

# Baseline of Content-Based Image Retrieval

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## ABSTARCT

Content-based image retrieval (CBIR) is used to identify relevant images based on their similarities to query images. CBIR has two types of features - high level feature & low level feature. Retrieval of images using high level features is very difficult. In this paper we present low level image feature: Color. Extraction using the Color feature gives accurate result. In color feature extraction, we use HSV attributes of image (Hue, Saturation and Value). In this paper we use Euclidean distances metric algorithm for ranking of images.

**Keywords:** Contact based image retrieval, relevant images, HSV, High level images, Low level images.

## 1. INTRODUCTION

CBIR has been very challenging topic, because CBIR [1] is based on high level feature & low level feature. Low level features visualize color, texture, shape & so on. High level feature express emotions meaning association of feature expression with combination of perceptual feature. Thus, It is difficult to extract high level features like emotions, or what are the activities present in that image. But they give relatively more important meanings of objects and scenes in the images that are perceived by human beings. So generally low level features like color, texture, shape & edge are used for retrieval of the image. This paper focuses on Color feature which is extracted from user image & same procedure is done for the standard images in the database. Then we can compare between two images & retrieve the images which are most similar to user image. Feedback obtained from low level & high level images that are different to each other. There is gap between low level feature & high level feature. To reduce this gap we use several approaches, one is online user's feedback and second is manual feedback. Collecting feedback information in an online manner [6] can be time-consuming and therefore inconvenient for users. Also, text descriptions generated by automatic annotation techniques are often

inaccurate and limited to a small vocabulary.

Therefore, it is insufficient to accommodate the diverse information needs from users. Hence, we can propose a methodology which automatically learns the distances metric for relevant judgment in database. For this, we use Euclidean algorithm which measures the distances between two images.

CBIR system is divided into three tasks which are required to complete retrieval procedure

- A. Extract feature
- B. Select particular feature
- C. Classification.

In one image there are many features (e.g. color, shape, and texture, edge etc). From these, we'll use color feature. Extraction means retrieving one particular feature from many available features. Feature extraction eases the complicated process of image selection & classification. Features which are important for efficient retrieval should only be considered and others can be neglected. This step is most important as the particular feature made available for discrimination directly influence the efficacy of the classification task. At the end of the retrieval task, set of features are represented in a 'Feature Vector'. Feature Vector is nothing but representation of the image in a matrix form. This matrix is formed by using the pixel value of image.

CBIR can be divided into mainly two stages:

- Preprocessing: First step is to extract a feature, which describes its contents. In this processing, we perform feature filtration, normalization, segmentation (i.e. divide the image content - visual feature, emotion, color shape etc) and object identification. The output of this stage is a set of significant regions and objects.
- Feature extraction: Low level features are used to describe the content of the image. Image Features can be classified into primitives.

Fig. 1 shows the architecture of a typical CBIR system. Each image in the image database is in standard form. For all images in database first features are extracted and the obtained feature space is stored in the feature database. When a query image is selected, its feature space will be compared with those in the feature database one by one and the similar images with the

smallest feature distance will be retrieved.

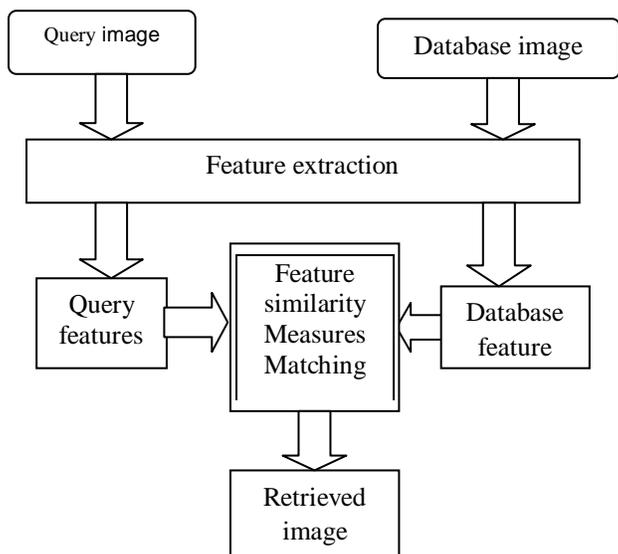


Fig 1 Diagram of the image retrieval process

## 2. COLOR FEATURE EXTRACTION

Color space typically defines a one-to four-dimensional space. In the case of the grey scale image, the color space will have one dimension, a dimension that defines the level of "grayness". In a color image, there are typically three dimensions, one for each of the primary color component. In certain cases a fourth dimension is used, which is referred to as the alpha-channel, which is a mask that indicates how the pixel's colors should be merged with another pixel when two images are overlaid, one on top of the other a white reference point. We have already described the RGB color model as the most commonly used (as shown in fig2). The reason for its widespread use is because it's ideally suited for hardware implementations, and because the human eye is strongly perceptive to red, green and blue components. The HSV color space is typically represented as a cone, shown on Figure 3. The Hue indicates what color it is, and is normally in a range of 0-360 (a circle). Some users of the model normalize this to 0-100%. The Saturation tells how saturated, that is, how rich the color is. The less saturated color is the greyer and bland it will look. Saturation range is from 0-100%. The Intensity indicates how bright the color. In this space, hue is used to distinguish which are true colors in image, saturation is the Percentage of white light added to a pure color and value refers to the perceived light intensity.

