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A Review of Query Image in Content Based Image Retrieval

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***Abstract*— CBIR applies to techniques for retrieving similar images from image databases, based on automated feature extraction methods. In recent years, the medical imaging field has been grown and is generating a lot more interest in methods and tools, to control the analysis of medical images. CBIR for medical images has become a major necessity with the growing technological advancements. The content of an image have to be carefully extracted, classified with efficient techniques foe easy retrieval. Contents in an image can be of various forms like texture, color and shape etc of which is regarded as the most efficient metric. Medical images are usually fused, subject to high inconsistency and composed of different minor structures. So there is a necessity for feature extraction and classification of images for easy retrieval. There are various methods have been proposed for medical image retrieval system such as Shape Based Method, Texture Based Method, Continuous Feature Selection Method, Storage and access methods.**

***Index Terms*— Content Based Image Retrieval (CBIR), feature extraction, Query By Image Content (QBIC).**

I. INTRODUCTION

A. What is CBIR?

Content-based image retrieval (CBIR) is a technique which uses visual contents to search images from large scale image databases according to users' interests. "Content-based" means that the search will analyze the actual contents of the image rather than keywords, tags or descriptions associated with the image. [1]The term 'content' in this context refers to colors, shapes, textures, or any other information that can be derived from the image itself [9].

The earliest use of the term content-based image retrieval in the literature seems to have originated in 1992, when T. Kato used it to describe his experiments into automatic retrieval of images from a database by color and shape feature. Since then, the term has been used to describe the process of retrieving desired images from a large collection of images based on syntactical image features. The technique and algorithms that are used for CBIR originate from fields such as statistics, pattern recognition, signal processing, and computer vision.

Content based image retrieval (CBIR) is a technique in which images are indexed by extracting their low level features and image retrieval is only based upon these indexed image features. In an effective image retrieval system, the user poses a query and the system should find images that are somehow relevant to the query [9]. Thus a way of representing the query, a way of representing images, and a way of comparing a query and an image are needed. This kind of approach is known as querying by image content (QBIC).

CBIR has accepted different kinds of user queries for its implementation such as query by example, query by color, and query by relevance [7]. When a query image is given, the image is processed to extract features in order to represent the image contents as numeric values. These values are called feature vectors which are used in the retrieval process. CBIR plays a pivotal role in medical image retrieval field such as CT scan images, MRI scan images, X-rays etc

In CBIR query is given in the form of image. Then image database is searched through all images in order to find those with the most similar indices which are returned as the images most alike to the query image [3]. Many CBIR were developed during the last years, both by commercial firms and academia. The earliest and most famous one is QBIC (Query By Image Content) which was proposed by IBM. This system only used low level features - mainly color, texture and shape and did not include any semantic level.

CBIR draws many of its methods from the field of image processing and computer vision, and is regarded by some as a subset of that field. It differs from these fields principally through its emphasis on the retrieval of images with desired characteristics from a collection of significant size [8]. Image processing covers a much wider field, including image enhancement, compression, transmission, and interpretation. While there are grey areas (such as object recognition by feature analysis), the distinction between mainstream image analysis and CBIR is usually fairly clear-cut.

An example may make this clear. Many police forces now use automatic face recognition systems. Such systems may be used in one of two ways. Firstly, the image in front of the camera may be compared with a single individual’s database record to verify his or her identity. In this case, only two images are matched, a process few observers would call CBIR. Secondly, the entire database may be searched to find the most closely matching images.

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B. Block diagram of CBIR

Basic idea behind CBIR is that, when building an image database, feature vectors from images (the features can be color, texture, shape, region or spatial features, etc.) are to be extracted and then store the vectors in another database for future use [9]. General image retrieval system is shown by Figure 1, is consists of three main modules, input module, query module, retrieval module.

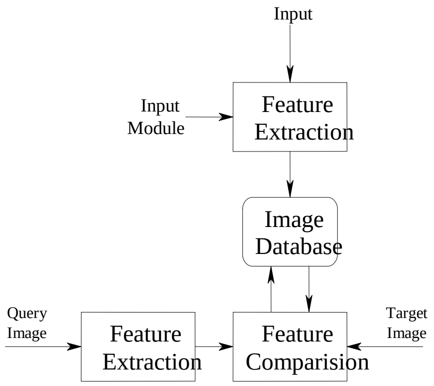

Fig 1:- Block diagram of General Image Retrieval System

In input module, the feature vector is extracted from each input image and stored into the image database with its input image. When query image is entered into the query module, the feature vector of the query image is extracted. In retrieval module, the extracted feature vector of query image is compared with the images stored in the database. Similar images are retrieved according to their similarity with the query image. Finally the target image will be obtained from the retrieved images [9].

