International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 10 • Issue 2 pp. 931-939 June - Dec 2018 www.csjournals.com

A Study on Content Based Image Retrieval for Modalities in Medical Imaging

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Abstract: The basic unit of a CBIR system is a bundle of pixels which have some meaning in the semantics of human life, furthermore the number of objects in an image, the greater is the need for annotation. The interpretation of the objects depicted in an image depends upon the perception and possible mathematical measurements like size/shape of image which can be calculated, so that it may be helpful in the diagnosis of diseases and it becomes an aid to doctors. So developing an annotation based upon a particular hypothesis may lead to a reduction in the semantic gap as it may require exact information. The overall performance of CBIR system and the validation of true value facts, distributions based on which the annotation scheme is being developed for particular goal of CBIR becomes questionable.

Index Terms— Content–based image retrieval (CBIR), Digital Images, Medical Imaging.

INTRODUCTION

Content based image retrieval has emerged in early 1990's and it is important part of computer vision and image processing techniques. Content based image retrieval refers to a system that returns an image similar to a query image from large image database. Each image in the database is defined by a specific feature vector. These feature vectors may consist of color, texture, shape, etc. These vectors are than stored along with the image. The similarity features between the image and the image database are arrived based on the stored vectors. Advances in medical imaging have led to growth in large image collections. The rapid growth in the field of software and hardware for medical imaging (technique and process to create images of human body for clinical procedure), has made the medical science very high-tech. The continuous collaborative approaches of handling medical procedures have led to exponentially develop the large database of medical images. The ultimate goal of medical imaging would succeed only if an intelligent, fast, and accurate medical image retrieval system could emerges out which should be adoptive in accordance to rapidly growing data size and semantically distinguishable as the features of various medical images are fuzzy in nature for different organs. The medical images are distinguished in its characteristics as compared to the general purpose images (GPI). Thus the

process adopted for searching GPI is not adoptable as it is in the case of medical image retrieval systems. The combined color, texture and shape features for better retrieval methods. The co occurance method was found to be more appropriate method for all image classes because it gave better precession and minimum retrieved images. As shown in Figure below image retrieval techniques can be classified into three categories: text-based image retrieval (TBIR), content-based image retrieval (CBIR), and semantic-based image retrieval (SBIR).

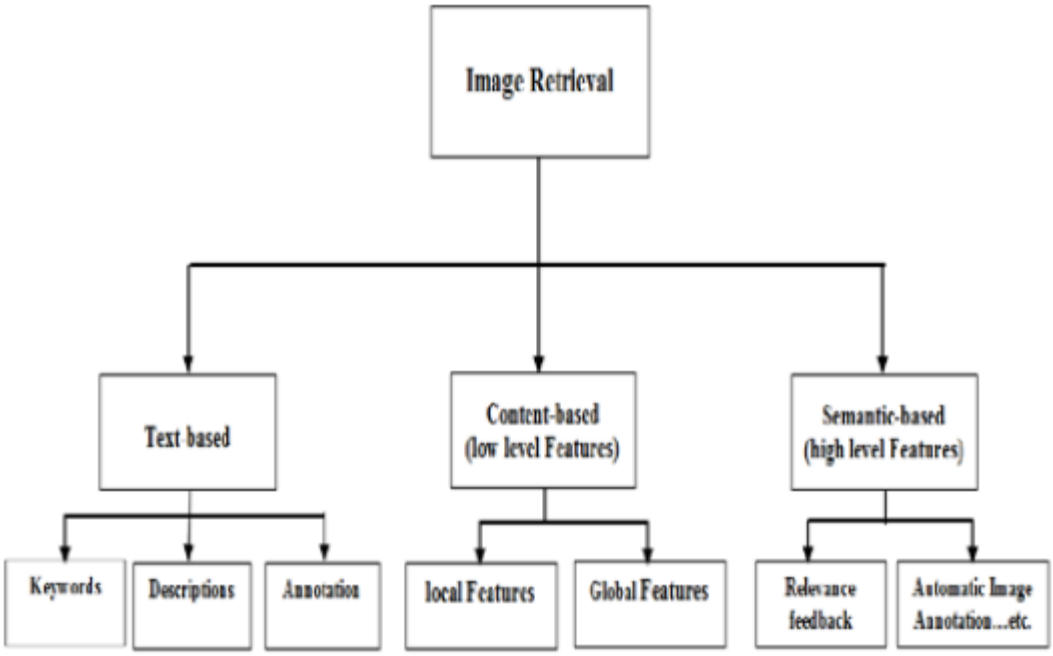

Figure 1 : Image retrieval categories

RELATED RESEARCH

In this paper, the work propose a combined set of methods based on color averaging technique is proposed to achieve higher retrieval efficiency and performance. Firstly an average mean based technique with reduced feature size is proposed. Secondly, a feature extraction technique based on central tendency is proposed. The proposed CBIR techniques are tested on Wang image database and indexed image database [1].In this work they are discussing content Based Medical Image Retrieval System, high level semantics of an image is very important. Regarding with this issue, the work proposed a method using co-occurrences matrix to extract

texture features and Canny Edge Detection is to extract shape features. Then K-means clustering algorithm and Euclidean distance measures are used to retrieve similar images for a query image in medical diagnosis [2].

