Volume 6, Issue 10, October 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Image Retrieval using Variants of Color Histogram Techniques

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Abstract: ***In this paper we explore different image retrieval method with combination to color histogram to enhance the color feature of the image with accurate precision. In this paper Comparison of different techniques are made by taking color histogram as a base for color feature retrieval from an image.AS color histogram of local feature regions, non-uniform quantized color histogram, invarient color histogram, color difference histogram, Edge histogram descriptor are some proposed methods of different papers. This is mainly done to enhance the performance of the image retrieval system. we will discuss its performance on bases of results computed in different work based paper.***

Index Terms: Color Histogram(CH), Invariant color histogram(ICH), Color coherence vector(CCV), Discrete wavelet Frames(DWF), Scale invariant feature transform, Color co-occurance histogram(CCH).

I. INTRODUCTION

Due to tremendous development of internet on such a wide scale and new modern devices such as digital cameras ,smart phones digital image collection is widely increasing. With all this, Content based image retrieval has received a wide attention.It is basically a technique to perform retrieval of the images. In an image retrieval process CBIR is more closer to human perceptions. It has different applications in different domains like medical images, weather forecasting, surveillance and remote sensing. Different feature descriptors are used to identify an image but main low level features are color, shape and texture of an image.

For efficient image retrieval and searching ,tools are needed for users in different domains as architecture ,crime prevention.As it becomes a key technology for improving the connection be-tween computer and user.Before this, a textual image retrieval system was used which use text patterns to retrieve the image from the database.Task for this method was very huge as more human work is required to annotate image and different human perception towards an image is always different so there is annotation inaccuracy.

To overcome this inaccuracy Content Based Image Retrieval systems were used in which ”contents” are its features through which we describe an image by low level feature descriptors as color ,shape, texture. The color content of an image is an impor-tant element in CBIR. Global histogram is the mostly used to represent color information in an image. It describes the three- color channel sand further tells the subsequent expressions of similarity between images. More to say,it is translation ,scale and rotation invariant and very simple to implement.But the main disadvantage It lack spatial information

Sensitivity to noise interference such as lighting intensity changes and quantization errors.

As each histogram represents a local color range in the given color space ,two similar color will be treated as identical provided that they are allocated i to the same histogram bin.

Two colors will be considered totally different if they fall into different bins even though they might be similar to each other.

As it also occupy more than one hundred dimensions due to which distance computation increases on retrieval stage.

To overcome these drawbacks different new techniques are attached to color histogram to make them far more better than the actual global color histogram. In this paper we have survey different papers to take up different techniques for color feature extraction by also considering its spatial information.In [1] the author has modified the simple color histogram to color histogram of local feature regions to enhance its performance.In [2] comparison of edge,color and texture based histogram techniques are taken.In [3] In this paper ,a color high Resolution,non-uniform quantized color histogram is proposed which gives higher precision and saves space.Both color images and gray images are fed to system The rest of the paper is organized as follows : In Section 2, we introduce the color histogram technique to describe color and its reformed techniques.In Section 3 comparison of different modified color histogram techniques are done.

II. COLOR HISTOGRAM

Color histogram, color correlogram, CCV(color coherence vector) and color moments are used to represent the color of an image. The color histogram isn an effective representation in unique color patterns.It is easy to compute and adequately characterize the global and local distribution of colors in an image. Moreover, it is robust to translation and rotation about the view axis.

Representation Of an image by color histogram is by breaking its color components and graphs out intensity and occurrences of particular color. When we have to let compare two images ,compare their corresponding histograms and determine their similarity .

Firstly, Color histogram are a good and easy of colors in an image.Therefore images are usually quantized ,meaning that the number of colors are often reduced to as per required to see the picture as per 64 or 256 colors[4].

The main Low point of a global histogram is that in-formation related to object, location, shape and texture is dis-carded.The global color histogram indexing method, corre-lates to the image semantics well.But ,images retrieved by using the global color histogram may not share similar color distribution[5].

Defination: The probability mass function of the image intensities is refered as Image Histogram. This is extended for color images to capture the joint probabilities of the intensities of the three color channels. Formally, the color histogram is defined by

$$h_{A,B,C}(a,b,c) = N \cdot \mathbf{Pr}ob(A = a, B = b, C = c)$$

where A,B and C represent the color spaces (R,G,B or H,S,V) and n is number of pixels in image.as the typical old computers represent the color images with upto 224 colors ,this process generally involves quantization of color spaces.the main issues regarding the use of color histogram for indexing involve the choice of color space. Choosing a uniform color space appropriate uniform quantization should be done.Same case if a non-uniform color space is chosen a non-uniform quantization should be done.

