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A Review Paper on Content Based Image Retrieval

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ABSTRACT

Content Based Image Retrieval (CBIR) plays very important role in the research field of digital Image processing. DIP deals with manipulation of digital images through a digital computer. Basically CBIR is responsible for extracting low level features of image like color, texture, shape and similarity measures for the comparison of different images. And after that retrieve the similar images using query image.

Keywords : Content-Based Image Retrieval (CBIR), IMage Euclidian Distance (IMED), histogram

I. INTRODUCTION

Digital Images are used in various field like architecture, fashion, face recognition, biometrics etc. DIP 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.

As the dissemination of video and image data in digital form has enhanced, Content Based Image Retrieval (CBIR) has become a striking research topic. Thus a significant job that needs to be addressed is immediate retrieval of images from large databases. Here Content based signifies that the search look into all the contents of the images instead of the metadata such as keywords or description associated with image. The term "content" might refer to colors, shapes, textures or any other information related to image that can be derived from the image itself. This is about CBIR. Since the image searching and retrieval used in many field that is why the output or result should be efficient and less time consuming. The researchers also focus on reducing the semantic gap. Semantic Gap is basically the gap between the information extractable automatically from the visual data and the representation; a user may have for the same data. The time consumed in sorting, searching and retrieval of images should be minimum with high level of percentage of similar images in both ways in terms of distance and human perception. In short the less time consume and the relevant output is produce.

The purpose of CBIR is to leave out the use of textual descriptions. So in CBIR, retrieving of image based on a likeness in their contents like textures, colors, shapes etc. are lower level attribute of image. CBIR is the use of computer vision techniques to the image retrieval difficulty, that is, the difficulty of finding of images from large databases. In Content based image retrieval the search will find out the actual contents of the image rather than the metadata such as keywords, tags, and/or descriptions associated with the image. In CBIR, retrieval of image is based on similarities in their contents, i.e., textures, shape and colors which are considered the lower level features of an image. The Marker of CBIR system is low level feature extraction. Feature extraction may be through with region or an entire image. These formal approaches for image retrieval are supported on the computation of the similarity between the users query and images. In CBIR each individual image is stored in the large database and its features are extracted, compared to the features of the query image. Thus, broadly, it involves two procedures, viz, feature extraction and feature matching.

II. METHODS AND MATERIAL

1. Low Level Images Features Used In CBIR

In CBIR systems, a feature is a characteristic that can interpret a definite visual belonging or property of an

image either globally for the whole image or locally for regions or objects. The features which are extracted 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.

1.1 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 space should be assign in order to determine the color based images. RGB (Red, Green, Blue), CMY(Cyan, Magenta, Yellow), HSV (Hui, Saturation, Value) 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 [3-5]. The most commonly used color based image retrieval is color histogram which has small critical effectualness as it neglect the spatial organization of colors. 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 explained in following way-

1.1.1 Color Moments

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

1.1.2 Color Histogram

A histogram is a graphical representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable.

To construct a histogram the first step is to "bin" the range of values that is responsible to divide the entire range of values into a succession of intervals and then count the number of values fall into each interval. The bins are normally specified as sequential(i.e. following each other continuously), non-overlapping intervals of variable. The bins(intervals) must be adjacent and are usually equal size.

1.1.3 Invariant Color Histogram

Theo Gevers et al., (2004) stated a robust histogram from photometric color invariants (invariant to illumination, shading, highlights and inter reflections) for object recognition. The histograms are computed with the help of variable kernel density estimators.

1.1.4 Dominant Color

To obtain the dominant or supreme color of the image the first step is to obtain the histogram and then the bin which has maximum size is interpreted as the supreme color of the region. When any segmented region does not have a uniform color then the average color will not be a favorable choice for the color feature (Ying Liu, et al., 2008)

1.2 Texture

Texture is the primary property using for the recognition of images. Basically texture is a continual pattern of pixels over a spatial domain, which has the extension of noise to the patterns or structure and their recurrence frequencies result in textures that can appear to be stochastic(random) and unorganised. 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. [7]. Texture 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 [8].

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

1.2.1 Grey level Co-Occurrence Matrics

Grey level co-occurence is a matrix or we can also say it distribution that is definite over an image to be the arrangement of co-occuring values at a given offset. The GLCM is created from a grey scale image. The GLCM is computed how frequently a pixel with grey level value occurs either vertically, horizontally or diagonally to adjacent pixels.

1.2.2 Gabor Transform

Gabor wavelet proved very useful texture analysis and is mostly adopted in the literature. Present an image retrieval method based on Gabor filter. 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.

1.2.3 Tamura Feature

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

1.3 Shape

Shape is an important attribute of segmented image regions and its effective and vigorous representation plays an important role in retrieval of images. Shape features in images are extracted using many approaches. They are one-dimensional functions for shape representation, polygonal approximation, spatial interrelation feature, moments, scale-space methods and shape transform domains (Yang Mingqiang, et al., 2008). An important shape feature has to be picking over depending upon the situation and the nature of the image (Zhang D. et al., 2004). Some of the shape features are discussed in this section.

1.3.1 Histogram of Edge Directions

The edge histogram extracts the general shape information in the image. In the image,the edge information contained is acquired, using edge detection algorithms like canny, sobel, etc. The edge directions are quantized into a number of bins (Rahman et al., 2007, Felci Rajam. I et al., 2011b, 2012). For achieving scale invariance, the histogram is normalized with respect to the number of pixels in the image.

1.3.2 Region Moments

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

2. Distance Measures

Distance measures are used for analysing the similarity of two images. There are different kinds of similarity measurements like Euclidean distance, histogram intersection, Bhattacharya distance and Mahalanobis distance for CBIR applications.

