Computer Assisted Diagnosis of Tumor in Brain MRI Images using Wavelet as input to Ada-Boost classifier

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ABSTRACT

Brain tumor segmentation is an significant method in medical image analysis since it provides an information related to anatomical structures as well as possible anomalous tissues necessary to treatment planning and patient follow-up. In this paper, fully automatic brain tumor segmentation scheme is presented, which focuses on the structural analysis on both tumorous and normal tissues. Our proposed method consists of three major steps: i) tumor region location ii) feature extraction using wavelet iii) feature reduction using priniciple component analysis and iii) classification using Ada-Boost classifier. The experimental results are validated using the evaluation metrics such as, sensitivity, specificity, and accuracy. The authors proposed system is compared to other neural network classifier such as Feed Forward Neural Network(FFNN) and Radial Basics Function (RBF). The classification accuracy of the proposed system results is better compared to other leading methods.

Keywords: Classification, Discrete Wavelet Transformation(DWT), Feature Extraction, Magnetic Resonance Image (MRI), Principe Component Analysis (PCA), Segmentation, Tumor

INTRODUCTION

The classification of Magnetic Resonance brain images be important in the medical field because it is essential for treatment planning and diagnosing abnormality (For e.g Brain Tumor, measure tissue volume to view tumor growth, learning anatomical structure and patient follow up. Manual classification of brain tumor in MRI is a difficult and time-consuming task (Chelsea Kidwell 2010). Manual classification is very prone to error due to interobserver inconsistency and human error. The classification results are highly low-grade which leads to critical results. Thus, an automatic or semi-automatic classification method is highly desirable since it reduces the load on the human viewer, large number of cases can be handled with same accuracy, moreover results are not affected due to fatigue, data overload, faster communication. There are no universal algorithm for segmentation of

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every medical images. Different body parts MRI image needs different type of segmentation.

Brain tumor is a collection of irregular cells developing in the brain. Brain tumors can be benign or malignant. Low grade gliomas and meningiomas, which are benign tumors and glioblastoma multiform is a malignant tumor and represents the most common primary brain tumor. Benign brain tumors have a homogeneous structure and do not contain cancer cells. They may be either simply monitored radiologically or surgically eradicated and they doesn’t produce back (Jayachandran & Dhanasekaran 2013a). Malignant brain tumors have a heterogeneous structure and contain cancer cells. They can be treated by radiotherapy, chemotherapy or a combination of these and they are life threatening. Therefore, diagnosing the brain tumors in a proper time is very vital for further treatments (Ricci & Dungan 2001). Brain tumors include all tumors inside the cranium or in the central spinal canal. They are created by an abnormal and uncontrolled cell division, usually in the brain itself, but also in lymphatic tissue, in blood vessels, in the cranial nerves, in the brain envelopes (meninges), skull, pituitary gland, or pineal gland. Brain tumors may also spread from cancers primarily located in other organs (metastatic tumors). Any brain tumor is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. However, brain tumors (even malignant ones) are not invariably fatal, especially lipomas which are inherently benign (Lia et al 2008).

The texture elements or texels acts as attributes based on the pixel region that digitizes the individual object into binary forms of information through computer imaging based on the silhouette of image information. The pixel region of the image consists of specified extracting object labeled as binary values of “0” and “1”. The images are extracted mainly based on the horizontal projection, vertical projection and aspect ratio. The area and perimeter based features developed from the thinness ratio that maximize circle shape object and minimize for line shape object and it depends on edge factors of the extracting object. Likewise, the aspect ratio deals with elongation of the object based on the row and column values in the pixel regions and the Euler number analyzes the list of dot, and curves in the object. The probability based distribution function estimates the histogram features such as skew, mean, entropy, standard deviation and energy function of the gray scale image (Luts et al 2008).

The step wise automated and clinically tested method for the detection of brain abnormalities and tumor edema segmentation, by using MRI sequences is presented by Goyal et al (2011). This method follows the radiologist’s approach for the brain diagnosis using multiple MRI sequences, which is not the case of many existing methods and training phases. The stages included in this work are given below. Initially, all the MRI sequences are preprocessed, then T2, T1 and T1 post contrast for size standardization, contrast equalization and division into active cells. Then, by exploiting vertical symmetry of the brain, the T2 MRI sequence is identified as normal or abnormal. After this, using the hyper intense nature, the region of abnormality is determined. By using the T1 and its post contrast sequences, the tumor affected region is separated from the edema. Finally, the volume of the tumor found is estimated and the anatomical differential of the possible disorders are generated.

The novel method for tumor classification in brain images is developed by Leblanc et al (1996) that is carried out in the Proton Magnetic Resonance spectroscopy (MRS) images in the set of various brain related images. The results obtained by employing this method portrays that this approach is accurate, fast and robust. For diagnosing breast cancer and to detect and localize small lesions in 3D with mathematical models is proposed by Fear et al (2003). In order to boost lesions responses and to diminish then earlier or for applying surgery, image formation algorithms are developed. It is given that the deformation covers of changes occur at the skin layer and the succeeding operations concentrate on the non-uniformity of the tissue regions. The results of this work show that the Confocal
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