In this research the heuristic function used for feature selection and feature optimization for retrieval process. The feature selection process depends on feature extraction process. The content based image consists of 3 types of features such as texture, shape and color. The shape feature is very important feature for image retrieval. The extraction of shape feature various authors used different method such ad Gabor filter wavelet transform function and Fourier descriptor. Now in the current research the feature descriptor are mostly authors are used. In this paper describe the review of content based image retrieval based on shape based feature and optimization technique. The empirical evaluation result show optimization technique is better optimization technique in compared with other such as genetic and neural network [3].The applied approach consists of two main phases: a pre-processing phase, which builds an image category index and a retrieval phase, which ranks similar images. Both phases are based only on visual information. Filtering images with a conceptual index out performs only-ranking-based strategies; combining features is better than using individual features; and low-level features are not enough to model image semantics [4].

This paper introduces a flexible learning approach for image retrieval with relevance feedback. A semantic repository is constructed offline by applying the k-nearest-neighbour based relevance learning on both positive and negative session-term feedback. This repository semantically relates each database image to a set of training images chosen from all semantic categories. The query semantic feature vector can then be computed using the current feedback and the semantic values in the repository. The dot product measures the semantic similarity between the query and each database image [5].This directs to retrieve efficient medical images based on visual contents. This paper proposed the content based medical image retrieval system by means of Gabor Wavelet to extract texture features of MRI images. Then the K-means clustering and Euclidean distance measure are used to retrieve related images for the query image in medical diagnosis [6].

In this research the medical field, digital images are produced in ever increasing quantities and used for diagnostics and therapy. The swift expansion of digital medical images has enforced the requirement of efficient Content-based image retrieval system for retrieving medical images that are visually similar to query image. Such systems provide great assistance to doctors in clinical care and research. In this paper, they have designed a content Based Image Retrieval System for Medical Databases (CBIR-MD) based on various techniques like Fourier descriptor, Euclidean distance, Canberra distance and analysed its performance on Endoscopy, Dental and Skull images [7]. CBIR is an approach for retrieving semantically-relevant images from an image database based on automatically-derived image features. The unique aspect of the system is the utilization of hierarchical and k-means clustering techniques [8].

IMPLEMENTATION OF CBIR METHODS

Shape Based Method

Shapes are all over the place; human eyes identify and classify the experienced objects according to their shape. Similarly, when a computer is given the task of image matching and search, it can only be done accurately if computer recognizes the shapes as content contained in an image. For shape based image retrieval, the image feature extracted is usually an N dimensional feature vector which can be regarded as a point in a 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. The desirable distance measure should reflect human perception. Various similarity measures have been exploited in image retrieval. In our implementation we have used Euclidean distance for similarity measurement.

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.

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 specialists' 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.

Using Low-Level Visual Features

The image retrieval process consists of two main phases: preprocessing phase and retrieval phase. Both phases are described as follows. The pre-processing phase is composed of two main components: a feature extraction model and a classification model. The input of the pre-processing phase is the original image database , The output of the pre-processing phase is an index relating each image to its modality and a feature database.

The Feature Extraction Model

The feature extraction model operates on the image database to produce two kinds of features: histogram features and meta-features. Histogram features are used to build the feature database, which is used in the retrieval phase to rank similar images. Meta-features are a set of histogram descriptors, which are used as the input to the classification model to be described later.

NEED OF THE STUDY

The image is probably one of the most important tools in medicine since it provides a method for diagnosis, monitoring drug treatment responses and disease management of patients with the advantage of being a very fast non-invasive procedure, having very few side effects and with an excellent cost-effect relationship. Hard-copy image formats, i.e., analog screen films, were the initial support for medical images but they are becoming rarer. Maintenance, storage room and the amount of material to display images in this format contributed for its disuse.

Nowadays digital images, the soft-copy format, lack the previous mentioned problems while offering the possibility of text annotations in metadata format. With the increase of data storage capacity and the development of digital imaging devices, to increase efficiency and produce more accurate information, a steady growth of the number of medical images produced can be

easily inferred. This huge amount of data also provides an excellent resource for researchers in the medical field.

