ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 6, June 2018

A Review Paper on Content Based Image Retrieval Techniques

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Abstract- **Content-based image retrieval (CBIR) is a technique used for retrieving similar images from the large collection of image database. CBIR basically responsible for extracting features of images. A 'feature' means anything that is localized, meaningful and detectable. Almost all the CBIR techniques start from the query by example i.e. one image. The system first extracts the feature of the query image, searches the database for images with similar features, and exhibits relevant images to the user in order of similarity to the query. In this, the content of the image is nothing but the features of the image like color, texture and shape etc. This paper presents review of different CBIR techniques which are helpful for finding relevant images for the query image.**

***Keywords*— Content Based Image Retrieval; Text Based Image Retrieval; Feature Extraction.**

I. INTRODUCTION

Image retrieval is defined as a method of searching and retrieving images from a huge database of digital images. Image retrieval methods can be classified into two categories as: text-based image retrieval (TBIR) and content based image retrieval (CBIR).

Text based image retrieval

Also known as concept based image retrieval is the most common retrieval system. TBIR searches the database for the similar text, tags, labels, keywords surrounding the image as given in the query image and system will return images similar to the query image. Sometimes it is difficult to express the whole visual content of images in words because one image equal to 1000 of words and TBIR may end up in producing irrelevant results.

Content Based Image Retrieval

CBIR is another way of searching and it overcomes the limitations imposed by TBIR [3]. The basic concept of content based image retrieval is divided into three parts Feature extraction, Feature matching and Retrieval system. CBIR enables extraction of images from databases using the similar features such as color, texture and shape between query images and database images. Similarly, the features of the query image are used to represent the query image. The matching of the user image with the images in the database is performed to retrieve images that have close matches to the database images. Digital Images are used in various field like medical science, forensic science, architecture, fashion, face recognition, biometrics etc. Digital Image Processing is a subfield of signals and systems but focus particularly on images. For all these purpose searching and retrieval of images are become very important.

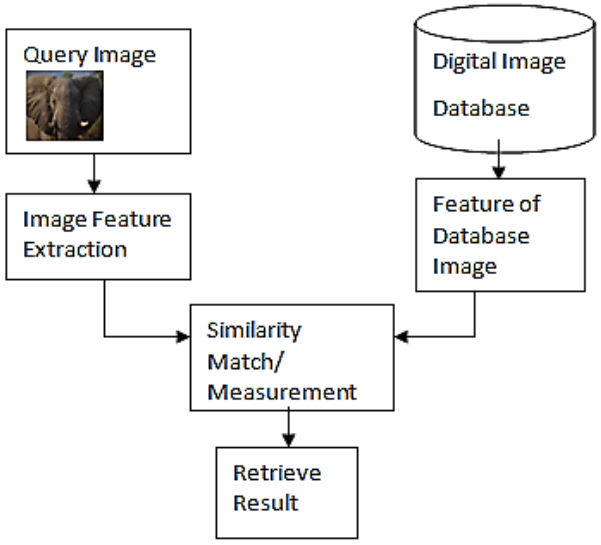

Fig. 1 Block Diagram of Content Based Image Retrieval

II. LITERATURE REVIEW

Majid Fakheri et al. proposed a method using texture and shape features of the image. The Texture semantics is extracted using Gabor wavelets. Shape feature is retrieved using Gradient Vector Flow fields. Similarity is matched using the principle of most similar highest priority. [5] Ramamurthy, B. and K.R. Chandran proposed a Content Based Medical Image Retrieval with Texture Content Using

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 6, June 2018

Gray Level Co-occurrence Matrix and K-Means Clustering Algorithms. [7]

Zhi-chun huang et al. illustrated an image retrieval technique based on combination of colour moments of the HSV colour space and Gabor texture descriptors with Euclidean distance used for distance measure. [6]

Sagar Soman et al. in their paper performed Content Based Image Retrieval using Color features extracted using moments of color and Texture features extracted by applying Discrete Cosine Transform (DCT) on a set of 1000 images. [9]

Rajshree S and Dubey proposed about an Image mining methods which is dependent on the Color Histogram. They have examined a histogram-based search techniques and color texture techniques in two different color spaces, RGB and HSV. [8]

Dr. H. B. Kekre et al. presented a technique to retrieve images wherein color averaging technique is used for feature vector generation and Euclidean Distance is used as a similarity measure for querying images. [10]

Deepak Johnet al.(2015) in his Paper Content L Zhang et al.(2013) in paper performance Analysis of Integer Wavelet Transform for Image Compression illustrated Color histogram Semantic subspace learning method. [12]

Saadet al. (2013) in his paper Visual Feature Extraction for Content Based Image Retrieval proposed the design of an image database and retrieval of specific features from the images for the CBIR, then the analysis of the CBIR system performed by using color histogram and the Euclidian distance measurement. Combination of features is not considered.'[11]

Majid Fakheri et al. (2011). The Texture semantics is retrieved using Gabor wavelets. Shape feature is extracted using Gradient Vector Flow fields. [14]

CBIR methodologies

A. Low Level Images Features Used In CBIR

In CBIR systems, a feature is keypoint of the image which gives information about image. Extracted features from any image are based on color, shape and texture. These three are the most important features of images used in CBIR systems. The following subsections address the color, texture, and shape features used in CBIR.

1. Color

Color is primarily interrelated with chromatic attributes of an image. Color is a part of the three dimensional coordinate module or system. The appropriate color room should be assign in order to determine the color based images. RGB (Red, Green, Blue), HSV (Hui, Saturation, Value), CMY (Cyan, Magenta, Yellow) and LHS (Luminance, Hue and Saturation) are the most popular color spaces. Color based image retrieval can be extracted in many ways like Histogram, Color moments, Color Correlogram etc [17][18]. The most commonly used color based image retrieval is color histogram. Probability of finding color pairs at determinate pixel distances is acknowledged as correlation of colors which is used to provide an effective spatial retrieval feature.