II. RELATED WORK

Numerous works are available in the literature related with the Content-Based Image Retrieval. Several reviews of the literature on image retrieval have been published, from a variety of different viewpoints. A brief summary of some of the significant researches is presented below:

Ramamurthy.B and K.R. Chandran,"Content based Image Retrieval for Medical Images using Canny Edge Detection Algorithm", 2011. To provide an efficient tool which is used for medical image retrieval from a huge content of medical database and which is used for further medical diagnosis purposes. [7]

Sagar Soman, Mitali Ghorpade, Vrushali Sonone and Satish Chavan. Article: Content Based Image Retrieval using Advanced Color and Texture Features. March 2012 , In this paper, an image retrieval system based on color and texture feature extraction methods was presented. [2]

Amandeep Khokher ,"Content-Based Image Retrieval: State-of-the-Art and Challenges"2011, the field of content-based image retrieval has emerged as an important research area in computer vision and image processing. The key issue in image retrieval is how to match two images according to computationally extracted features. [1]

Prof. K. Wanjale Asst. Professor, Content Based Image Retrieval for Medical Images Techniques and Storage Methods, February 2010, This article gives an overview of available literature in the field of content based access to medical image data and on the technologies used in the field. Section 1 gives an introduction into generic content based image retrieval and the technologies used. Section 2 describes the basic algorithm used in the implemented systems. Section 3 describes various methods of implementing CBIR. [5]

III. PROPOSED MODEL OF CBIR

The idea behind content-based retrieval is to retrieve, from a database, media items (such as images, video and audio) that are relevant to a given query. Relevancy is judged based on the content of media items. Several steps are needed for this. First, the features from the media items are extracted and their values and indices are saved in the database. Then the index structure is used to ideally filter out all irrelevant items by checking attributes with the user's query. Finally, attributes of the relevant items are compared according to some similarity measure to the attributes of the query and retrieved items are ranked in order of similarity [6]. This provides a short introduction to each of the steps mentioned above, which are also shown in Figure 2.

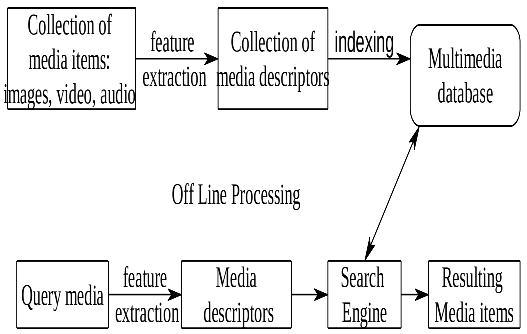

Fig 2: - Block diagram of the content-based retrieval system

In proposed system there are two parts of the process has been carried out namely offline and online. In offline process, Multimedia database has been constructed through one of the dominant feature of the media items such as feature extraction. In online process, Graphical User Interface (GUI) for the user interaction has been developed through which user can interact with the system for retrieval of their desired media items from the multimedia database [6]. For retrieval process, similarity comparison technique has been carried out between online user query media and offline multimedia database. After comparison, resulting images are indexed and retrieved based on their rank.

IV. METHODS OF CBIR

A. *Shape Based Method*

For shape based image retrieval, the image feature extracted is usually an N dimensional feature vector which can be regarded as a point in an N dimensional space. Once images are indexed into the database using the extracted feature vectors, the retrieval of images is essentially the determination of similarity between the query image and the target images in database, which is essentially the determination of distance between the feature vectors representing the images [5]. The desirable distance measure should reflect human perception. Various similarity measures have been exploited in image retrieval.

B. *Texture Based Method*

Texture measures have an even larger variety than color measures. Some common measures for capturing the texture of images are wavelets and Gabor filters where Gabor filters perform better and correspond well to. The texture measures try to capture the characteristics of images or image parts with respect to changes in certain directions and scale of changes. This is most useful for regions or images with homogeneous texture [5].

