Image Retrieval: Current Techniques and Promising Directions based on Colour and Texture

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***Abstract*—Image retrieval is an important part of image processing for browsing and searching images from a large set of database of digital images. Nowadays content based image retrieval has been an active research area in image processing. Color is one of the important high level features of content based images. In this paper, a unique and efficient method is designed to extract the color pixel feature by the LAB color space and texture features by the use of GLCM. This image retrieval method includes the process of resizing the image and then converts those images into LAB color space and computing the GLCM values. The comparison then takes place between query image feature and a database image which finally retrieves the information (images) based on color feature. This method will demonstrate a faster, efficient and promising image retrieval method. The performance can be measured by recall and precision values.**

Keywords: LAB color space, CBIR, color pixel feature, precision and recall, GLCM

I. INTRODUCTION

In current generation www and internet has taken an important place in our life so the collection of images are added every second and the image accessible by the users are also growing exponentially. Images or information cannot accessed properly if it is not organized in well mannered so there is a need of efficient, fast searching and browsing tools. Users from various fields like remote sensing, medical, architecture, fashion, crime prevention, weather forecasting, data mining, management of earth resources, face findings, media, press publishing so on.

Image retrieval is a set of process that organized and stored the desirable information according to a certain manner and as per needs of users. In previous days text based image retrieval was one of the method used widely, because the main problem with text based image retrieval is manual annotation, inaccuracy and the grown storage capacity of database with GB and TB, so the TBIR has not found an efficient image retrieval technique. Nowadays content based image retrieval has been a popular and active research field. It includes the color, texture, shape, size, color layout and all visual content. Among all these feature color is one of the important feature in CBIR which is independent of size, orientation and complexity.

So the basic goal of this paper is to retrieve images through LAB color space based on color feature and GLCM for texture feature. For which resize the image then convert the image into LAB color space then compute GLCM values and then combine both the features after that find the distances between query image and target image, sort the distances and take the minimum one and retrieve the image

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II. LITERATURE REVIEW

- Author proposed scheme based on both features of color and texture to combine a HSV color model and edge histogram descriptor in mpeg7. [4]
- Author proposed the texture and colour feature are extracted by wavelet transformation and colour histogram.[8]

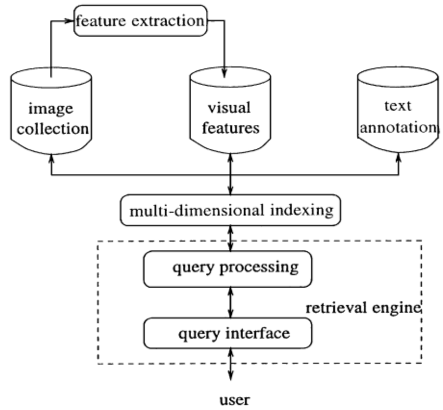

Figure 1. An Image Retrieval System Architecture [2]

- Author proposed method of colour histogram and colour moment based on division of the image into three equal non overlapping horizontal region.[9]
- Author proposed method based on color and texture features of image sub blocks with one to one matching.[11]

EXTRACTION FEATURES FOR IMAGE RETRIEVAL

Features may include both the text based (keywords, annotations) and the visual feature (color , texture , shape , face) and for any given feature there exist multiple representation which characterize the feature from different perspective.

- Color: It is most widely used feature and relatively robust to background complication.

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- Texture: This refers to visual patterns that have properties of homogeneity. It contains important information about the structural arrangement of surfaces and their relationship to surrounding environment.
- Shape: shape representation can be achieved by the basic requirement of is to be invariant to translation , rotation and scaling.
- Segmentation: It is also important to image retrieval. Segmentation algorithm can extract boundaries from a large no of images without occupying human time and effort.

TECHNIQUES FOR IMAGE RETRIEVAL

On the basis of various research papers there is some methods which is used for image retrieval by the various authors:

i. HSV Colour Space And Edge Histogram Descriptor : hue, saturation and value provides the perception representation according to human visual feature. The HSV model provide a colour space in terms of three constituent components: hue the colour type range from 0 to 360, saturation the vibrancy of the colour ranges from 0 to 100%, value the brightness of the colour. The formula that transforms RGB to HSV is defined below [1] :

$$H= (\cos)^{-1}\ ½[(R-G)+(R-B)]/\ [(R-G)^2+(R-B)(G-B)]^{1/2}$$

$$S=1-3/R+G+B(\min(R,G,B))$$

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

ii. Edge Histogram Descriptor: [1] This includes the process of portioning the whole image into sub images and the edges in all sub images are categorized into five types, four directional edges vertical, horizontal, 135degree, 45 degree and one non directional. Now generate the histogram of each sub image then edge histogram descriptor captures the spatial distribution of edges.

