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Dual Tree Wavelet Based Brain Segmentation And Tumor Extraction Using Morphological Operation

C. Prema, G. Athilakshmi Vinothini, P. Nivetha, A. Sahaya Suji
Research Scholar, U.G Students , JACSI college of engineering, Nazareth, TN, India

Abstract

Brain Cancer Detection system is designed. Aim Of this paper is to locate the tumor in brain. A computer based diagnosis is performed in order to detect the Tumor from the given Magnetic Resonance Image. This paper includes two phases as Brain segmentation and tumor extraction. For brain segmentation, dual tree wavelet based watershed segmentation algorithm is used. In all the existing methods, wavelet based segmentation is not used to segment the brain. This wavelet based segmentation gives better result compared with the existing methods. For extracting the tumor region, morphological operations are used. The proposed method is compared with existing algorithm to check the efficiency of this method. Better result is achieved by this proposed method.

1. Introduction

The National Cancer Institute (NCI) estimated that 22,070new cases of brain and other central nervous system (CNS) cancers would be diagnosed in the United States in 2009[1]. The American Brain Tumor Association (ABTA) clarifies this statistic further by estimating that 62,930 new cases of primary brain tumors would be diagnosed in 2010 .Today, tools and methods to analyse tumors and their behaviour are becoming more prevalent. Clearly, efforts over the past century have yielded real advances; however, we have also come to realize that gains in survival must be enhanced by better diagnosis tools. Although we have yet to cure brain tumors, clear steps forward have been taken toward reaching this ultimate goal, more and more researchers have incorporated measures into clinical trials each advance injects hope to the team of caregivers and, more importantly, to those who live with this diagnosis . Magnetic Resonance Imaging (MRI) is the state-of the-art medical imaging technology which allows cross sectional view of the body with unprecedented tissue contrast. MRI is an effective tool that provides detailed information about the targeted brain tumor anatomy, which in turn enables effective diagnosis, treatment and monitoring of the disease. Its techniques have been optimized to provide measures of change within and around primary and metastatic brain tumors, including oedema, deformation of volume and anatomic features within tumors; etc.MRI provides a digital representation of tissue characteristic that can be obtained in any tissue plane. The images produced by an MRI scanner are best described as slices through the brain. MRI has the added advantage of being able to produce images which slice through the brain in both horizontal and vertical planes. This makes the MRI-scan images an ideal source for detecting; identifying and classifying the right infected regions of the brain. Most of the current conventional diagnosis techniques are based on human experience in interpreting the MRI-scan for judgment; certainly this increases the possibility to false detection and identification of the brain tumor. On the other hand, applying digital image processing ensures the quick and precise detection of the tumor [5]. One of the most effective techniques to extract information from complex medical images that has wide application in medical field is the segmentation process. The main objective of the image segmentation is to partition an image into mutually exclusive and exhausted regions such that each region of interest is spatially contiguous and the pixels within the region are homogeneous with respect to a predefined criterion. Widely used homogeneity criteria include values of intensity, texture, color, range, surface normal and surface curvatures. In our paper we have taken Texture based Brain segmentation using dual tree wavelet decomposition for brain segmentation and morphological operation for tumor extraction [3].

2. Existing Image Segmentation Approach

Image segmentation plays a critical role in all advanced image analysis applications, a key purpose of segmentation into divide image into regions and objects that correspond to real world objects or areas, and the extent of subdivision depends on requirements of specific application. In this brain segmentation
Process we have chosen analysis process, thus we have implemented some existing algorithms. They are Watershed, Texture, and Otsu thresholding.

2.1 Watershed based segmentation

Watershed transform is often applied to this problem. The watershed transform finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low[2].Segmentation using the watershed transforms works well if you can identify, or "mark," foreground objects and background locations. Marker-controlled watershed segmentation follows this basic procedure:

1. Compute a segmentation function.
2. Compute foreground markers.
3. Compute background markers.
4. Modify the segmentation function so that it only has minima at the foreground and background marker locations.
5. Compute the watershed transform of the modified segmentation function.

6: Visualize the Result

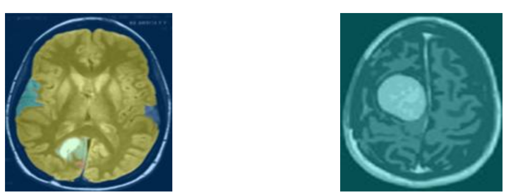

Fig. 1:a.Segmented output b. Segmented output

The above watershed algorithm was not suitable for all the images.

2.2 Texture based segmentation

Texture segmentation is to identify regions based on their texture. Your goal is to segment two kinds of fabric in an image using texture filters.

1: Read Image
2: Create Texture Image
3: Create Rough Mask for the Bottom Texture
4: Use Rough Mask to Segment the Top Texture
5: Display Segmentation Results

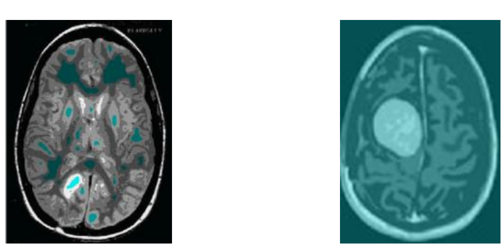

Fig. 2:a. Segmented output b. Segmented output

2.3 Otsu thresholding

A measure of region homogeneity is variance .Otsu's method selects the threshold by minimizing the within-class variance of the two groups of pixels separated by the thresholding operator. It does not depend on modeling the probability density functions, however, it assumes a bimodal distribution of gray-level values. compute histogram and probabilities of each intensity level.

