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A STATE OF THE ART OF FEATURE EXTRACTION TECHNIQUES USED IN CBIR SYATEM

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Abstract: To extract desired features to describe content of the images is very interesting and challenging task in content based image retrieval system. The CBIR system allows to search an image based on the feature extracted from it. Various feature extraction techniques are used to successfully design many CBIR systems. This paper provides a survey of different feature extraction techniques to develop the CBIR system. Further it provides the overview of different CBIR system with respect to feature extraction technique used. It also states the effectiveness of the combination of low level features and high level features to design the system. MPEG-7 feature descriptor algorithm is also discussed here.

Keywords: CBIR, Feature extraction, Low level features, Semantic features, MPEG-7

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INTRODUCTION

Image processing applications mostly used the process of retrieving desired images from a large set of images based on features that can be automatically extracted from the images themselves [1]. Such systems called.

CBIR (Content-Based Image Retrieval) have received intensive attention now a day. This technique overcomes the disadvantages faced by text based retrieval system like it is cumbersome and tedious. At some extent, it is subjective as it changes from person to person.

Feature extraction is the first step in any image processing application which includes describing the image based on its contents. Feature is a "point of interest" for image description. We will found the applications of CBIR system in many areas. The advantages and end users of such systems range from simple users searching a particular image on the web as well various type of professional bodies from Government to civilian, like police force for picture recognition, journalists requesting pictures that match some query (ies) event (s), engineers investigating a possible anomaly in system design so finding the right mapping of initial query images is of paramount importance, etc [2].

1. CONTENT BASED IMAGERETRIEVAL (CBIR)

In content based image retrieval system the retrieval is based on matching of the features of the query image with that of image database based on similarity evaluation. Therefore, the images will be indexed according to their own visual content. The visual contents are the chosen features like color, texture, shape, or a combination of a set of elementary visual features [1][2]. Figure 1 shows a generic description of a standard image retrieval system [1].

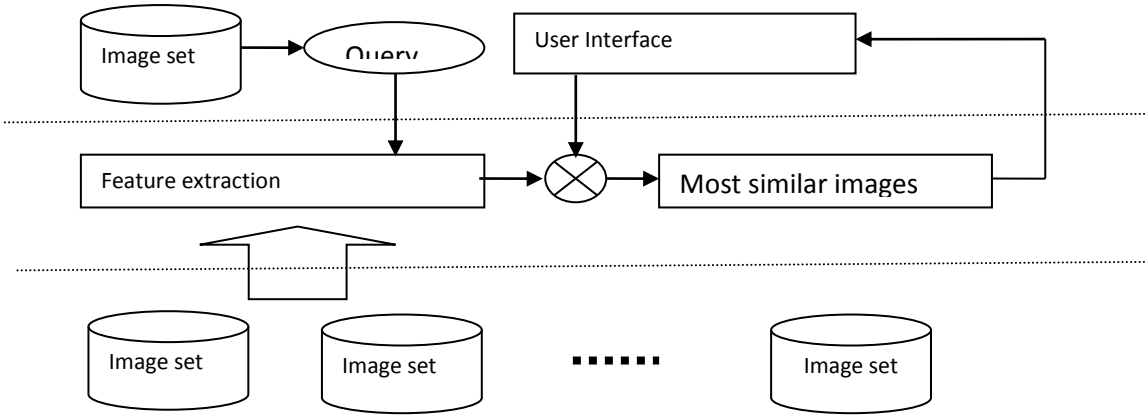

Figure 1: A generic CBIR System

Working of any CBIR system is as follows: Feature extraction of image and image database is done according to the chosen visual features, which form the perceptual feature space. Then there is matching the query image to the most similar images in the feature database. User interface and feedback is used to govern the display of the outcomes, their ranking, and the type of the user-interaction with possibility of refining the search through some automatic or manual preference (weighting) scheme, etc. In the CBIR system, the input is in form of image and output produce is not a single image but is the list of images.

2. FEATURE EXTRACTION

Feature extraction is a crucial step in CBIR system. The result of system is based on this step. There are two types of visual contents (features) in CBIR: primitive (low level) features and domain specific (high level) features.

2.1 The primitive feature

They includes color, shape, and texture while domain specific features includes for instance, finger prints, handwriting, and human faces, is application dependent and may involve domain knowledge.

3.1.1 Color

Color is most extensively used visual content for image retrieval. Color space must be defined first. Mostly there are RGB, HSV and CMY color spaces available. However RGB color space is most widely use color space in practice. Again Color Histogram, Color Coherence are also used to represent the image. Some example includes Chabot[1] developed by Department of Computer Science, university of Californnia, USA, represents each image using the Color histogram. Other systems such as C Bird [1] , CHROMA[1] uses color vector to represent each images.

Dr.N.Krishnan, M.Sheerin Banu, C.Callins Christiyana (2007) [3], proposes the method to retrieve images based on dominant colors in the foreground image. The foreground of the image only gives semantics compared to the background of the image. Suryani Lim, Guojun Lu (2003)[4] , propose method using the Looseness parameter from geostat, to describe the global spatial relationship of colours. They analyse and compare the performance of geostat and SCH (Spatial Chromatic Histogram) in their work. Tat-Seng Chua, Chun-Xin Chu and Mohan Kankanhalli (1999)[5] , proposes Relevance Feedback approach has been applied to images' text and color attributes. In order to ensure that meaningful features are extracted, a pseudo object model based on color coherence vector has been adopted to model color content.

