A Review : Fast Image Retrieval Based on Dominant Color Feature

Pallavi Sitaram Narkhede
Research Scholar
RKDF Institute of Science & Technology, Bhopal

Piyush Singh
Professor
RKDF Institute of Science & Technology, Bhopal

Gaurav Shrivastav
HOD, RKDF Institute of Science & Technology, Bhopal

***Abstract*: Everyone is familiar with digitization. Everyone has a craze of digital images. Each sector consists of huge database of digital image. That's why digital image processing is becoming the most powerful research area. Color, shape, edges and texture these are the basic features used for content based image retrieval. Among these features color is the most useful property and intuitive feature of image. In this paper, a review of Content based image retrieval based on color as a feature is proposed. Color images retrieval includes RGB(Red, Green, Blue) and HSV(Hue, Saturation, Value) and other color spaces.**

Keywords: Digital image, Content based Image retrieval, color space.

I. INTRODUCTION

"A picture description is more easier to understand than words." At childhood textbook contains stories with more pictures and less contents related to it. But from that picture based stories we define that guessing power by learning the pictorial stories and our background knowledge. Similarly Computer program also discover semantic concepts from images. Computer program extract different visual features for semantic understanding which plays an important role in various tasks of image processing. As we known, the most common visual features include color, texture and shape, etc. [1], and most color image retrieval systems have been constructed based on these features. There are two classes of techniques for color indexing: indexing by (1) global color distribution and (2) local or region color. A main difference between these techniques is that indexing by global distribution enables only whole images to be compared while regional indexing consists of matching between localized regions within images. These techniques are more useful for retrieval of images and videos but are suited for different types of queries[6]. Color indexing by global distribution is useful when user provides a sample image for the query.

A most basic form of color retrieval involves specifying color values that can be searched for in images from a database. Computer represent all visible colors with a combination of some set of base color components, generally Red, Green and Blue (RGB). Thus, images perceived by a computer to contain a large component of red may not necessarily appear in red shade as perceived by a human eye.

Mostly, HSV color space is used for extracting color features, which prepares a clear perception. HSV color space combination has increased the retrieval efficiency because it defines color information, global information and added deformation invariance.

II. LITERATURE SURVEY

Color Features:

Color is an expressive visual attributes that can provide more information about the visual content of an image. Color space facilitates the specification of color which defines particular color feature. Each color in the color space is a single point represented in a coordinate system. Most widely used color spaces are RGB, LUV, HSV and HMMD [5]. RGB color space is most commonly used for image display which is composed of Red Green Blue color components. HSV space is used in computer graphics to describing color with the color components as hue, saturation(lightness) and value (brightness). CMY color space mainly used for printing. It consists of cyan, magenta, and yellow color components.

Color feature can be extracted from images or regions by a specified color space. Image Color features includes color histogram, color moments (CM), color coherence vector (CCV) and color correlogram, *etc. Most effective color feature is* CM. Color distribution information is captured by the three low order moments. The common moments are mean, standard deviation and skewness. The first order moment (μ) captures the mean color, the second order moment (σ) captures the standard deviation, and the third-order moment captures the skewness (θ) of color. The corresponding calculation can be defined as follows:

$$\mu_i = \frac{1}{N}\sum_{j=1}^{N} f_{ij}$$

$$\sigma_i = \left(\frac{1}{N}\sum_{j=1}^{N}(f_{ij} - \mu_i)^2\right)^{\frac{1}{2}}$$

$$\gamma_i = \left(\frac{1}{N}\sum_{j=1}^{N}(f_{ij} - \mu_i)^3\right)^{\frac{1}{3}}$$

where *fij* is the color value of the i-*th* color component of the j-*th* image pixel and *N* is the total number of pixels in the image. μi denotes the mean deviation, σi, denotes the standard deviation and γi (i=1,2,3) denote the skewness of each channel of an image.

Color histograms compares images[11]. The color histogram provides effective description of the color content of an image for unique color pattern. The global and local distribution of colors in an image are clearly defined by color histogram. Color histogram distances measure the similarity between two different colors. They defines its color histogram distance as:

$$d_{\text{hist}}(I, Q) = (h(I) - h(Q))^{T} \cdot A \cdot (h(I) - (h(Q)))$$

The color histogram specifies similar color distributions for different images without taking spatial information of pixels. So for consideration of image retrieval divide that image into sub-areas and calculate a histogram for each of the sub-areas

1. *Global Color Histogram (GCH):* This describes the color attribute of an image[2] . The normalized percentage of the color pixels corresponding to each color element are computed and the histogram can be constructed. Consider an example of a RGB image and the corresponding histograms of each component is displayed in Fig. 1.

