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A Study on CBIR for Brain Tumor Magnetic Resonance Imaging

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Abstract- Content based image retrieval is used for retrieving images from database by giving query. Content of an image can be expressed in terms of color, shape and texture. A study on CBIR for Brain Magnetic Resonance Imaging (MRI) is the research area in computer vision and image processing to diagnose and treat disease. MRI is used in radiology to interrogate, function of the body for analyzing health and identifying disease. MRI scanners hold strong magnetic field and radio waves to form images of the body. This research plans to spread the information of the Content Based Image Retrieval approach to the practical use of medical image and to differentiate between the normal and abnormal images based on a distinctive attribute. In this paper, we will focus on using CBIR, brain MRI from large medical databases, notify the problems specific to this area and describe the recent advances in the field.

Keywords- content based image retrieval, brain magnetic resonance imaging (MRI), feature extraction, classification, image database

I. INTRODUCTION

Content based image retrieval is the most active research areas in computer vision and image processing [1]. It is used for automatic indexing and retrieving images from large database by using query. It is fast searching of images based on visual features. Image database contains millions of images by using common keywords in database system which can be retrieved by human operators. One of the fields that may benefit more from CBIR in radiology. Radiology is a medical specialty that employs the use of image is to analyze and treat disease in the human body. Radiologists use many technologies such as X-ray radiography, ultrasound, computed tomography(CT), nuclear medicine, positron emission tomography(PET) and magnetic resonance imaging(MRI) to diagnose or treat disease.

Magnetic resonance imaging (MRI) is used for many reasons, for detecting problems such as brain tumors, bleeding, injury, blood vessel diseases. MRI scan can be used for brain, chest, blood vessels, abdomen and pelvis, bones and joints. In this paper, we will focus on CBIR in Brain MRI. The medical field has grown simultaneously in recent years has generated additional interest in methods and tools for the management analysis and communication of medical images.

Medical image explanation include of three tasks: (1) recognition of image findings, (2) interpretation of those finding a diagnosis or differential diagnosis, and (3) commendation for clinical management if a stable diagnosis had not been established [2]. In this paper, we propose a Brain MRI for detecting brain tumors and differentiate between normal and abnormal images. MRI can also find problems in the eyes and the ears.

In its broadest sense, still automatic segmentation is not possible. In this research area, various techniques for Content Based Image Retrieval (CBIR) systems have been studied and a number of features for classifying images extracted from medical journal and medical image retrieval articles into categories based on modalities have been investigated. These features were combined into different groups and used for classification.

The rest of this paper is organized as follows. Section II discusses about medical content based image retrieval. Section III presents the scheme of typical MRI in CBIR system. Section IV describes the similarity measures. Section V gives applications for MRI brain tumor. Finally we conclude in section VI.

II. MEDICAL CONTENT BASED IMAGE RETRIEVAL

A) Image Improvement

A visual image produced by computer processing is to improve the quality of a digitally stored image by manipulating image with software. It is quite easy, to make an image lighter or darker to increase or decrease the contrast. Image enhancement support many filters for altering images in various methods. Programs specialized for increasing enhancement is sometimes called image editor [3].

B) Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. The goal is to alter the representation of an image into something that is powerful and easy to examine [4]. It is typically used to discover the exact objects and a dividing line in images. It is the process of allocating a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

The result is categorized into two ways as: region based approach and contour based approach. Region based

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approach that satisfy a given homogeneity criterion. This criterion can be based on image features which mean color, shape and texture. Contour-based approaches usually start with a first stage of edge detection, followed by a linking process that seeks to exploit curvilinear continuity.

III. THE SCHEME OF TYPICAL MRI IN CBIR SYSTEM

The fundamental content based image retrieval which described in two parts: feature extraction and classification.

