ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

Color and Texture Based Image Retrieval Based on Quadtree Segmentation Technique

[1] Shradha Naik,[2] Prof. Umesh A. Bapat
[1] ME student, [2] Associate Professor
[1][2] Computer Engineering Department,Goa Engineering College,Farmagudi,ponda-Goa,India

***Abstract*— With the increasing demand for need of retrieval of images based on different aspects, properties, characteristics there has been tremendous research going on in the field of Content-based image retrieval (CBIR), also known as query by image content (QBIC). Content here is referred to visual features ie colour, texture, shape, spatial layout of an image which needs to be extracted.**

This paper proposes a novel approach wherein content based image retrieval is based on color and texture primarily implementing color histogram for color based and gabor filter for texture based retrieval. Colour histogram comprises of two colour models(RGB and HSV). For texture based, Frequency and orientation representations of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for representing and discriminating texture well . Main aim of this paper is to implement a new technique that is quadtree segmentation on query and database images and then apply feature extraction ie color histogram on all images and match the query and database images using similarity criteria. Similarity metric used in this paper is Euclidean distance. Quad tree is a segmentation technique which divides image into homogeneous blocks. Hence the name Quadhistogram is a new revised technique to implement colour based retrieval under local colour histogram which divides the images into homogeneous blocks and then compute histogram of each block

***Keywords*— colorhistogram, rgb, hsv, gabor filter, quadhistogram**

1. INTRODUCTION

Images make the communication process more interesting, illustrative, elaborate, understandable. Text-based image retrieval schemes utilize text to illustrate the content of the image that stimulates uncertainty and insufficiency in image database search and query processing. This trouble is due to the complexity in specifying accurate Language and phrases in unfolding the content of images as it is much complex than what any set of keywords can convey. Since the textual remarks are based on language, which might fluctuate according to every user, therefore variations in notation will create challenges to image retrieval.

Content-Based Image Retrieval (CBIR) is the process of retrieving desired images from large databases based on extracted features from the image themselves. Features of an image are extracted and analyzed by means of computer processing. CBIR provide access of multimedia databases that deal with text, audio, video and image data, which could provide us with enormous amount of information. CBIR is a technique, which uses visual contents (features), to search images from large-scale image databases according to users' requests in the form of a query image. The usual features like color, texture, and edge density (shape) extracted with the help of feature extraction algorithm. The CBIR is used to operate on the query image and then obtain the output relevant to that query Image.

Query-by-example (QBR) or pictorial-query approach gives similar images to the query image given by a user. The query images can be a photograph, user-painted example, or line- drawing sketch.

Retrieval process and the algorithm process is as follows:

1. Analyze and compute the visual features of the image by feature extraction technique, extract features of each image and then construct a feature vector for all the images which could be further used for reference purpose
2. During the image retrieval, user need to provide some input such as sample image or a sketch, then select a feature extraction method to extract features of the query image and database images as well
3. Select the similarity comparison, for matching the feature vector of both query image and database images
4. Return the relevant results to the user by similarity

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

according to smallest distance criteria.

II. LITERATURE SURVEY

Feature Extraction

Feature means characteristics of an image. Feature extraction is refers that dimensionality reduction of that object. Features are classified into three types in image processing, that is low, middle and high. Color represents low-level features, middle level feature are basically texture and shape and high level feature is represented by semantic gap of objects.

A. Color based methods

In image retrieval, the color is widely used feature. Many methods are use to extract color feature from images. The key items in color feature extraction consist of color space, color quantization, and the kind of similarity measurements. In common, colors are defined in three-dimensional color space. In digital image purposes, RGB color space is the most prevalent choice. The main drawback of the RGB color space is that it is perceptually non-uniform and device dependent system. The HSV color space is an intuitive system, which describes a specific color by its hue, saturation, and brightness values. HSV Histogram shows the frequency of occurrence of each color in the image according to its intensity, it shows the Global description of the color in image. Simply by matching it with the stored histogram in database the relevant images can be retrieved.