These methods are explain as follows

- **Color Histogram**

The color histogram defines the occurrences of intensities of the three color channels. The Histogram of images is taken by counting the number of each color pixels occurs in the image and each color pixels are contained in separate bins. The bins are normally defined as consecutive, non-overlapping intervals of variable. The bins must be adjacent and are usually equal size [16].

- **Color Moments**

Image color distribution is characterized by its moments. First, second and third central moment of each of the color channels is stored as a color feature.

- **Dominant Color**

The Dominant Color Descriptor (DCD) narrates the typical colors in an image [11]. It is used for retrieving similar images from database based on single or various color values. The DCD can provide the powerful and compact salient color representation compared to the conventional histogram based descriptors.

- **Color Correlogram**

It gives the information about how the colors pairs are changed with distance.

2. Texture

Basically texture is a continual pattern of pixels over a spatial domain, it is the primary property using for the recognition of images. Its properties are the visual patterns in an image which have properties of homogeneity that do not response from the existence of only a single color or intensity of pixel [15]. It is a natural property of surfaces and it gives visual patterns of the image. It contains critical details regarding the structural arrangement of the surface (e.g. leaves bricks). It also gives the relationship between the side and external environment.

Texture features are extracted by using various methods like Gabor Transform, Gray Level Co-occurrence matrix (GLCM) and Tamura Features. These procedures of extracting texture features are as follows

- **Grey level Co-Occurrence Matrices**

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 6, June 2018

Grey level co-occurence is a matrix. The GLCM is created from a grey scale image. The GLCM is computed how frequently a pixel with grey level value occurs either horizontally, vertically or diagonally to adjacent pixels.

- **Gabor Transform Gabor wavelet**

It is most widely used technique for texture analysis feature extraction. In present days texture features are found by calculating mean and variation of the Gabor filtered image. Rotation normalization is accomplished by a circular shift of feature elements therefore all images have the same dominant direction. Mostly the image indexing and retrieval are organized on textured images and natural images.

- **Tamura Feature**

Coarseness, there are sir Tamura features directionality, line likeness, contrast, regularity and roughness. In Tamura features coarseness, contrast and directionality correspond strongly with human perception and therefore they are very important.

- **Gabor wavelet Transform (GWT)**

GWT is most widely used technique for texture analysis of feature extraction. It uses the multi-resolution and multi-orientation approach for texture analysis.

- **Shape**

Shape of object play an important role among the different aspect of visual information. Shape features in images are extracted using many approaches. Some of the shape features are as follow

- **Histogram of Edge Directions**

The edge histogram extracts the general shape information in the image. The process to detect the important features of image is known as Edge detection. In the image, the edge information contained is acquired, using edge detection algorithms like canny, sobel, etc.

- **Region Moments**

Among region-based descriptors moments are very popular. They are invariant moments, Zernike moments and Legendre moments.

B. Distance Measures

Distance measures are used for analysing the similarity of two images. There are different kinds of similarity measurements.

- **Euclidean Distance**

To calculate the Euclidian distance between images or image features, our metrics should have same dimensions.

E distance = sqrt(sum((h-h1)^2))

h= histogram of first image h1= histogram of second image

In Euclidean distance, the least value of distance measure indicates the similarity.

- **Bhattacharya Distance**

This is one of the most used methods for finding out the distance. The Bhattacharya Distance measures the similarity between two discrete or sequential probability distributions. A popular distance of similarity between two Gaussian distributions is the Bhattacharya distance.

- **Histogram Intersection**

Histogram Interaction is a distance measure for comparing histograms. It neglects the features occurring in a single histogram and calculates the common part of the two histograms.

- **Mahalanobis Distance**

It is based on the correlations between variables, and is used to analyze various patterns. It is useful in determining the similarity between an unknown sample set (query image) and a known one (database).

C. User Interaction

Interaction of users in CBIR system is essential good. User interaction in CBIR system dwells of a query arrangement which is discussed briefly below.

- **Category Browsing**

This approach is looking for the image in database with the category nominal for query. Categorizing and fast browsing can be done with self-organizing plan of action which carries clustering or arrangement of same regions of images.

- **Queries by Example**

In Queries by Example, user gives query by example (image) to reduce the system for the retrieval procedure. CBIR system extracts the features like color, shape or texture from example image. Then database is searched for the most similar feature image. In query by example it is not mandatory for the user to provide description of image in any form. In Web based browsing query by example plays very important role.

- **Query by Sketch**

User sketches the image with characteristics of features (color, texture, shape) of query image with a graphic user interface tool to acquire the image in query by sketch method. Sometimes sketch is more than enough for the retrieval of images.

- **Query by Group Example**

It allows the user to give group images as an example of query to the system. The system will then search for exact images applicable to group image examples of query.

- **Relevance Feedback**

In present days, a comprehensive research has been set up in Content Based Image Retrieval (CBIR) area while using Relevance Feedback (RF) techniques for making modifying retrieval of images is achievable.

- **Relevance Feedback Schemes:**

Kernel based approach techniques and entropy based techniques for relevance feedback. These methods have a key advantage that under transformations the applicable images form groups in image database and the irrelevant images form detached.

III. CONCLUSION

In this paper we study and discuss the various CBIR methodologies which are used for extracting the salient low level features and various distance measures to find out the similar features between images. A wide variety of researches have been made on image retrieval. Each work has its own technique, contribution and limitations but the aim is same. The purpose of this survey is to provide an overview of the CBIR systems that describe the content of images.

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