C. *Continuous Feature Selection Method*

This method deals with the "dimensionality curse" and the semantic gap problem. The method applies statistical association rule mining to relate low-level features with high-level specialist's knowledge about the image, in order to reduce the semantic gap existing between the image representation and interpretation. These rules are employed to weight the features according to their relevance. The dimensionality reduction is performed by discarding the irrelevant features (the ones whose weight are null) [5]. The obtained weights are used to calculate the similarity between the images during the content-based searching. Experiments performed show that the proposed method improves the query precision up to 38%. Moreover, the method is efficient, since the complexity of the query processing decreases along the dimensionality reduction of the feature vector.

D. *Storage and access methods*

Image retrieval system is a huge system and it needs to store many images in database. That's why it requires large database to store the images. Common storages are being used are relational databases, inverted files, self made structures or simply keep entire index in the main memory which will inevitably cause problems when using large databases. These methods often need to use dimension reduction techniques or pruning methods to allow for an efficient and quick access to the data. Some indexing techniques such as KD trees. Principle of Component analysis (PCA) for feature space reduction is being used [5].

Another space reduction technique is Independent Component analysis (ICA). Due to the lack of a common database for evaluation in CBIR with known relevance's we use two databases where relevance's are implicitly given by classifications. These databases are chosen as representatives for two different types of CBIR tasks: The WANG database represents a CBIR task with arbitrary photographs. In contrast, the IRMA database represents a CBIR task in which the images involved depict more clearly defined objects, i.e. the domain is considerably narrower.

V. APPLICATIONS OF CBIR

A wide range of possible applications for CBIR technology has been identified. Potentially fruitful areas include:

A. *Medical diagnosis*

B. *Education and training*

C. *Digital Libraries*

D. *Home entertainment*

A. *Medical diagnosis*

The increasing reliance of modern medicine on diagnostic techniques such as radiology, histopathology, and computerized tomography has resulted in an explosion in the number and importance of medical images now stored by most hospitals [2][4]. While 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.

B. *Education and training*

It is often difficult to identify good teaching material to illustrate key points in a lecture or self-study module. The availability of searchable collections of video clips providing examples of avalanches for a lecture on mountain safety, or traffic congestion for a course on urban planning, could reduce preparation time and lead to improved teaching quality [4]. In some cases (complex diagnostic and repair procedures) such videos might even replace a human tutor.

C. *Digital Libraries*

There are several digital libraries that support services based on image content. One example is the digital museum of butterflies, aimed at building a digital collection of Taiwanese butterflies. This digital library includes a module responsible for content-based image retrieval based on color, texture, and patterns [4].

D. *Home entertainment*

Much home entertainment is image or video-based, including holiday snapshots, home videos and scenes from favourite TV programmes or films [4]. This is one of the few areas where a mass market for CBIR technology could develop. Possible applications could include management of family photo albums ('find that photo of Aunt Sue on the beach at Brighton') or clips from commercial films ('play me all the car chases from James Bond movies').

VI. FUTURE SCOPE

When thinking about future research directions it becomes apparent that the goal needs to be a real clinical integration of the systems. This implies a number of changes in the ways that research is done at the moment. It will become more important to design applications in a way that they can be integrated easier into existing systems through open communication interfaces.

For example based on XML as a description language of the data or HTTP as a transport protocol for the data, such a use of standard Internet technologies can help for the integration of retrieval methods into other applications. Such access methods are necessary to make the systems accessible to a larger group of people and applications and to gain experience that goes far beyond a validation of retrieval results. This can not only be seen as engineering but as research as the practical use of the integrated methods needs to be researched.

VII. CONCLUSION

Several reviews of the literature on image retrieval have been published, from a variety of different viewpoints. Many CBIR systems have been developed, but the problem of retrieving images on the basis of their pixel content remains largely unsolved. Many content-based image retrieval (CBIR) systems have been developed in the last several years. Almost all of these systems are founded on the premise that images can be characterized by global signatures for the purpose of retrieval from the database. One of the key issues with any kind of image processing is the need to extract useful information from the raw data before any kind of reasoning about the image's contents is possible. The goal of Content-Based Image Retrieval (CBIR) systems is to operate on collections of images and, in response to visual queries, extract relevant image. The application potential of CBIR for fast and effective image retrieval is enormous, expanding the use of computer technology to a management tool.

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