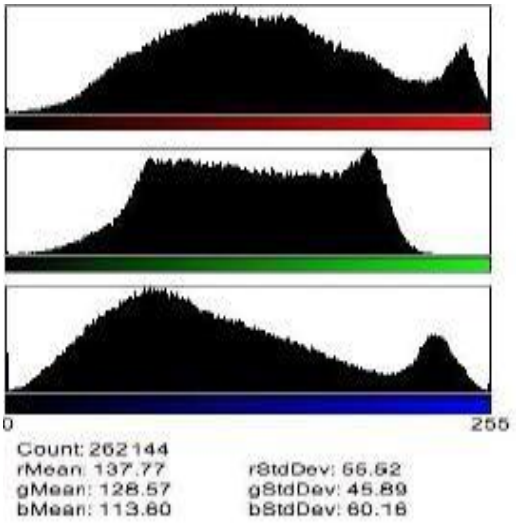

Fig. 1. Color histogram of three channels (R,G,B)

Extraction algorithm:
Selection of color space
Quantization of the color space
Computation of Histograms
Derivation of the histogram Distance function
Identification ofn indexing shortcuts [6].

A. Color Space And Color Quantization

Color Space: Color space is defined as a model for representing color in terms of Intensity values I.e High and low points according to Dark and light of a particular color.It describes a One -to four -dimensional space. A color channel is one of the dimensions.These color space are related tp each other by mathematical formulas[5]. A color space Represents the gray-scale space. The main models commmonly used are as :1.RGB color Model 2.HSV color model

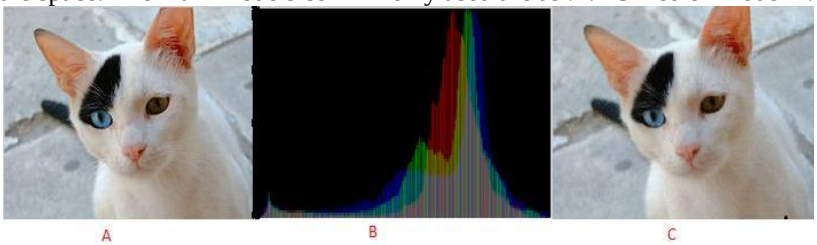

Fig. 2. A.Image of cat B.Histogram of image C.Image reduced to 256 in a RGB color space

RGB: RGB is the most used color model in computer graphics. main primary color combination models it is said as it has three main colors Red,Green,Blue which are combined to make other ones.It is not perceptually uniform as same variation in color doesnot always give same variation of value of the components[7].it means the variation that human eye perceive are different in sense of mathematical distance [8].

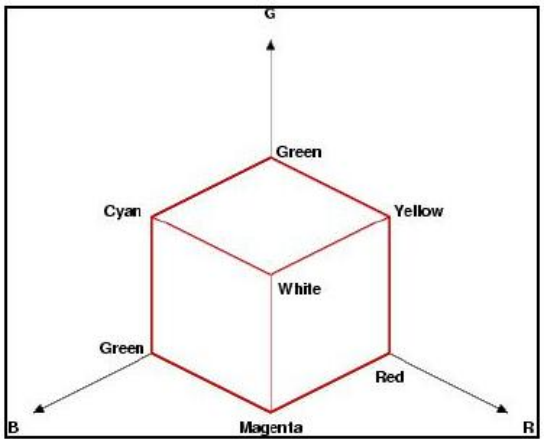

Fig. 3. RGB coordinate system

HSV: HSV models are very mich closer to human eye realization of colors but are Perceptually non- uniform [9].He main components of these models are- Hue,Saturation and value(brightness).Hue define chromatic component in the model and defines the color by the combination of the primary choice of color.Dominance of a color defines saturation and lastly the value defines intensity.

Color Quantization: It is the process that reduces the number of distinct colors used in an image,with an intention that new image be visually similar to original image.t is critical for displaying images with many colors on devices that can on display limite number of colors because of memory limitation. Color quantization can be viewed as a subset of the field of vector quantization.Vector Quantization is the problem of selecting k vector in N dimension space to represent N vectors from that space Where K¿N and the total error incurred by the quantization is minimized.Color quantization is then vector quantization in a 3-dimentional space(RGB,CIE,HSV).Stages of color image quantization.

Sampling the original image for color statistics.

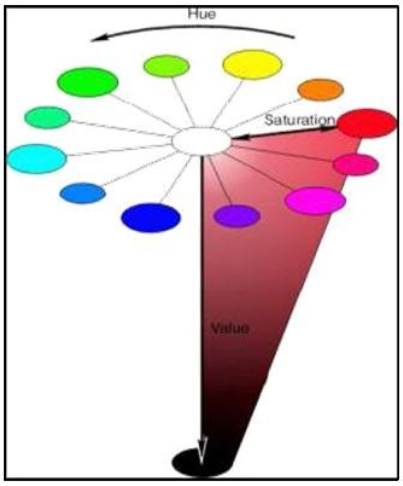

Fig. 4. Hue, saturation, and the value (brightness/luminosity) represented on a wheel of colors.