3.1.2 Texture

Texture is another important property of images. There are number of texture representations have been recognised in pattern recognition and computer vision. They are Tamura features, Wold features, Gabor Filter, Wavelet Transform etc.ADL [6], CBVQ[1],CIRCUS[1] user texture features to represent the image.

Mathieu Lamard, Guy Cazuguel, Gw´enol´eQuellec, Lynda Bekri, Christian Roux, Beatrice Cochener (2007) [7], proposed a CBIR method for diagnosis aid in medical fields. They characterize images without extracting significant features by using distribution of coefficients obtained by building signatures from the distribution of wavelet transform. To enhance results, a weighted distance between signatures is used and an adapted wavelet base is proposed. Christian Wolf , Jean-Michel Jolion, Walter Kropatsch and Horst Bischof (2000) [8], present methods for CBIR based on texture similarity using interest points and Gabor features. Interest point detectors are used in computer vision to detect image points with special properties, which can be geometric (corners) or non-geometric (contrast etc.). Gabor functions and Gabor filters are regarded as excellent tools for feature extraction and texture segmentation.

3.1.3 Shape

With shape the objects and regions with the image have been described. In contrast with color and texture, shape features are used after segmentation. Shape descriptions are categorised either into Boundary-based or Region based methods. SQUID[1], SYNAPSE[1], uses the pure shape features to developed the system.

HuiZhao ,Pankoo Kim and Jongan Park (2009)[9], proposed a new CBIR method using the feature analysis of edge extraction and median filtering. To the defect of median filter reducing the image's resolution especially on edges, edge detection is applied in order to get the edge values, and then replace the values of edge position of median filtering image with detected edge values. Ramashish Baranwal, Ripinder Singh, P.K. Bora (2003) [10], presented image segmentation as a problem of maximizing the information by segmentation. The segmentation is done by classifying the image features in the feature space and measuring the information gained by the classification by an evaluation function.

3.1.4 Which feature is best?

There is no straightforward answer to the question. The use of specific feature is depended on the specific image processing application. However the most of the system uses combinations of these features for more accurate results. Photo Finder [1], developed by the Alta Vista, uses

the color, shape and texture features, Blobworld [1], CANDID [1] , DrawSearch [1] also uses all the three features collectively to develop system.

P. S. Hiremath, Jagadeesh Pujari (2007) [11], presents a novel framework for combining all the three i.e. color, texture and shape information, and achieve higher retrieval efficiency. The image is partitioned into non-overlapping tiles of equal size. The color moments and moments on gabor filter responses of these tiles serve as local descriptors of color and texture respectively. Lenina Birgale, Manesh Kokare and Dharmpal Doye (2006)[12], explains the novel approach combines color and texture features. They are obtained by computing the measure of standard deviation in combination with energy on each color band of image and sub band of wavelet. Aster Wardhani and Tod Thomson(2004) [13], focused on category based searching. Based on the regions' features of colour, texture, shape and relation between regions, the image is then categorised. Users are presented with retrieval results sorted into different categories. A. H. Kam, T. T. Ng, N. G. Kingsbury and W. J. Fitzgerald(2000) [14],propose a general and powerful multiscale segmentation algorithm automates the segmentation process, the output of which is assigned novel colour and texture descriptors which are both efficient and effective.

3.1.5 MPEG-7

MPEG has started a new work item called MPEG-7, whose formal name is multimedia content description interface. It will specify a standard set of descriptors (feature representations) that can be used to describe various types of multimedia information. The descriptions shall be associated with the content itself, to allow fast and efficient searching for information of a user's need.

Ka-Man Wong, Kwok-Wai Cheung, and Lai-Man Po (2005) [15],develop a CBIR retrieval called MPEG-7 Image Retrieval Refinement based On Relevance feedback (MIRROR).The system is based on MPEG-7 Experimentation Model (XM) with web-based user interface for query by image example retrieval.

3.2. Semantic Features

Semantics features are obtained by either human interpretations or by complex inference procedure on primitive visual contents. It is a form of high level image description or meta-object.

Raoul Pascal Pein, Joan Lu, and Wolfgang Renz(2008) [16], presents a hybrid query language suitable for both image and text retrieval. It is very similar to those of a full text search engine

but also includes some extensions required for content based image retrieval. Miguel Arevalillo, Francesc J. Ferri, Salvador Moreno-Picot (2009)[17], described a CBIR algorithm which combines relevance feedback, evolutionary computation concepts and adhoc strategies in an attempt to fill the existing gap between the high level semantic content of the images and the information provided by the low level descriptors. S. Kulkarni, B. Verma, P. Sharma and H. Selvarj (2009) [18], proposed an intelligent CBIR which is based on neuro fuzzy technique. The system will accept multiple queries as input such as "mostly red &many blue &few green" that can be provided on-line and the outputs of the system are the images with their confidential values. The system uses fuzzy logic to interpret multiple natural expressions such as mostly, many and few and a neural network to learn the meaning of mostly red, many red and few red.

CONCLUSION

The main contribution of this work is to identify various feature extraction techniques used in CBIR system. The review of literature on current CBIR System is presented here. Both low level features and semantic features can be used to develop a CBIR system. The use of specific feature is depended on the specific image processing application. However the combination of these features is also used in some cases which give the promising results.

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