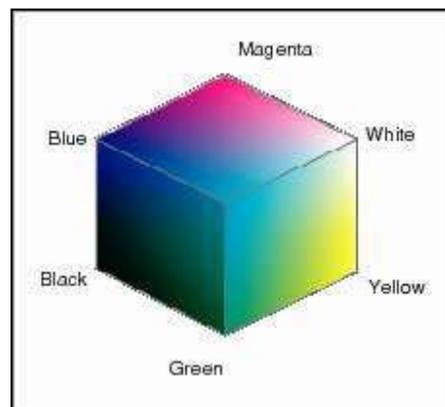


Fig 2: RGB color spaces

The advantage of HSV [2] [5] color space that it is closer to human conceptual understanding of colors and has the ability to separate chromatic and achromatic components. Because of a large range of every color component, if we consider directly calculate the process for retrieval, it is very difficult for computation process. It is essential to quantify HSV space component to reduce computation and improve efficiency

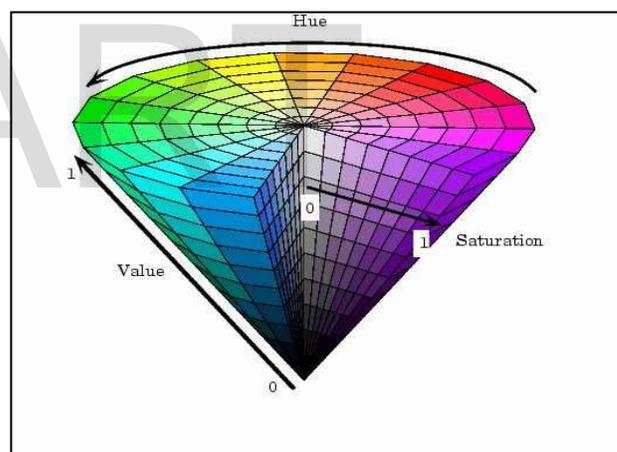


Fig 3 HSV color spaces

We can form three dimensional HSV spaces in to one dimensional space.

$$G = QS QVH + QV S + V \tag{1}$$

Where QS is quantified series of S, QV is quantified Series of V.

Here we set QS =QV=3, then

$$G = 9H + 3S + V \quad (2)$$

$$0 \text{ if } h \in [316, 20]$$

$$1 \text{ if } h \in [21, 40]$$

$$2 \text{ if } h \in [41, 75]$$

$$3 \text{ if } h \in [76, 155]$$

$$H = 4 \text{ if } h \in [156, 190]$$

$$5 \text{ if } h \in [191, 271]$$

$$6 \text{ if } h \in [271, 295]$$

$$7 \text{ if } h \in [296, 315]$$

$$0 \text{ if } S [0, 0.2]$$

$$0 \text{ if } S [0, 0.2]$$

$$S = 1 \text{ if } S [0.2, 0.7]$$

$$V = 1 \text{ if } S [0.2, 0.7] \quad (4)$$

$$2 \text{ if } S [0.7, 1]$$

$$2 \text{ if } S [0.7, 1]$$

In this way, three-component vector of HSV form is stored in G as shown in (2) then it is form in One-dimensional vector. By quantification we can be effectively reducing the light intensity in images, but also reducing the time and complexity for computation.

### 3. ALGORITHM

Various steps to retrieve images are given below

1. Load the database in the Mat lab workshop.  
Resize the image for [256,256]
2. Convert image from RGB to HSV.
3. Generate the histogram of hue, saturation &value.
4. Quantization of values into 72 bins.
5. Stored the values of database image into Mate file.

6. Apply the procedure 2-6 to find quantized HSV values of query image.
7. Determined the Euclidean distances of query image with database.
8. Sort the distances values to perform indexing.
9. Display the result on GUI.