Choosing a color map related to those statistics. Mapping the colors to their Representative in color map. Quantizing and drawing the new image.

Fig. 5. (a) The original image 256 bins, (b) Quantified image in 8 bins.

III. COMPARISON OF DIFFERENT MODIFIED COLOR HISTOGRAM

A. Chromaticity histograms

The two-dimensional or one dimensional histograms of the CIE lab chromaticity co-ordinates are used as a color feature. 1-d histograms of the a,b co-ordinates were modeled according to the generalized gaussian distribution.In this paper with the color, texture image retrieval is done with DWF (Discrete wavelet frames).Bhattacharya distance is used for similarity measure after feature extraction is defined. combination of two databases are used for image retrieval process i.e. Corel Photo Gallery and Vistex database of MIT Media Laboratory.As for performance parameter Recall is measured for both color and texture [10].

For extracting color feature contents the CIE lab color space are used,as for its perceptual uniformity.Only the Chromaticity co-ordinates re used to describe color.In simple,color content is best described by the chromaticity distribution which is given by 1-D or 2-D histograms.The figuring complexity reduced if Gaussian models are assumed for these distributions.In MPEG-7 color histogram description is defined by uniformly quantizing into 256 bins in the HSV(Hue,Saturation and value). We have opted For the CIE Lab color space because the quantization assumes Euclidean distance,which goes better with the color dissimilarity in a uniform space.In MPEG-7 , color layout are used for capturing the spatial distribution of color in an image,but here our work is focused on Color Histogram more[11].

In order to compare the color feature here bhattacharya dis-tance is chosen as it has good classification properties and it allows the combination of different features in a straightfor-ward way.

Merits: The color Coordinate is designed to be perceptually uniform i.e equal distances in color spaces correspond to equal color differences as recognized by humans and for this it relates that chromatic components are same of perceptually similar images.

The Lightness L is distinct and independent from the Chromaticity coordinate (a,b).

Is also describes the exact 2-d distribution of the chro-maticity coordinates [10].

So chromaticity of an image is more relevant to compare for an image classification and retrieval,disregarding the lightness component.Keeping out the lightness component is done as for the fact that it will be used to extract texture features.

Demerits: The main disadvantage of color cooridnate system is storage as 1024 floating point numbers are needed for storage of empirical probability density function of each image and the size of these can be reduced by use of 1-d histogram as by using 232 or 233 bins of (a,b) histogram for color feature[10]. Method :Now in order to reduce color feature for each coor-dinate distribution Gaussian and laplacian distribution models are used here which only takes mean and variance of the image coordinates.

So storage demand is minimized Comparison of color features are accelerated.

Constraint: Constrained data set is needed In which each image will contain chromaticities concentrated around a concrete value at each coordinate.

Here 2-d histogram is overpowering 1-d histogram (91.3 versus 90.6) whereas modeling of histogram with guass and laplace models when combined with texture features gives(88.5 and 85.3).

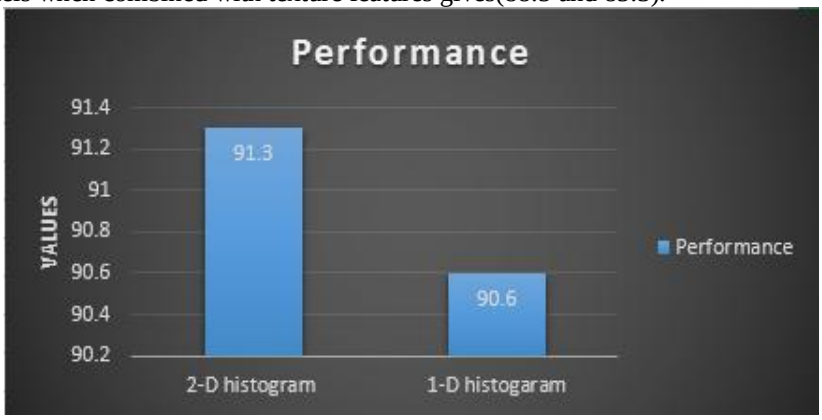

Fig. 6. Performance of Color histogram Features

B. Invariant histogram in HSV space

In this paper the SIFT(Scale invariant feature transform) is combined with deformation and viewpoint Invariant histogram in HSV color space.SIFT has been proven to be the best descriptor for rotation,translation,and partially to illumination and affine or 3D projection invariant image matching.but only used for gray images. Invariant histogram is developed for creating color histogram based on color gradients which are invariant to deformation and changes in viewpoint and is developed in rgb color space.Database used is ZuBud database containing 1005 images of 201 building of zurich and each building is photographed from diffrent view point.