RECENT WORK IN CBIR

Support vector machines (SVM) are extensively used to learn from relevance feedback due to their capability of effectively tackling the above difficulties. However, the performances of SVM depend on the tuning of a number of parameters. It is a different approach based on the nearest neighbor paradigm. Each image is ranked according to a relevance score depending on nearest neighbor distances. This approach allows recalling a higher percentage of images with respect to SVM-based techniques [11] there after quotient space granularity computing theory into image retrieval field, clarify the granularity thinking in image retrieval, and a novel image retrieval method is imported. Firstly, aiming at the Different behaviors under different granularities, obtain color features under different granularities, achieve different quotient spaces; secondly, do the attribute combination to the obtained quotient spaces according to the quotient space granularity combination principle; and then realize image retrieval using the combined attribute function. [12] Then a combination of three feature extraction methods namely color, texture, and edge histogram descriptor is reviewed. There is a provision to add new features in future for better retrieval efficiency. Any combination of these methods, which is more appropriate for the application, can be used for retrieval. This is provided through User Interface (UI) in the form of relevance feedback.

The image properties analyzed in this work are by using computer vision and image processing algorithms. 1. Evaluating an emotional response to color images. It is mainly used for the case – base reasoning methodology, emotional evolution of color images values , and also find out fuzzy similarity relational & inter and intra similarities and used for visual descriptors.

OBJECTIVES OF THE STUDY

The prime aim of the proposed research work is to design a framework for Content Based Image Retrieval system for biomedical images for highly enhanced classification and in order to accomplish the research aim, the following objectives of the study are proposed:

- To collect multiple categories biomedical images that has modalities, body parts, and orientation.
- To perform feature classification based on image filtering using SVM considering multiple categories of biomedical images.
- To evaluate category specific resemblance synthesis technique for multiple categories of medical image.
- To apply the feature extraction technique using visual color descriptors e.g. Color Layout Descriptor and Edge Histogram Descriptor.
- To apply explicit significance feedback on resemblance synthesis based technique for better retrieval system and establishes the resemblance between the queried image and target image.

RESEARCH METHODOLOGY

The research methodology will mainly focus on the achieving the proposed architectural goal with a mathematical model then simulating it as a kind of prototyped implementation with variety of medical image datasets. The following would be essential steps to achieve the novelty with better performance.

- Collection of all the algorithms previously deployed on CBIR for medical images.
- Conducting literature survey for all the research work currently conducted for CBIR for medical images and analyzing the outcome of the experiments.
- Narrowing the collected data to gather problems and to formulate problems for solving it.
- Create system architecture for the problems and formulate algorithms and pseudo code.
- Conduct pilot programs for evaluating the algorithms and analyze/compare the results with the existing system.
- Use of cost-effective diversified tools and technologies to implement it.
- Software testing in large scale for the performance analysis of the designed model.
- Comparative Analytical modeling for the CBIR Systems for Medical images application to be developed with previous research models.
- Publication of research papers

Quantitative research using statistical methods will starts with the collection of data, based on the hypothesis or theory. Usually a big sample of data will be collected which may require verification, validation and recording before the analysis can take place.

THE PROPOSED ARCHITECTURE OF THE RESEARCH IS AS BELOW:

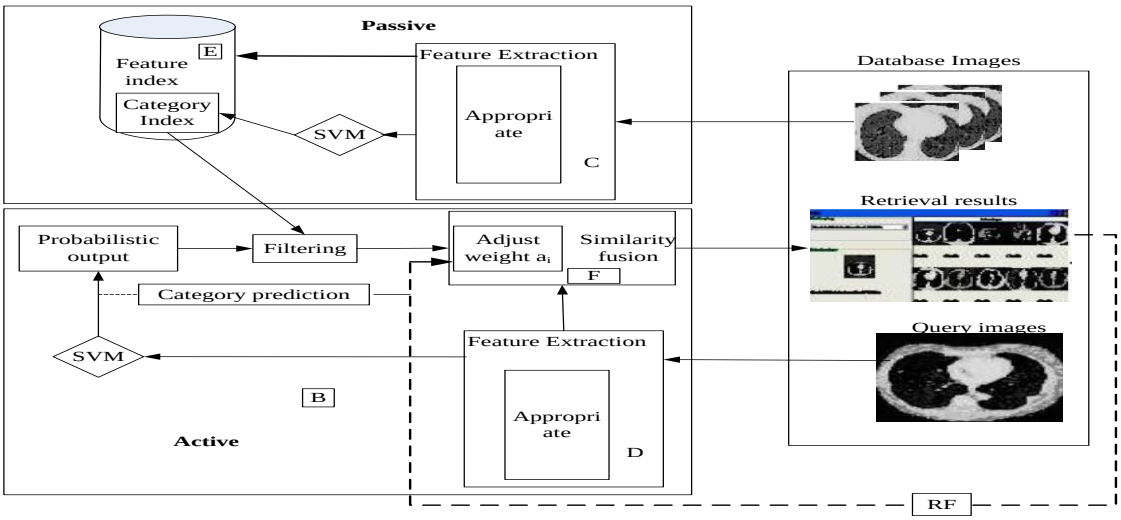

Figure: 2 Architecture of the research modal

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