As shown in fig 4, two point A & B are linearly so distances between A & B are measured in straight line

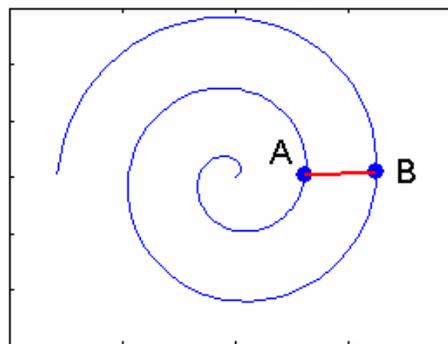


Fig 4 Euclidean distances between two data point

### 4. EXPERIMENTAL RESULT

Experimental database consist of 80 images of different colored flowers. All images are not in same size, so they need to be resized. First step is to select query image and then extract the color feature of query image & database image. Find the distance between the feature of query & database image. To measure the distances we use Euclidean distances algorithm which is represented as,

$$d = \sqrt{\sum_{i=1}^N (F_Q [i] - F_{DB} [I])^2} \quad (5)$$

In (5) Q and DB are Euclidean vectors starting from the origin point. Euclidean distances or Euclidean vector measures the length of the vector. In this implementation we use the query image from the image database itself. As seen in fig 5, we first select the query image from all the available images. Then we extract the color features of the query image and compare it with all the images in the database. The result of comparison will get us 10 relevant images based on the distance.



Fig 5 Retrieval of image select query image inside the database

Fig 6 shows the result of extraction when the query image is outside Database. Here we selecting query image outside the database & rank the 10 nearest images. As we see, first three relevant images are somewhat similar query image



Fig 6 Retrieval of image - select query image outside the database

The performance of retrieval system can be measured in terms of its recall and precision. Recall measures the ability of the system to retrieve all the models that are relevant, while Precision measures the ability of the system to retrieve only Models that is relevant. These HSV values has a high recall and precision of retrieval, and is effectively used in content based image retrieval systems. They are defined as:  
 Precision = Number of Relevant images retrieved /Total Number of images retrieved.

Recall = Number of Relevant images Retrieved/Number of relevant images in the database.

Here in table 2. We have taken different color images of, Pink Flower, White Flower and from this we have calculated the parameters Precision and Recall. Precision is given by Number of Relevant images retrieved to the total number of Images retrieved, whereas Recall is the number of Relevant Images retrieved to the number of relevant images in the Database. After calculating Precision and Recall, Accuracy for the HSV model is calculated by the average value Of Precision and Recall Here in table 2. We have taken different color images of, Pink Flower, White Flower and from this we have calculated the parameters Precision and Recall. Precision is given by Number of Relevant images retrieved to the total number of Images retrieved, whereas Recall is the number of Relevant Images retrieved to the number of relevant images in the Database. After calculating Precision and Recall, Accuracy for the HSV model is calculated by the average value Of Precision and Recall

TABLE 2. ACCURECY OF CBIR WITH HSV COLOR MODEL

| Image        | No. of images in database | No. of Retrieve images | No. of Relevant images | Precision | Recall |
|--------------|---------------------------|------------------------|------------------------|-----------|--------|
| Pink Flower  | 50                        | 8                      | 6                      | 0.75      | 0.65   |
|              | 80                        | 10                     | 8                      | 0.8       | 0.6    |
| White Flower | 50                        | 20                     | 15                     | 0.75      | 0.58   |
|              | 80                        | 30                     | 20                     | 0.66      | 0.77   |

## 5. CONCLUSION & FUTURE SCOPE

The proposed system is highly experimental and makes use of Euclidean Algorithm and color feature extraction to provide the solution for accurate image retrieval problem. Euclidean algorithm is used for distances metric learning; by this, we obtained retrieval accuracy in CBIR system. In this algorithm we cannot take log data of users so we use image database for every retrieval. If two points are linearly spaces then we can measure distances& for non-linear point cannot measure the distances. Hence in future we are planning to seek algorithm for non-linear points. This method

demonstrated a good solution and we made a step closer to efficient image retrieval but still I acknowledge that there is a room for improvement. The result can be improved further by considering the other image features like shape, texture etc which will be my focus point in the months to come. CBIR has been an active research topic for many years. However, its retrieval accuracy is still not satisfactory due to the semantic gap between low-level image feature representation and high-level image semantic meaning. I am hoping to contribute a method which will make this method more meaningful and efficient.

## REFERENCES

- [1] Luo Si · Rong Jin · Steven C.H. Hoi · Michael R. Lyu "Collaborative image retrieval via regularized metric learning" *an international Journal*, 2006.
- [2] Fan-Huikong. "Techniques for Color Image Retrieval" *Symposium on Electronic*.
- [3] Imaging: Science and Technology-"Storage and Retrieval for Image and Video Database" *IV*, pp.426-237, 1996.
- [4] Gong, Y., Chua Zhang, H.Z., Sakauchi, H.C.M.:" An image database system with content capturing and fast image indexing abilities". *In: IEEE International Conference on Multimedia Computing and Systems (1994)*.
- [5] Fan-Huikong "Image retrieval both color & texture feature" *Proceedings of the Eighth International Conference on Machine Learning and Cybernetics, Baoding, 12-15 July 2009*.
- [6] Smith, J., Chang, S.F- "Automated image retrieval using color and texture". *IEEE Trans. Pattern Anal. Mach. Intel.* (1996).
- [7] Ryszard S. Chora's- "Image Feature Extraction Techniques and Their Applications for CBIR" (2007).

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