1. Color histogram: It represents the number of pixels that have colors in each of a fixed list of color ranges that span the image's color space, the set of all possible colors, for digital images.

2. Color Coherence Vector

Color coherence vector contains more significant information about the spatial distribution of colors. It classifies each pixel as coherent or incoherent. A coherent pixel is part of a large group of pixels consisting of same color while an incoherent pixel is not. If the same color group contains more coherent pixels than a threshold value defined beforehand, it belongs to coherence pixels..

3. Color Correlogram

The color correlogram has the advantages over color histogram that it includes the spatial correlation of colors, can be used to describe the global distribution of local spatial correlation of colors and is simple to compute. It expresses the spatial correlation of color changes with respect to the change in distance in contrast to a color histogram which captures only the color distribution in an image and does not include any spatial information. Therefore, the correlogram is one kind of spatial extension of the histogram and is extensively used over color histogram.

4. Color Moments

Color moments provide a measurement for color similarity between images. These similarity values can be compared to the values of images indexed in a database for image. By the three low-order moments most of the color distribution information is captured. The mean color captures by first-order moment (μ), the standard deviation captures by the second-order moment, and the skewness of color captures by the third order moment.

B. Texture Based Retrieval Methods

1. Gray Level Co-Occurrence Matrix (Glcm):

Haralick first introduced the use of co-occurrence probabilities using GLCM for extracting various texture features. GLCM is also called as Gray level Dependency Matrix. It is defined as "A two dimensional histogram of gray levels for a pair of pixels, which are separated by a fixed spatial relationship." GLCM of an image is computed using a displacement vector d, defined by its radius δ and orientation θ. δ values ranging from 1, 2 to 10 and every pixel has eight neighbouring pixels allowing eight choices for θ, which are 0°, 45°, 90°, 135°, 180°, 225°, 270° or 315°.

2. Wavelet Transform:

Wavelet transform is based on diminutive waves called wavelet of varying frequency and limited duration. Discrete Wavelet transform divides the images into four different parts namely higher frequency part (HH), High Low Frequency part (HL), Low High Frequency part (LH), and Lower frequency part (LL). After doing the vertical parts as 1-level images decomposition, it computes moments of all parts and store and use it as feature to obtain images.

C. Shape based retrieval methods

Shape and the shape feature have the following characteristics:

1. People perceive the shape of the retina on the real world experience and knowledge of people between the consolidated results, so the shape is still no exact mathematical definition, including geometry, statistics, Morphological measure so that it can be linked to the

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

person's feelings
Shape does not refer to the shape of an image but to the shape of a particular region that is being sought out. Shape descriptors may also need to be invariant to translation, rotation and scale. Some shape descriptor includes:
1. Fourier Transform
2. Moment Invariant
3. Wavelet descriptors
4. Grid-Based Visual Shape Descriptors consists of 3-D Shape Descriptor, Region-Based Descriptor, Contour-Based Shape Descriptor and 2- D/3-D Shape Descriptor.

Following are some applications where CBIR technique is mainly used.
i) CBIR is popular for police force for picture recognition in crime prevention.
ii) Medicine Diagnosis.
iii) Architectural and Engineering Design.
iv) Fashion and Publishing.
v) Geographical information and remote sensing.
vi) Home Entertainment.

III. METHODS FOR FEATURE EXTRACTION

A. Techniques used for implementing color and texture based extraction in this paper

1. Color Histogram
A histogram is a graphical representation of the number of pixels in an image. A histogram is a bar graph, whose X-axis represents the tonal scale, and Y-axis represents the number of pixels in an image in a certain area of the tonal scale.
A color histogram of an image represents the distribution of the composition of colors in the image. It shows proportion of colors and specifies in what quantities they are present.
There are two types of color histograms, Global color histograms (GCHs) and Local color histograms (LCHs). A GCH
represents entire image with a single color histogram while the LCH divides an image into fixed blocks and computes the color histogram of each of those blocks

a) Local colour histogram

- Segments the image into blocks considering the size of the image and then compute a color histogram for each block.
- While comparing two images, distance is calculated using their histograms, between a region in one image and a region in same location in the other image
- The distance between the two images will be determined by the sum of all these computed distances.

b) Global color histogram

- a single color histogram is computed for the entire image
- The distance between two images will be determined by the distance between their color histograms.