2.1 Euclidean Distance

To calculate the Euclidian distance between images or image features, our matrics 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 (Rahman et al., 2007, Felci Rajam. I et al., 2011a, 2012).

2.2 Histogram Intersection

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

2.3 Bhattacharya Distance

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

2.4 Mahalanobis Distance

The Mahalanobis Distance 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 and a known one. The unknown sample set is the query image, and the known set is the images in the database.

3. User Interaction

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

3.1 Category Browsing

Category browsing 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.

3.2 Queries by Example

In this approach, user gives example of image in query by example to alleviate 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 obligatory for the user to provide description of image in any form. In Web based browsing query by example plays very important role.

3.3 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 plenty for the retrieval of images.

3.4 Query by Group Example

Query by group example grant the user to give group images as a example of query to the system. The system will then search for exact or resemble images applicable to group image examples of query. By using group by query example we can provide the target images features more accurately with different image example in group. Now days CBIR systems have both query examples i.e. relevant and irrelevant.

3.5 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.

3.6 Relevance Feedback Schemes:

There are different relevance feedback algorithms which are classified on the foundation of statistical analysis, 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.

4. Datasets Used

For performing experiments in the CBIR, many datasets are available. Many of the researchers used the COREL dataset (Yixin Chen, 2003, Ja- Hwung Su, 2011, Yu Ma et al., 2010), which contains natural scenery images. The Corel image database contains a broad number of images of various contents, ranging from animals and outdoor sports to natural scenes. These images are pre-categorized into different categories of size 100 by domain professionals. The Caltech dataset (Samuel Rota Bul et al., 2011, Felci Rajam. I et al., 2012) is a reference dataset, which contains natural images and it has 101 different object categories. The Oliva Dataset, Flickr18 (Nikhil Rasiwasia, 2007), and IAPR TC-12 benchmark also contain natural image datasets. The SIVAL (Spatially Independent, Variable Area, and Lighting) benchmark consists of 25 different objects, and 10 scenes. SIVAL emphasizes the task of localized CBIR through nearly indistinguishable scenes, which only vary by the localized target objects (Feng et al., 2010). The Vistex texture database (Raghu Krishnapuram et al., 2004, Imtnan- Ul-Haque et al., 2011), Outex database (Imtnan-Ul- Haque et al., 2011), Brodatz texture database (Yu Ma et al., 2010), and Meastex (Najlae Idrissi et al., 2009) are the texture databases. ImageCLEFmed contains medical images. The MNIST, Pendigit, Optdigit and Statlog are databases containing handwritten characters and digits (Gjorgji Madzarov et al., 2009).

5. Literature Review

I go through various research papers for literature review and till now. I am taking some papers as literature review for my research, those are:

- **Content Based Image Retrieval using HSV-Color Histogram and GLCM**

In this paper a new image retrieval method which is based on HSV color and GLCM texture features of image sub-blocks with one to one matching is suggested.

We merged texture and color features with normalized Euclidean distance. Our experimental results exhibit that the proposed method based on texture and color features of image sub-blocks has better retrieval performance analysed with the Image retrieval system using only HSV color, only GLCM texture and combined HSV color and GLCM texture. As further research the proposed retrieval method is to be rated with other unified matching techniques.

- **Segmentation And Histogram Generation Using The HSV Color Space For Image Retrieval**

In these paper important properties of the HSV color space and have evolved a framework for extracting features that can be used both for image segmentation and color histogram generation which are two important approaches to content based image retrieval. This experiment makes use of the saturation value of a pixel to rectify if the Hue or the Intensity of the pixel is more proximate to human perception of color that pixel corresponds. The K-means clustering of features merges pixels with corresponding color for partition of the image into objects.We are too power to create a histogram that enpower us to execute a window-based smoothing of the vectors during retrieval of same images. While it is well found that color itself cannot retain semantic information beyond a definite degree, we have shown that retrieval results can be expectly improved by choosing a better histogram.

- **Content Based Image Retrieval using Color and Texture**

In this paper novel approach for Content Based Image Retrieval by merging the color and texture features called Wavelet-Based Color Histogram Image Retrieval (WBCHIR). There is similarity between the images is rectified by means of a distance function. The experimental result shows that the given method overreaches the other retrieval methods in terms of Average Precision. Moreover, the computational steps are efficiently reduced with the use of Wavelet transformation. As a result there is a substational increase in the recieved speed. The whole indexing time for the 1000 image database is approximately 5-6 minutes.

- **Well-Organized Content based Image Retrieval System in RGB Color Histogram,Tamura Texture and Gabor Feature**

In this paper Content Based Image Retrieval is a difficult method of interpreting relevant images from a wide storage space. A newfound low level feature contains histogram, color and texture contents.This element is proposed for implement in image retrieval and image indexing systems.

6. Applications of CBIR

There are different possible applications for CBIR technology has been determined. Some of these are cited below:

a. Investigations : In investigation CBIR used as face recognition systems and copyright on the Internet
b. Shapes Identification: In this identification of defect and fault in industrial automation.
c. Medical Diagnosis: In medical diagnosis CBIR plays very important role in Tumours detection, Improve MRI and CT scan Understandability.
d. Remote Sensing: Various information systems, weather forecast, satellite images.
e. Trademark Databases, Art galleries, museums and archaeology.
f. Architectural and engineering designs.
g. Cartography: map making from photographs, synthesis of weather maps.
h. Digital Forensics: finger prints matching for crime detection.
i. Radar Engineering: helps in detection and identification of targets.

III. CONCLUSION

This paper discusses the various methodologies used for extracting the salient low level features and various distance measures to find out the similarity between images. Many researchers show their work by using different methodology but the aim is common. The purpose of this survey is to provide an overview of the CBIR systems that describe the content of images.

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