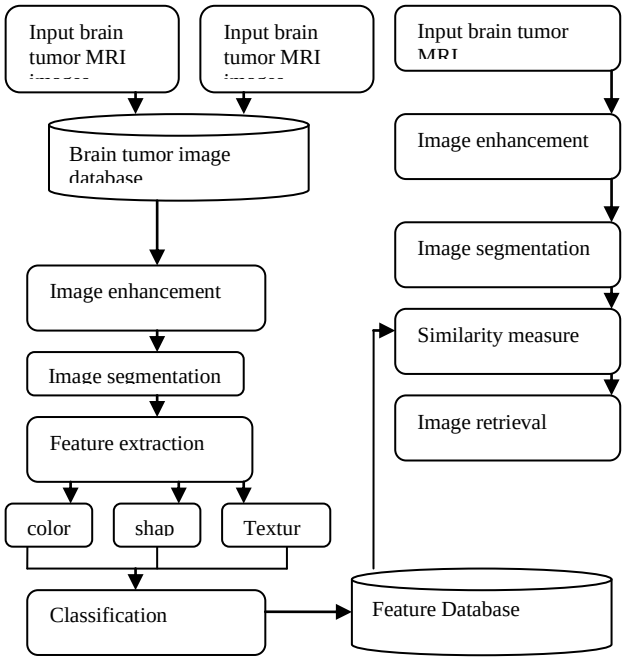

Fig 1. A scheme of a typical M-CBIR system

A) Feature Extraction

It is used to inherent features in images such as shape, color and texture. It helps to diagnosis and determines the accurate segmentation of brain tumor MRI images is important for a correct diagnosis by these tools. Feature extraction consist of three levels are pixel, local and global. The simplest visual image features are based on pixel. Images are measured to common size and compared using Euclidean distance. Local features are extracted from sub images from original images. Global features are extracted to describe whole image in an average fashion [5].

Feature can be extracted by both text based (keywords) and visual based (color, shape and texture).A CBIR using Brain tumor MRI has two basic components. The first component is retrieving the images from database and feature extracted such as color, shape and texture. The second component is classification has been done to find whether the image is normal or abnormal.

1) Color:

Color is the common features extracted in CBIR, because of the simplicity of extracting color information from images [5]. Calculating the distance measurement based on color aspect is derived by computing a histogram for an individual image that identifies the part of pixels within an image carrying precise values. Current research is making an effort to achieving a segment color part by region and by spatial relationship among many color regions.

Each color is represented as 3- dimensional vector which means one red value, one green value and one blue value (RGB) and Hue-Saturation value(HSV) totally 9(3*3) features each segments are obtained.

2) Shape:

Shape feature sets normally include edges, corners, and curvature scale space and chain codes. Shape contains the most absorbing visual information for easy understanding. It does not define the shape of an image but it defines the shape of a particular area. It will be determined first applying segmentation or edge detection to an image. Detecting the accurate shape will require human intervention, since methods like segmentation is difficult to automate completely.

Shape representation is normally defined to be invariant to translation, rotation, and scaling. Shape representation can be generally divided into two types are Region base, Boundary base [6].

Boundary base shape representation is used for the outer boundary of the shape as shown in Figure 2. This is done by defining the considered region using its external characteristics.

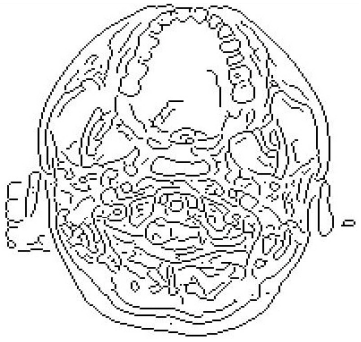

Fig 2. Boundary based representation.

3) Texture:

Texture is most important features of an image. It is used to represent visual patterns in images and determine and specify how they are spatially defined. They are represented by texels which are placed into many sets, depending on how many textures are identified in the image.

Texture is a difficult concept to determine. The process of identifying something in specific textures in an image is achieved by modeling as a two-dimensional gray level

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variation. The brightness of pairs of pixels is calculated as degree of contrast, regularity, coarseness and directionality may be estimated. Textural representation can be classified into two types of approach are: statistical and structural approaches.

B) Classification

The main idea of Support Vector Machine is to specify optimal hyper plane by minimize an upper bound of the general statement error through maximize the distance between the separating hyper plane and the data. It is found that maximize the margin between itself and the nearest training points [7].

The output result from Principal Component Analysis comes to the classifier as an input. SVM classifies the MRI database into two classes consisting of normal images, and abnormal images.

The results for the proposed classifiers are compared in Table 1, which shows the percentage of classification between the two different image classes.

Table 1 classification percentage between normal and abnormal classes.

96%	No of normal image which classify as normal class
100%	No of abnormal image which classify as abnormal class

1) Image Database:

The techniques have been implemented on a human brain tumor MRI. All the input dataset (total images is 90: 42 images are normal, 48 images are abnormal) used for classification consists of axial, T2-weighted, 256 -256 pixel MRI brain images. Figure 3 shows some sample for differentiate between normal and abnormal images in brain tumor MRI images.