Selection of color spaces: The color space selection plays a significant role when image retrieval is done on the basis of color features. Choice of appropriate color space is a crucial task. There are 11 color models (RGB, I1I2I3, YIQ, HSV, HSI, YUV, LAB, XYZ, CMYk, YCbCr and HMMD).
The RGB image is first converted into one of the color spaces then the feature exaction is done.

- ***RGB Color*** Space The most primary color space is RGB which stands for 3 additive primary colors Red-Green-Blue. This histogram is the most used histogram in computer graphics and combination of them creates secondary colors.
- ***HSV Color*** Space The HSV color space are defined in terms of three components: Hue, Saturation and Value. Hue varies from 0 to 1.0, the corresponding colors vary from red through yellow, green, cyan, blue, magenta, and back to red, so that there are actually red values both at 0 and 1.0. As saturation varies from 0 to 1.0, the corresponding colors (hues) vary from unsaturated (shades of gray) to fully saturated (no white component).As value, or brightness, varies from 0 to 1.0, the corresponding colors become increasingly brighter.

B. Methods for texture based retrieval
Texture refers to visual patterns with properties of homogeneity that do not result from the presence of only a single color such as clouds and water. Texture features typically consist of contrast, uniformity, coarseness, and density. There are two basic classes of texture descriptors, namely, statistical model-based and transform-based. The

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

former one explores the grey-level spatial dependence of textures and then extracts some statistical features as texture representation. One example of this group is co-occurrence matrix representation. The latter approach is based on some transform such as DWT.

The common known texture descriptors are Wavelet Transform, Gabor-filter, co-occurrence matrices and Tamura features. In MPEG-7 two descriptors related to texture known as Homogenous Texture Descriptor and Non- Homogenous Texture Descriptor (Edge Histogram). Edge histogram descriptor is used for texture. And also CCH (Contrast Context Histogram) is used find out the feature of the query image and other images stored in the database. CCH is in spatial domain and it provides global distribution. Gray Level Co-occurrence Matrix (GLCM) method, which is based on the conditional probability density function. Co-occurrence matrix is a function of distance and direction. GLCMs have been used very successfully for texture calculations. From GLCM all the features are calculated and stored into the database

1. Gabor filters

In image processing, a Gabor filter, named after Dennis Gabor, is a linear filter. Frequency and orientation representations of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for representing texture in terms of different orientations and frequencies and discriminating based on texture segmentation.

Gabor filters have been used in several image analysis applications including texture segmentation, defect detection, face recognition, motion tracking, document analysis, retina identification, target detection, edge detection, line characterization, image representation and image retrieval.

Its impulse response is defined by a sinusoidal wave (a plane wave for 2D Gabor filters) multiplied by a Gaussian function.

Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function. The filter has a real and an imaginary component representing orthogonal directions. The two components may be formed into a complex number or used individually.

complex

$$g(x,y;\lambda,\theta,\varphi,\sigma,\gamma)= \exp\left(\frac{-x'^2+\gamma^2y'^2}{2\sigma^2}\right)\exp\left(i\left(2\pi\frac{x'}{\lambda}+\varphi\right)\right) \quad (1)$$

real

$$g(x,y;\lambda,\theta,\varphi,\sigma,\gamma)= \exp\left(\frac{-x'^2+\gamma^2y'^2}{2\sigma^2}\right)\cos\left(2\pi\frac{x'}{\lambda}+\varphi\right) \quad (2)$$

Imaginary

$$g(x,y;\lambda,\theta,\varphi,\sigma,\gamma)= \exp\left(\frac{-x'^2+\gamma^2y'^2}{2\sigma^2}\right)\sin\left(2\pi\frac{x'}{\lambda}+\varphi\right) \quad (3)$$

Where

$x' = x\cos\theta + y\sin\theta$

$y' = -x\sin\theta - y\cos\theta$

In this equation, lambda represents the wavelength of the sinusoidal factor.