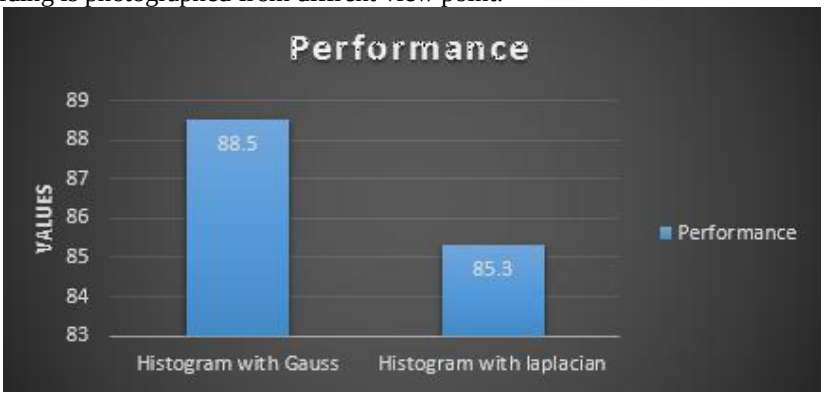

Fig. 7. Histograms distribution with Gauss and Laplace Models

Merits: To increase the deformation and viewpoint in variance capability and thus to improve image recognition both are combined [12].

This combination has boost up the retreival efficiency as it traverse global information, color information and added deformation invariance.Along with SIFT ,ICH in HSV color space extracts the global information.

In different papers SIFT is used with different histogram techniques.Some of the methods are :SIFT is combined with Color Co-Occurance Histogram [13]. In object description CSIFT describes the colored local invariant feature descriptor by combining color and geometrical information [14].Edge color histograms and SIFT descriptors are proposed in [15].Sift is combined with invariant color histogram in RGB color space.

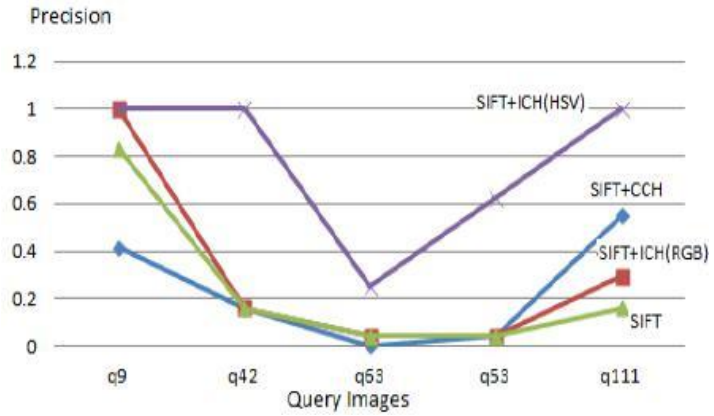

Fig. 8. Precision cycle SIFT+ICH(HSV)

C. Max frequency of CH based Color Correlogram

In this paper,method proposed is simple yet interesting that is image bin separation technique followed by extracting maxi ma frequencies and plotting a correlogram.In illustration ,the histogram is computed for an image,then it is divided i to four equal b ins.Each is subdivided into four more bins and for every such subdivision maxima of the values is calculated. Correlogram stores this whole information in it[16].The distance measure used for this is Euclidean distance. For two vectors of images (Q and D) .Let the correlogram of two be

Corr(Q) and Cor(D),the euclidean distance be

Distance(Q,D)=Corr(Q)-Corr(D)

The components of resulting matrix are summed and absolute value of this sum is made and these values are sorted in order to dissplay top matches.Wang database i used for algorithm testing. In[17], [18] it is suggested the use of multi-resolution histogram for image retrieval and further proposed method say to use Gaussian filtering for multi-resolution decomposition of the image .

Merits: Less computation is required, which makes the extraction and retrieval process fast. this sort of correlogram representation is independent of differences in displacements and hue of images. complex images having wide range of color content can be taken out precisely.

Fig. 9. Retrieval images of food independent of differences in displacements and hue

IV. CONCLUSION

The user who want to search for images in a database independent of differences in displacement and hue of images and has less face detection as it goes less likely for face detection can go for correlogram based CH.For 3-D projection invariant image matching means the who have different view point from every angle but can be stored in database of one image to match the projection from any side Invariant histogram in HSV space should be preferred. And lastly if we have a constrained data set of fixed values and less complex image bin structures at that time we can use chromaticity histogram.

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