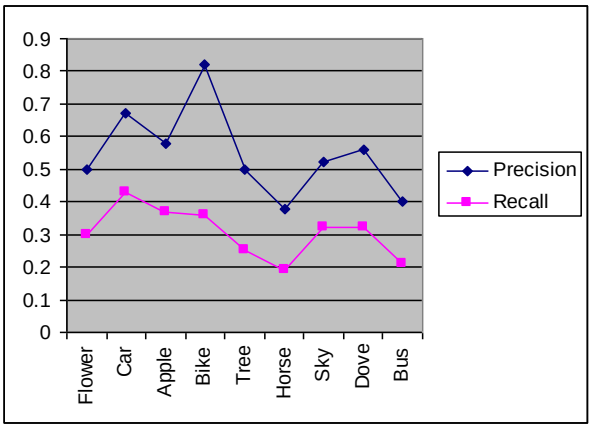

Fig.7. Precision and Recall values for Image retrieval

From the experimental results the precision value is increased for the lower recall values and is shown in Table 1. But for the higher recall values, the precision value is comparable and our experimental results have performed well and is shown is Fig.7.
We have considered different images of flowers, sky and natural scenes and the parameters of precision and recall have calculated for the images. Precision is calculated by the number of relevant images retrieved from the total number of images retrieved, where Recall is calculated by the

number of relevant images retrieved by the number of relevant images from the database.
When comparing both the RGB model and the HSV model the accuracy obtained is higher and better for HSV model and RGB model have lower accuracy and also the HSV model supports less negative (i.e.) non relevant images but RGB model support more non relevant images.

Conclusion

The HSV color space performance is evaluated in terms of content based image retrieval and we have compared the RGB with the HSV model. From our experimental results we have achieved higher accuracy for the content based image retrieval by retrieving more number of relevant images by using HSV and when we compared the achieved results with RGB it shows that RGB must support with lowest accuracy. In our proposed work the content based images retrieval uses the content of HSV color space scheme that transfer individual pixels of image to an quantized color. The quantized color code is used to compare the images from the database. More number of images with the quantized code is used to achieve the content based image retrieval techniques in future.

Future Scope

In our work, color model is effectively used to retrieve the database images. Edge detection techniques can be included to trace and detect the edges and also bitmap images can also be considered towards color models. Color quantization algorithms can be used in the input image to reduce the color dimensions in order to obtain the effective results.

References

[1] .Simardeep Kaur & Dr. Vijay Kumar Banga, Content Based Image Retrieval: Survey and Comparison between RGB and HSV model. International Journal of Engineering Trends and Technology., 4(4). (2013).

[2] Sharma,N.,Rawat,P.,and singh J. Efficient CBIR using color Histogram Processing. Signal and image processing an International Journal., 2(1). (2011).

[3] Ying Liu, Dengsheng Zhang, Guojun Lu, Wei-Ying Ma. A survey of content-based image retrieval with high-level semantics. Pattern Recognition.,40(1). 262-282, (2007).

[4] M. S. Lew, N. Sebe, C. Djeraba, and et al. Content-based multimedia information retrieval: State of the art and challenges. ACM Transactions on .Multimedia Computing. Communication. Applications., 2(1).1-19. (2006).

[5] Lidiya Georgieva, Tatyana Dimitrova, Nicola Angelov. RGB and HSV colour models in color identification of digital traumas images. International Conference on Computer Systems and Technologies., 12.1-6. (2005).

[6] Deb & Y. Zhang An overview of content-based Image retrieval techniques. Int. Conf. on Advanced Information Networking and Applications., 1,59-64. .(2004).

[7] Nezamabadipour. H. & Kabir. E. Image retrieval using histograms of uni-color and bicolor blocks and directional changes in intensity gradient. Pattern Recognition Letters., 25:1547-1557. (2004).

[8] .D. Feng, W. C. Siu, and H. J. Zhang. Fundamentals of Content-Based Image Retrieval. Multimedia Information Retrieval and Management Technological Fundamentals and Applications., New York: Springer. (2003).

[9] Vadivel A., Majumdar A. K. & Sural Shamik, Perceptually Smooth Histogram Generation from the HSV Colour Space for Content Based Image Retrieval. International Conference on Advances in Pattern Recognition., Kolkata, 248-251. (2003).

[10] Sameer Antani, Rangachar Kasturi, Ramesh Jain. A survey on the use of pattern recognition methods for abstraction, indexing and retrieval of images and video. Pattern Recognition., 35(4):945-96. (2002).

[11] Jain, A & Vailaya,A Image retrieval using colour and shape. Pattern Recognition., 29:1233-1244. .(1996).

[12] Li, Liu and Cao. An Image Retrieval Method Based on Color Perceived Feature. Journal of Image and Graphics. (1999).