Theta represents the orientation of the normal to the parallel stripes of a gabor function. Psi is the phase offset, sigma is the sigma/standard deviation of the gaussian envelope. Gamma is the spatial aspect ratio, and specifies the ellipticity of the support of the gabor function. Purpose of using Gabor Filters for extracting textures Gabor filters have various properties that make them particularly suitable for texture segmentation.

- Gabor function is a band-pass filter that can be tuned to a narrow set of frequency band anywhere in the frequency domain.
- Each texture contains most of its energy accumulated in a narrow band of frequencies and orientations.
- A gabor filter tuned to that frequency range exhibits a strong response in the presence of the texture.

Similarity Measurement

A similarity metric gives us the measure of how similar a feature vector to another vector is the features extracted from the query image are used to retrieve the similar images from the image database. Instead of directly comparing two images, comparison of their feature vectors is done. The retrieval system returns the relevant images, whose computed distance from the query image is the least.

By analyzing feature vector for color based extraction, first calculate the number of colors and distribution of colors to state in what proportion it is present in both query image and database image. Then both the images are matched by seeing if the proportions of a particular color in both the images are comparable. The image which satisfies most of the conditions is the best match. Retrieval result is not a single image but a list of images ranked by their similarities with the query image.

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

1. Euclidean Distance

Euclidean distance is the most common metric for measuring the distance between two feature vectors and is implemented in a number of content based image retrieval approaches. The Euclidean distance is given by the square root of the sum of the squares of the differences between vector components.

The Euclidean distance between the color histograms h and g colors can be computed as:

$$d^2(h,g) = \sum \sum \sum (h(a,b,c) - g(a,b,c))^2 \qquad (4)$$

In this distance formula, there is only comparison between the identical bins in the respective histograms, where h(a,b,c) and g(a,b,c) represents the frequency values in bin. These features are compared with database images stored features. The features values which are less than defined threshold are sorted based on increasing difference between query and database images then stored separately.

Image Segmentation

Image segmentation technique is used to partition an image into meaningful parts having similar features and properties. The main aim of segmentation is simplification i.e. representing an image into meaningful and easily analysable way. The goal of image segmentation is to divide an image into several parts/segments having similar features or attributes

The output of image segmentation is a set of layer extracted from the image, a set of segments that if connected cover the entire image. In a segment every pixels are similar with regard to computed feature, such as intensity, texture, or color.

IV. PROPOSED METHODOLOGY

The main aim is to implement color and texture based extraction on a given query image using colour histogram for color based extraction and gabor filter for extracting textures. Texture is being represented by frequency and orientation.

RGB and HSV based feature extraction is applied for colour based retrieval.

For quadtree based retrieval

- Image segmentation, application of quadtree decomposition on query and database images.
- Application of histogram on decomposed image blocks
- Comparison of corresponding image blocks of query and database images.

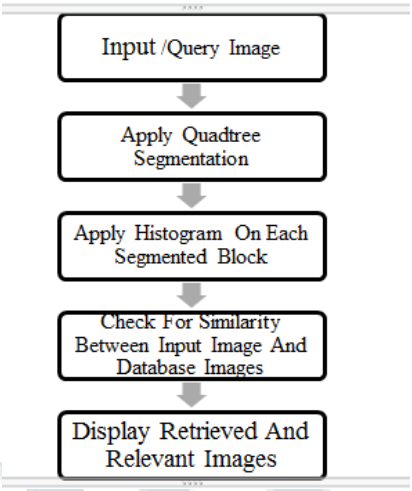

Fig 1: data flow diagram for quadhistogram

A. IMPLEMENTATION FLOW

The entire implementation process is divided into modules

Module 1:
Construction of datasets for database images ie creation of feature vector comprising feature values stored along with corresponding images.