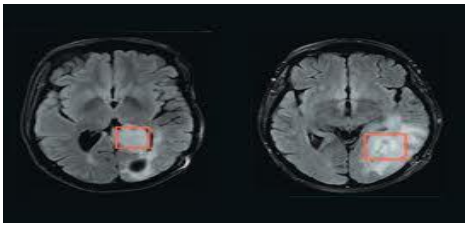

Fig 3 shows sample MRI images from the database.

IV. SIMILARITY MEASURE

Similarity measure is to represent the image features as multidimensional vectors. In image retrieval system, the user gives a query and the system should find images that are somehow relevant to the particular query [8]. In medical image, similarity measure commonly is used to define the distance between input image feature and images in DB feature. Vector space is the simplest feature representation for distance between input image and features in feature database. There are four classes of similarity measures are color, texture, shape, object and relationship.

V. APPLICATIONS FOR MAGNETIC RESONANCE IMAGING BRAIN TUMOR IMAGES

Image registration is the process of taking two or more images of the same scene at different times, from different point of view. It is a crucial step in all image analysis tasks in which the final information is gained from the combination of various data sources, like in image fusion, change detection, and multi channel image restoration.

A) ASSERT

Automatic Search and Selection Engine with Retrieval Tools was developed by Purdue University, Indiana University in USA. This system extracts 255 features of texture, edge, shape and gray-scale properties in pathology-bearing regions.

B) 3D PET/CT

It supports the effective interpretation with whole body FDG oncology studies and interacts with PET and CT. It determines radiologists to accurately and visibly blend PET and CT to combine anatomical and functional images. 3D allows you to separately the advanced visualization and analysis tools you need on a routine basis.

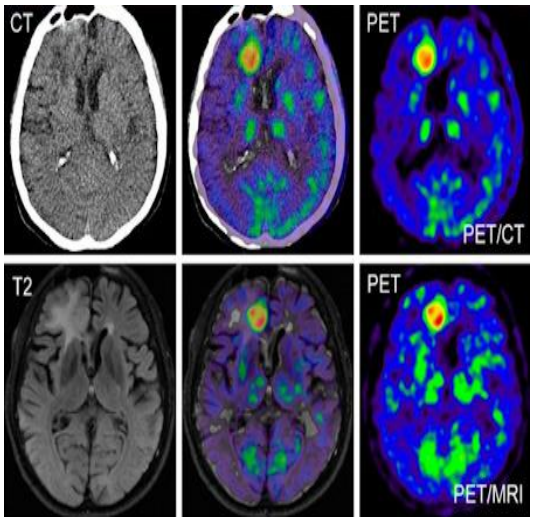

Fig 4. The 3D PET/CT image retrieval system

C) MIRAGE

It is an online learning system on medical informatics. Which is situated at Middlesex University in the United Kingdom, which covers over 100,000 2D and 3D images and facilitates such as domain, atlas and content-based retrieval for both 2D and 3D images.

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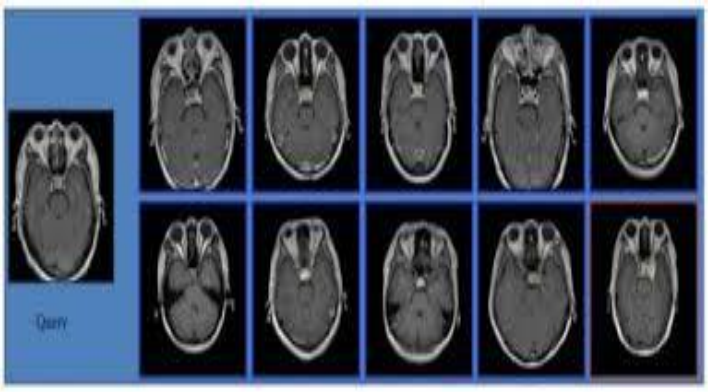

Fig 5. The MIRAGE image retrieval system

VI. CONCLUSION

This paper has focused on CBIR Brain tumor Magnetic Resonance Imaging speculations for future research. The overall efficiency of Magnetic Resonance Imaging brain tumor image retrieval can be improved by the usage of feature extraction and using CBIR, study of strength and promotion in the medical field and classification. Content-based image retrieval of diagnosis brain tumor disease has achieved a degree of maturity, at a research level, at a time of significant need. Since, the field has yet to make considerable attacks into mainstream clinical practice, medical research.

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