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A Study of Low Level Feature Extraction Techniques for Content based Image Retrieval Systems

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Abstract: With the development in the computer technologies and the advent of the internet, there has been bang in the amount and the difficulty of digital data being produced, stored, conveyed, analysed, and accessed. The emergence of multimedia technology and the rapidly expanding image collections on the Internet have attracted significant research efforts in providing tools for effective retrieval and management of visual data. Content-based image retrieval (CBIR) is a technique for retrieving images on the basis of automatically-derived features such as colour, texture and shape. Feature extraction is the most important step in image classification. It helps in extracting the feature of an image as ideal as possible. These methods used for content based image retrieval are classified as low-level feature extraction and High-level feature extraction. Low-level feature extractions are based on finding the points, lines, edge, etc. while high level feature extraction methods use the low level feature to provide more significant information for further processing of Image analysis.This paper discusses some of the techniques available for effective extraction of feature for CBIR systems.

Keywords: Content Based Image Retrieval (CBIR), Query by image content (QBIC), Content-based visual information retrieval (CBVIR), Feature Extraction, Low Level Feature extraction.

I. INTRODUCTION

Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases Content based search analyses the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term "content" in this context might refer to colours, shapes, textures, or any other information that can be derived from the image itself [1]. The architecture of a CBIR system can be understood as a basic set of modules that interact within each other to retrieve the database images according to a given query. To retrieve images, users provide the retrieval system with query images or sketched figures. The system then changes the query image into its internal representation of feature vectors. The similarities/differences between the feature vectors of the query example and those of the images in the database are then calculated and retrieval is performed with the aid of an indexing scheme [2]. Research and development issues in CBIR cover a range of topics, many shared with mainstream image processing and information retrieval [3]. Some of the most important are:

- understanding image users' needs and information-seeking behaviour
- identification of suitable ways of describing image content
- extracting such features from raw images
- providing compact storage for large image databases
- matching query and stored images in a way that reflects human similarity judgements
- efficiently accessing stored images by content
- providing usable human interfaces to CBIR systems

Major application areas of CBIR include:-
A .Crime Prevention: The Law enforcement agencies typically maintain large archives of visual evidence, including past suspects' facial photographs (generally known as mug shots), fin whenever a serious crime is committed, they can compare evidence from the scene of the crime for its similarity to records in their archives [4].

B. The Military: Military applications of imaging technology are Recognition of enemy aircraft from radar screens, identification of targets from satellite photographs, and provision of guidance systems for cruise missiles [4].

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C. Medical Diagnosis:The prime requirement for medical imaging systems is to be able to display images relating to a named patient, there is increasing interest in the use of CBIR techniques to aid diagnosis by identifying similar past cases[4].

II. APPROACHES USED FOR CBIR

Basically CBIR systems use two approaches for retrieving the images from the image data base which are:

A. Text-based approach: Text based method used the keywords descriptions as a input and get the desired output in the form of similar types of images [5]. It applies traditional text retrieval techniques to image annotations or descriptions. Most of the image retrieval systems are text-based, but images frequently have little or no accompanying textual information. Keywords are words or phrases that are described content. They can be used as metadata to describe images, text documents, database records, and Web pages. Assign keywords for an image allows one to retrieve, index, organize and understand large collections of image data. Limitations of Text-based Image Retrieval are:

- The task of visualizing image content is highly subjective.
- Accompany the relevant search results; it could be a large number of irrelevant search results which may be the precision of the text based search can be low.
- In many times, a few words cannot accurately describe the image content, and many words have multiple meanings.
- The textual descriptions provided by an annotator should be different from the other user. A picture defines various things for different people. It can also mean different things to the same person at different time. It must be a variety of inconsistencies for user text queries and image descriptions [6].

B. Content-Based Approach: Content based approach using image as an input query and it generate the output of similar types of images [5]. The term “Content based” means that it will search the actual content of an image. Information retrieval means the process of converting a request for information into a meaningful set of reference. CBIR is a technology that in principle helps organize digital image archives according to their visual content. This system distinguishes the different regions present in an image based on their similarity in colour, texture, shape, etc. and decides the similarity between two images by reckoning the closeness of these different regions [6].

III.LOW LEVEL FEATURE EXTRACTION

Feature extraction plays an important part in the fields of pattern recognition and data mining technology. It basically extracts the meaningful feature subset from original sets by some rules. It is done, however, to reduce the complexity of space and the time of machine training and, also to achieve the goal of dimensionality reduction [7].

The techniques for Feature extraction can be divided into following four categories:

- Non transformed structural characteristic includes moments, model parameters, and power and phase information.
- A transformed structural characteristic includes frequency spectra and subspace mapping methods.
- A structural description includes parsing techniques, formal languages and their grammars, and string matching techniques.
- Graph descriptors include semantic networks, attributed graphs and relational graphs.

Low level features of any image are as mentioned below:

A. Colour Feature: Colour is one of the important features that make possible the recognition of images by humans. It is a property which is dependent on the reflection of light to the eye and also the processing of that information by the brain. We generally use color to tell the difference between some objects, places, and the time of day. First of all, color space is specified and once the color space is specified, color feature can be extracted from images or regions.

B. Texture Feature**:** Texture is one of the useful characterizations for a wide variety of images. It is generally believed that for recognition and interpretation, human visual systems use texture. In general, it is said that colour is usually a pixel property whereas texture can only be calculated from a group of pixels. There are a large number of techniques that have been proposed to extract texture features. They can be broadly classified into two types based on the domain from which the texture feature is extracted. Those are: spatial texture feature extraction methods and spectral texture feature extraction methods. In case of spatial texture feature extraction methods, texture features are generally extracted by calculating the pixel statistics or by finding the local pixel structures in original image domain. Whereas in case of spectral texture feature extraction method, firstly an image is transformed into frequency domain and then feature is calculated from the transformed image.

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IV. CONCLUSION

As few previous studies review both image feature extraction and image feature representation, which play a crucial role in multimedia processing community. In this paper, survey of low level feature extraction techniques is done which includes colour, and texture based. Among the various colour features, colour moments are not considered as sufficient to represent the regions. The study in content-based image retrieval (CBIR) in the past has been emphasis on image processing, low-level feature extraction. This paper focuses on the study of content based image retrieval and future is to implement the content based image retrieval in medical field.

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