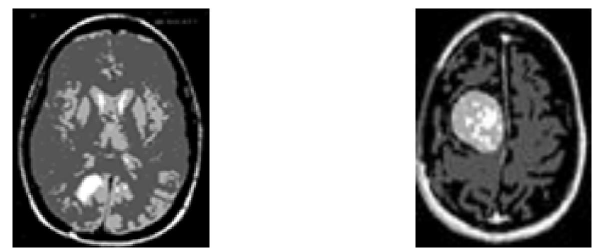

Fig. 3:a.Segmented output b.Segmented output

The above all existing algorithm is not shows exact segmentation for all the database images.

3. Proposed approach for brain segmentation

The objective of image segmentation is to cluster pixels into prominent image region. In this paper, we proposed Texture based brain segmentation using Dual Tree Wavelet Decomposition [3]. It calculates the complex transform of a Signal using two separate DWT decompositions (tree a and tree b). If the filters used in one are specifically designed different from those in the other it is possible for one DWT to produce the real coefficients and the other the imaginary .This redundancy of two provides extra information for analysis but at the expense of extra computational power. It also provides approximate shift-invariance (unlike the DWT) yet still allows perfect reconstruction of the signal. The design of the filters is particularly important for the transform to occur correctly and the necessary characteristics are: The low-pass filters in the two trees must differ by half a sample period. Reconstruction filters are the reverse of analysis. All filters from the same orthonormal set. Tree a filters are the reverse of tree b filters both trees have the same frequency response.

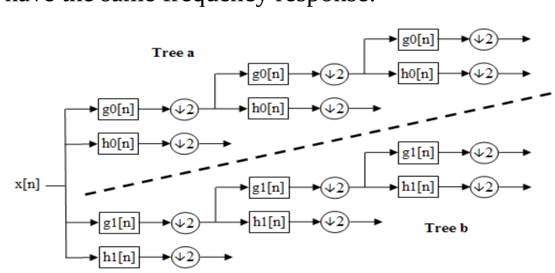

Fig.4: Dual tree structure

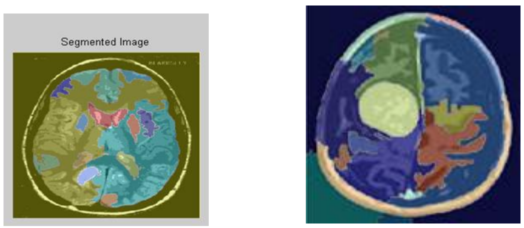

Fig .5: a. Segmented image b.Segmented image

4. Tumor extraction using morphological operation

Tumor Extraction is a concept of which extracting tumor pixels from the segmented image [6]. In our process tumor extraction is a third process thus MRI image containing tumor is first segmented using Texture segmentation Dual tree wavelet decomposition. Then from the segmented image in which the tumor area is extracted using the morphological operation. Morphological image processing is collection of non-linear operations related to the shape or morphology features in an image [4]. Binary image may contain numerous imperfections. In particular, the binary regions produced by simple threshold are distorted by noise and texture. Morphological image processing pursues the goal of removing these imperfections by accounting for the form and structure of the image. These techniques can be extended to gray scale images.

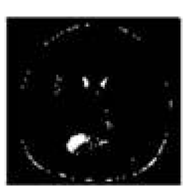

Fig 6: Morphological operated dilated image

5. Results and analysis

MRI images are taken as input. Different MRI samples are collected and given as input for the query phase. The result is as follows

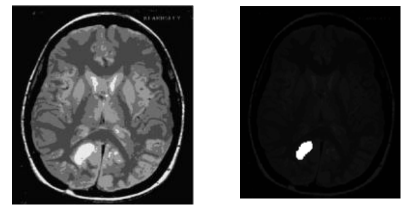

Fig. 7: a. Input Image b. Tumor extraction

Analysis based on few Database images

Input image Output tumor region

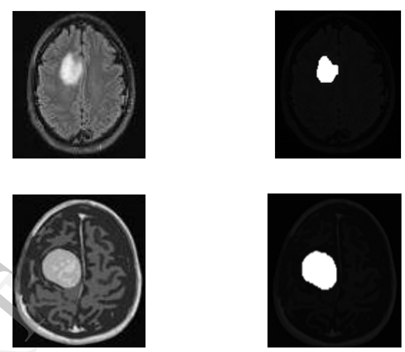

Fig.8: Comparison in the data base images

6. Conclusion and future work

This project work was conducted to extract brain tumor using medical imaging techniques. The main technique used was segmentation, which is done using a method Texture based segmentation using Dual Tree Wavelet Decomposition. The proposed segmentation method was experimented with MRI scanned images of human brains: thus segmented the brain image clearly. Samples of MRI human brains were taken, and then were processed through segmentation method thus giving efficient end results. Next by applying the morphological operation tumor was extracted from the segmented brain image. This technique gives efficient results as compared to previous researches. Experiments are applied on various images and results were extraordinary. Our proposed research is easy to execute and thus can be managed easily.

Future work is to extend the above proposed method for color based segmentation of 3D images. For this purpose a classification method is needed to organize three dimensional objects into separate feature classes, whose characteristics can help in diagnosis of brain diseases.

7. References

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