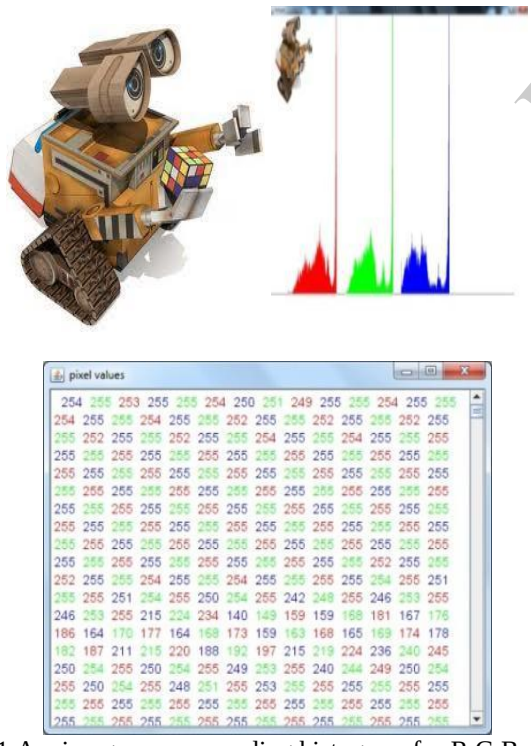

Fig.1 An image, corresponding histogram for R,G,B , and pixel values.

To construct the color feature vector for the query image and all images in the database, the three-color components (Red, Green, and Blue) are identified and corresponding histograms of these components is computed. Color histogram is widely used in image retrieval because of its lower complexity as compared to traditional techniques of pattern recognition [2]

2. In desired images retrieval using multiple local features of query images, multiple color and texture features in local windows are extracted based on user's interest from query images[3]. To retrieve desired images, color and texture feature are evaluated. In such a method local windows are selected by pointing with a mouse on graphical user interface based on user's interest regions.

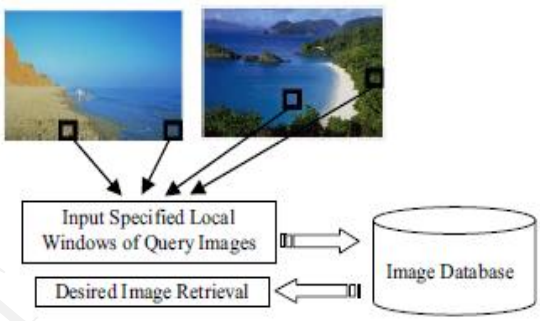

Fig. 2. Desired Image retrieval

Color moment and texture histogram based on local binary pattern of DT-CWT are calculated. Similarity between multiple local features of query images and database images was measured by weighted Euclidean norm.

(a) Query image

(b) Retrieved images

3.Chua *et al*. presented Signature-based image retrieval method in which image is represented by its major dominant colors[4]. The dominant colors consist of the colors that have highest frequencies in the global color histogram of the image. Image can be partitioned into $m \times n$ cells of equal size, Each cell represented an index i in the range $[1, 2, \ldots, n \times m]$. A bit-string

is assigned to each dominant color to describe its spatial distribution. A bit i is set to 1 if the cell number *I* contains significant number of pixels of that color. The image representation consists of the set of all the bit-strings. It can be represented by specifying the following steps:

4. Tian *et al.*, [8] proposed a fusion of global and local block-based image feature representation method which reflect the intrinsic content of images efficiently, For such a purpose the color histogram in HSV space is extracted. This histogram represent the global feature of images, and color moments, Gabor wavelets texture and shape detector are used to extract local features. Alongwith, shape feature can be extracted by the convolution of 3×3 masks with the image in four different directions (horizontal, 45°, vertical and 135°). A last, they combine the global feature and local features, *i.e.*, features of the blocks connected by left-to-right and top-to-down orders together, which results in a block-line feature structure. It explore the relationship between their appropriate combination and the final performance to see whether the combination can further improve the performance.

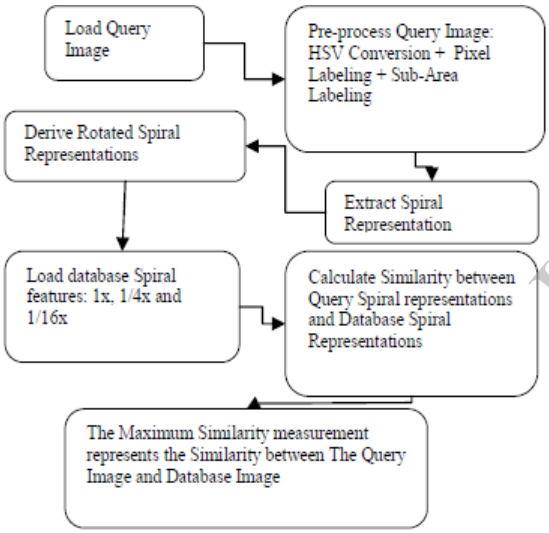

Fig. 3 Bit string Image retrieval system module

5. Abdesselam and Wang [9] implemented a cluster-based image retrieval method. This method improves the performance of image retrieval. A predefined HSV color set is constructed instead of the RGB color set. Each pixel of the image is assigned to one color among the n predefined color clusters using clustering process. The image is subdivided into *m x m* sub areas to get the spatial distribution of the color. For each sub-area, dominant cluster is obtained to form the Color Cluster Distribution (CCD) image. CCD captures the spatial distribution of the colors. The image similarity is defined by the cummulative distance between all corresponding sub-regions in each orientation. This particular method is capable of retrieving rotated images like 90 and 180 degrees. The main disadvantage is that it cannot retrieve scaled images.