Module 2:
Feature matching :
In order to match images, and find out similar images their feature vectors are matched using similarity metric.
All the stored feature values are compared one by one using similarity measurement. In this paper, Euclidean distance is used to compute similarity quotient between 2 comparing images

Module 3:
Image retrieval:
After comparison of feature vectors, based on smallest computed distance images are retrieved. sort the images using smallest Euclidean distance.

B. ALGORITHMS

1. Algorithm for Color Retrieval

Step 1: Browse for the query image from the directory of images

Step 2: Apply feature extraction, RGB /HSV based histogram on query image and construct a feature vector for query image which will store images along with their

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 8, August 2017

rgb/hsv values.
Step 3: Apply feature extraction, RGB/HSV based histogram on database images and construct a feature vector.
Step 4: Compare the feature vectors of both query image as well as database images one by one using similarity metric.
Euclidean distance will be calculated between histograms of both images.
Step 5: Sort the images in ascending order.
Step 6: Specify the number of images to be retrieved and display the results which satisfies the similarity criteria the most. The top 5 results will be the most relevant results.

2. Algorithm for texture Retrieval

Step 1: Browse for the query image from the directory of images.
Step 2 : Apply feature extraction, gabor filter on query image and construct a feature vector for query image which will store mean amplitude and energy values.
Step 3: Apply feature extraction, gabor filter on database images and construct a feature vector.
Step 4: compare the feature vectors of both query image as well as database images one by one using similarity metric
Euclidean distance will be calculated between histograms of both images.
Ste 5: Sort the images in ascending order.
Step 6: specify the number of images to be retrieved and display the results which satisfies the similarity criteria the most. The top 5 results will be the most relevant results.

3***. Proposed Algorithm for quadtreeColor Retrieval***

Step 1: Read the query image
Step 2: Apply image segmentation ie quadtree decomposition on a given query image
Step 3: Apply feature extraction
Apply histogram on segmented subimage homogeneous blocks.
Step 4: Construct a feature vector comprising histograms of all segmented subimage blocks
Step 5: apply the same steps from 2 -4 on database images
Step 6: compare the feature vectors of both input and database images using similarity criteria
Step 7: retrieve and display the results which satisfies the similarity criteria the most.

C. QUADTREE SEGMENTATION TECHNIQUE

The quadtree segmentation is based on successive subdivision of the image into blocks ie into quadrant depending on the size and complexity of the block.
If the divided subimage block is not a homogeneous block, it is further subdivided into four equal sized subimages again until the final resulting output is all the subimages obtained are homogeneous block.

D. Implementation results

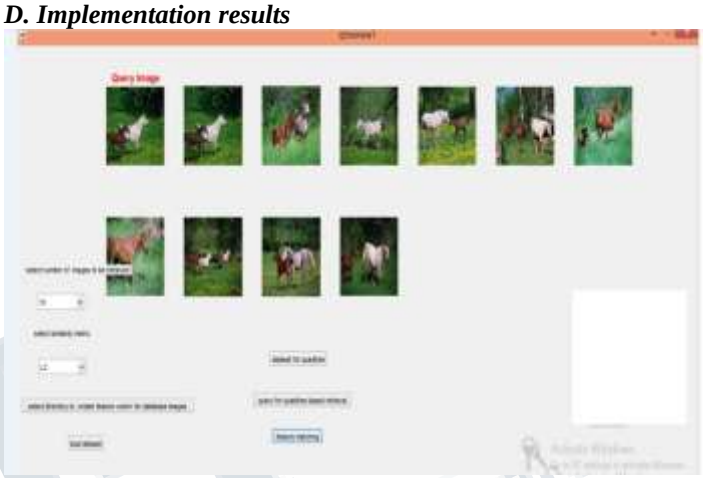

Fig 2 retrieval results of quad histogram based extraction

Euclidean distance	Retrieved Image name
0	733
38.131	725
38.288	718
38.575	713
38.601	729
38.704	706
38.781	736
38.962	705
39.064	703
39.217	732