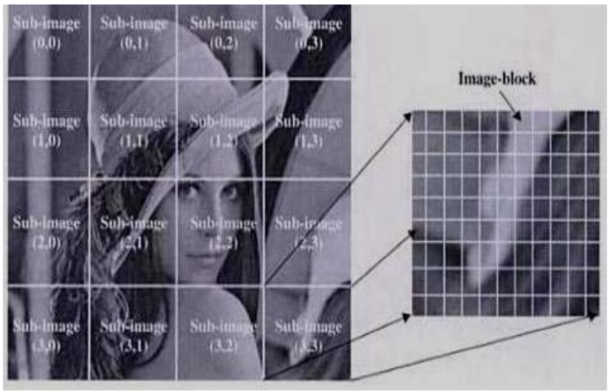

Figure 2. Defination Of Sub Image And Image Block

Provide filters for edge detection then compute the intensity value of each sub image if intensity value of the edge exceeds a given threshold then the corresponding image block is considered to be an edge block.

iii. Discrete Wavelet Transformation: [2] It is used for transforming an image from spatial domain into frequency domain. Wavelet extracts information from signals at different scales by passing the signals through low pass and high pass filter. DCT provides multi resolution capability. Wavelet is robust with respect to colour intensity and can capture both texture and shape information efficiently. DCT decomposes a signal into set of basic function. At each level image decomposes into four frequency sub bands which is LL, HL, LH, HH where H indicates high and L indicates low.

iv. Haar Wavelet: It is used to compute feature signature because it is faster to compute and also have been found to perform well. Haar wavelet enable speed up the wavelet computation phase for thousand of sliding window of varying size in images.

The haar wavelet mother function

$$f(t)= \{1,\ 0<=t<=1/2 \text{ or } -1,\ ½<=t<=1 \text{ or } 0 \text{ otherwise}\}$$

And its scaling function can be

$$\Phi(t)=\{1,\ 0<=t<1 \text{ or } 0, \text{ otherwise}\}$$

Figure 3. Retrieved Image Through Wavelet Transformation

v. Colour Histogram and Colour Moment : [3] colour histograms are set of bins where each bin represent a particular colour of colour space being used. CH for a given image is defined as a vector.

$$H= \{ H[0], H[1], H[2]....H[i]...H[n]\}$$

Where i=colour bin in colour histogram

$$H[i] = \text{no of pixels of colour in image}$$

$$n= \text{total no of bins used in colour histogram}$$

Each pixel in an image will be assigned to a bin of a colour histogram of that image and the value of each bin is the no of pixels that has the same corresponding colour. Now for comparing images CH should be normalized H'

$$H'= \{H'[0],H'[1],H'[2]...H'[i]...H'[n]\}$$

$$H'[i]= H[i]/p$$

Where p= total no of pixels of image

In colour moment, moments are invariant of geometric transformation so it is more precise.

vi. Color Coherent Vector: Each histogram bin is partitioned into two types which are coherent and incoherent. Pixel value of a large informally coloured region falls into coherent type other is incoherent.

vii. High Dimension Indexing: two basic challenge for making content based image retrieval truly scalable for large size of image collection which are high dimensionality and non Euclidean similarity. To solve this problem again two approaches which are follow Dimension reduction: KLT karhunen loeve transform and column clustering are basic reduction technique. Clustering is used for various things like pattern reorganization, speech analysis, information retrieval. It is used to cluster similar objects normally. Multidimensional indexing: the existing popular MDI technique are bucket algorithm, k-d tree, priority k-d tree, quad tree, r tree and its variant.

III. Methodology

The methodology of this paper is totally based on LAB and GLCM. First of all preprocess the input image then change it into LAB color space after it compute the GLCM values then combine the both texture and color feature and find the distance between query image and target image. Sort the distances and take the minimum one.

LAB color space: A LAB color space is a color opponent space with dimension L for lightness and a and b for the color informations. Unlike the RGB and CMYK color models, LAB is designed to approximate human vision. As mentioned previously, the L coordinate ranges from 0 to 100. The possible range of a and b co ordinates is independent of the color space. This color model is device independent so it can be used as a interchange format.

GLCM: Gray level co-occurrence matrix . This is for calculating the texture features of image. It tells how often different combination of pixels brightness value occur in image. Texture feature for calculating GLCM values are: entropy, energy, homogeneity, variance, difference variance, and information measure of co-relation, inverse difference, cluster shade, dissimilarity and so on.

- Homogeneity: Measures the closeness of the distribution of elements in the images.
- Contrast: Measures the local variations in the gray-level co-occurrence matrix. Entropy: Entropy is the average amount of information contained in each message received. Here, message stands for an event, sample or character drawn from a distribution or data stream.

$$E = \Sigma pi \log i/pi$$

- Energy: Energy is a property of objects, transferable among them via fundamental interactions, which can be converted into different forms.

ALGORITHM OF PROPOSED METHODOLOGY:

Step1. Take the image as input

Step2. Compute lab colour space for the input image

Step3. Compute GLCM for various features.

Step4. Combine feature vector for colour and texture feature

Step5.Find distance between feature vector of query image and target image

Step6. Sort the distances

Step7. Retrieve most similar images with minimum distance

Figure 4. LAB conversion

IV. Conclusion

Image retrieval through the LAB colour space based on color feature and GLCM based texture feature will demonstrate effective and faster retrieving technique because LAB colour space is good for detecting a particular colour selected by the user and LAB is for producing a colour space that is more perceptually linear than the other colour space means that a change of the same amount in colour value should produce a change of same visual importance. The performance can be calculated by various recall and precision values.

Where recall value= no of relevant documents retrieved/total no of relevant documents

Precision value= no of relevant document retrieved/total no of retrieved documents

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