6. Dominant Color Descriptor (DCD) represents an effective description of the colors in the image[10]. This achieves to describe global and local spatial color distribution in images for high-speed retrieval and browsing. Two color components are required for it: color vectors and percentage of color. Color vector is retrieved from Y domain which defines the color and which represent the ratio of the dominant color in the image. This technique is found to be efficient according to performance and the feature extraction wise.

III. CONCLUSIONS

In this paper, we provide a review of a Content Based Image Retrieval system based on color. Prior to queries a table of meta-data is created by the systematic iteration over color sets to extract localized color regions. The table is indexed directly by color set value which enables very fast indexing of the image collection. The color set approach also allows queries to include multiple regions and their spatial layout.

REFERENCES

[1]. Dong ping Tian, "A Review on Image Feature Extraction and Representation Techniques", International Journal of Multimedia and Ubiquitous Engineering Vol. 8, No. 4, July, 2013.

[2]. Prajakta R. Thakare, Saba Anjum J. Patel, Tanaji. D. Khadtare, "Efficient Image Retrieval Mechanisms using Color Feature", International Journal of Inventive Engineering and Sciences (IJIES) ISSN: 2319–9598, Volume-1, Issue-4, March 2013.

[3]. Yiming Li, Zhuo Liu and Shigeo Wada, "Desired Image Retrieval Using Multiple Local Features of Query Images", ICSP2012 Proceedings.

[4] Chua T., Tan K., and Ooi B., "Fast Signatured Color-Sptial Image Retrieval," *in Proceedings of IEEE*, pp. 362-369, 1997.

[5] P. L. Stanchev, D. Green Jr. and B. Dimitrov. "High level colour similarity retrieval", International Journal of Information Theories and Applications, vol. 10, no. 3, **(2003)**, pp. 363-369.

[6] John R. Smith and Shih-Fu Chang, "Tools and Techniques for Color Image Retrieval", IS&T/SPIE proceedings vol. 2670, storage & retrieval for image and video databases iv

[7] Rishav Chakravarti, Xiannong Meng, "A Study of Color Histogram Based Image Retrieval", 2009 Sixth International Conference on Information Technology: New Generations.

[8] D. Tian, X. F. Zhao and Z. Shi, "Support vector machine with mixture of kernels for image classification", In Proc. ICIIP, (2012), pp. 67-75.

[9] Abdesselam A. and Wang Y., "Color-Clustering for Image Retrieval," *in Proceedings of International Conference on Pattern Recognition and Computer Vision*, 2000.

[10] Ahmed Hosny El-Kholy, Ahmed Mahmoud Abdel-Haleim, "Content-Based Image Retrieval Using Combined Features and Weighted Similarity", *2012 2nd International Conference on Computer Technology and Development (ICCTD 2012)*

[11] Sh. Akbarpour, "A Review On Content Based Image Retrieval In Medical Diagnosis", IJTPE June 2013 Issue 15 Volume 5 Number 2 Pages 148-153.

[12] Y. Rubner, L.J. Guibas, and C. Tomasi, "The earth movers distance, multi-dimensional scaling, and color-based image retrieval," in Proceedings of the ARPA Image Understanding Workshop. Citeseer, 1997, pp. 661–668.

[13] J.Z. Wang, J. Li, and G. Wiederhold, "Simplicity: Semantics-sensitive integrated matching for picture libraries," IEEE Transactions on pattern analysis and machine intelligence, pp. 947–963, 2001.

[14] Y. Chen and J.Z. Wang, "A region-based fuzzy feature matching approach to content-based image retrieval," IEEE Transactions on Pattern Analysis and Machine Intelligence, pp. 1252–1267, 2002.

[15] M. Banerjee, K. M K, and PK Das, "Image retrieval with visually prominent features using fuzzy set theoretic evaluation," in IEEE International Conference on Visual Information Engineering VIE. Citeseer, 2006, pp. 298– 303.

[16] PS Hiremath and J. Pujari, "Content based image retrieval based on color, texture and shape features using image and its complement," International Journal of Computer Science and Security, vol. 1, no. 4, pp. 25–35, 2007.

[17] A.W.M. Smeulders, M. Worring, S. Santini, A. Gupta, and R. Jain, "Content-based image retrieval at the end of the early years," Pattern Analysis and Machine Intelligence, IEEE Transactions on, vol. 22, no. 12, pp. 1349– 1380, 2000.

[18] L. Fei-Fei and P. Perona, "A bayesian hierarchical model for learning natural scene categories," in Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference on. IEEE, 2005, vol. 2, pp. 524–531.

AUTHOR'S PROFILE

Pallavi Sitaram Narkhede is research scholar at RKDF Institute of Science and Technology, Bhopal pursuing her M.Tech. in Computer Science Engineering under Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal. She is highly interested to work on images processing technology.