Table 1 Top 10 Retrieved Images For Quadhistogram Based Extraction Along With Their Euclidean Distance

V.CONCLUSION

Various feature extraction techniques are studied for implementing content based image retrieval. The main objective is to implement colour and texture based extraction for retrieval of images. Colour histogram is used as a feature extraction technique for retrieving images based on colour. A new approach to implement colour based retrieval under local colour histogram is been implemented which is much better in terms of retrieval than global colour histogram. Quadhistogram is

an improvement over existing technique which outperforms local colour histogram methods. Gabor filters are found to be best for implementing texture based extraction. This paper explains primarily main methods for implementing colour and texture based retrieval and make a comparative analysis on all the methods in order to determine its accuracy and relevancy.

REFERENCES

[1] Reshma Chaudhari, A. M. Patil, P. G. Student, Department of E.C.E, J. T. M. College of Engineering, Faizpur, Jalgaon, India, Professor, Department of E.C.E, J.T. M. College of Engineering, Faizpur, Jalgaon, India, Content Based Image Retrieval Using Color and Shape Features International Journal of Advanced Research in Electrical,Electronics and Instrumentation Engineering Vol. 1, Issue 5, November 2012.

[2] K. Haridas, Dr. Antony Selvadoss Thanamani, Ph.D Scholar, Department of Computer Science , NGM College Pollachi HOD, Department of Computer Science (Aided), NGM College. Well-Organized Content based Image Retrieval System in RGB Color Histogram, Tamura Texture and Gabor Feature. Pollachi International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 10, October 2014

[3] A.Kannan,Dr.V.Mohan,Dr.N.Anbazhagan, "Image Clustering and Retrieval using Image Mining Techniques", IEEE International Conference on Computational Intelligence and Computing Research, 2010.

[4] Cheruvu Mahammad Ibraheem, Dr. G. Umamaheswara Reddy M.Tech (Communication Systems), Department of E.C.E., S.V. University, Tirupati, Content Based Image Retrieval using HSV Color, Shape and GLCM Texture International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 10, October 2015.

[5] Ms. Pragati ashok deole, prof. Rushi longadge m. Tech. (cse) in G. H. Raisoni Academy of Engineering and Technology, Nagpur (MS) India Content Based Image Retrieval using Color Feature Extraction with KNN Classification International Journal of Computer Science and Mobile Computing A Monthly Journal of Computer Science and Information Technology.

[6] Pooja Bandekar & Rachel Dhanaraj Department of Computer Engineering, Goa College of Engineering, Ponda, Goa Active Learning Paradigms for CBIR Systems Based On Color and Texture Feature Extraction ITSI Transactions on Electrical and Electronics Engineering (ITSI-TEEE) Volume -1, Issue -1, 2013

[7] Gulfishan Firdose Ahmed Raju Barskar Jyoti Bharti Nitin Singh Rajput I.T. Department DA-IICT Ghandinagar,Gujarat Content Base Image Retrieval Using Fast Phong Shading 2010 International Conference on Computational Intelligence and Communication Networks.

[8] Dr.N.Krishnan Professor and Head,Department of CITE,M.S University,Tirunelveli India SheerinBanu Professor and Head,Department of CSE,Sethu Institute of Technology,Madurai.Indi C.Callins Christiyana Senior Lecturer, Department of CSE,Sethu Institute of Technology,Madurai.India Content Based Image Retrieval using Dominant Color Identification Based on Foreground Objects International Conference on Computational Intelligence and Multimedia Applications 2007