International Journal of Information and Computation Technology.
ISSN 0974-2239 Volume 4, Number 4 (2014), pp. 415-418

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Image Analysis for Identifying Brain Diseases

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Abstract

Image segmentation is one of the primary steps in image analysis for object identification. The main aim is to recognize homogeneous regions within an image as distinct and belonging to different objects. Segmentation stage does not worry about the identity of the objects. They can be labeled later. The segmentation process can be based on finding the maximum homogeneity in grey levels within the regions identified.

Segmentation subdivides an image into its regions of components or objects and an important tool in medical image processing. As an initial step segmentation can be used for visualization and compression. Through identifying all pixels (for two dimensional image) or voxels (for three dimensional image) belonging to an object, segmentation of that particular object is achieved. In medical imaging, segmentation is vital for feature extraction, image measurements and image display. Segmentation of the brain structure from MRI has received paramount importance as MRI distinguishes itself from other modalities and MRI can be applied in the volumetric analysis of brain tissues such as multiple sclerosis, schizophrenia, epilepsy, Parkinson's disease, Alzheimer's disease, cerebral atrophy, etc.

Other important aspect of the segmentation method is the color space from which color features are computed (for instance RGB space with Euclidean color distance). Each segmentation technique is usually based on some mathematical model (theory) and/or algorithmic approach (for instance fuzzy clustering, Markov random field, recursive procedure, bottom-up algorithm etc.). Most of segmentation techniques assume something about the scene which is seen in the image (for instance objects are polyhedral made of dielectric materials).This is an additional knowledge attribute of the given segmentation method.

Keyword: Image Segmentation, MRI, fMRI, Tumor, Pixel.

1. Introduction

1.1 Image Segmentation

Image segmentation is used to separate an image into several "meaningful" parts. It is an old research topic, which started around 1970, but there is still no robust solution toward it. There are two main reasons; the first is that the content variety of images is too large, and the second one is that there is no benchmark standard to judge the performance. Image segmentation is identification of homogeneous regions in the image. Many algorithms have been elaborated for gray scale images. However, the problem of segmentation for color images, which convey much more information about objects in scenes, has received much less attention of scientific community. While several surveys of monochrome image segmentation techniques were published, similar surveys for color images did not emerge [1].

Image segmentation is a process of pixel classification. An image is segmented into subsets by assigning individual pixels to classes. It is an important step towards pattern detection and recognition. Segmentation is one of the first steps in image analysis. It refers to the process of partitioning a digital image into multiple regions (sets of pixels). Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. The level of segmentation is decided by the particular characteristics of the problem being considered. Image segmentation could be further used for object matching between two images. An object of interest is specified in the first image by using the segmentation result of that image; then the specified object is matched in the second image by using the segmentation result of that image [5].

1.2 Objectives

- Objective of utilizing more meaningful information to improve brain tumor segmentation
- An approach which employs bilateral symmetry information as an additional feature for segmentation
- Motivated by performance improvement in the general automatic brain tumor segmentation systems

2. Proposed System Design

It is based on the image segmentation method, which refers to the major step in image processing, the inputs are images and, outputs are the attributes extracted from those images. It will help to find out symmetric extraction of the brain image.

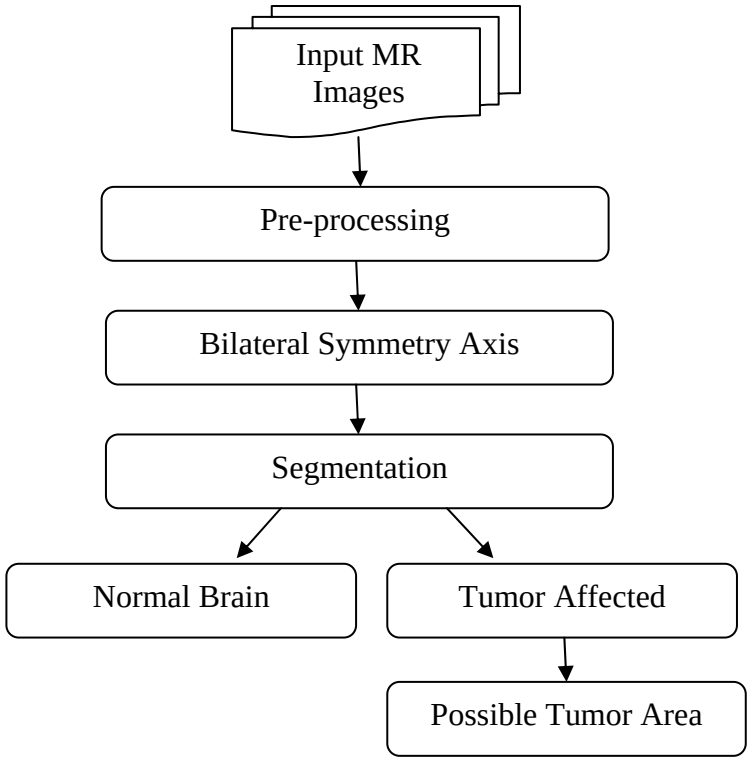

Fig. 2.1: Proposed Model.

3. Experimental Analysis

Several simulated experiments are carried out to demonstrate the validity and feasibility of the segmentation method for segmenting regions from brain images. Measures reflect the effectiveness of a image segmentation method. The system has been implemented using MATLAB because of powerful inbuilt mathematical and image processing functions.[8]

In the first step, the color image is transformed from RGB to gray scale. Although, traditionally, RGB is the most commonly used model for fMRI images. All of our data are acquired on Phillips/Siemens/Wipro 1.5T scanners for brain image segmentation. Table 5.1 show detail description about the patient with their disease and grade which contains original MRI images with tumor used for this study. The input images are of patient ID's 397384 (High Grade) 19430618 (Low Grade)[11]

Table 3.1: Initial Testing - Number of detected edges.

Patient ID	**Grade**	**Number of Detected Edges**		
		Robert	**Prewitt**	**Canny**
397384	High	5259	4382	1997
19410407	High	5120	4323	1836
19530428	High	6807	5757	2302

19790628	Low	1491	649	317
19560416	Low	2509	1080	433
19430618	Low	2567	1072	417

4. Conclusions

A new system that can be used as a second decision for the surgeons and radiologists is proposed. It determines whether an input MRI brain image represents a healthy brain or tumor brain. High grade tumor have more true edges than low grade. MRI of healthy brain has an obviously character almost bilateral symmetrical However, if there is macroscopic tumor, the symmetry characteristic will be weakened. According to the influence on the symmetry by the tumor, we develop a segment algorithm to detect the tumor region automatically.

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