Chapter 29
Classification of Magnetic Resonance Image and Segmentation of Brain Tissues for Tumor Detection

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ABSTRACT

Advancing techniques in image processing has led to many inventions and provides valuable support especially in medical fields to identify and analyze the diseases. MRI images are chosen for detection of brain tumor as they are used in soft tissue determinations. Brain tumor is one of the severe diseases in the field of medicine. Early identification of disease increases the chances for successful treatment. Classification and Segmentation plays a vital role in identifying the disease. First, image Pre-processing is used to enhance the image quality. Subsequently, Decomposition is performed using Dual-Tree Complex Wavelet Transform to analysis texture of an image and features are extracted using Gray-Level Co-Occurrence Matrix. Then, Neuro-Fuzzy and Neural Network can be used to categorize the types of Brain Tumor such as normal, benign and malignant. Finally, tumor region is detected using Kernel weighted clustering method by segmenting the brain tissues and also to find the size of the tumor.

INTRODUCTION

Classification and segmentation plays an important role in medical imaging. Classification used to classify the MRI image into Normal, Benign and Malignant. Segmentation segments the brain tissues to detect tumor region. The objective of this work is to classify the MRI image and identify the tumour region. In order to correctly classify the image, it is necessary to analysis texture using Dual- Tree Complex Wavelet

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Transform and to extract features from multiple sub- bands. Using Neuro- fuzzy technique, accurately classify the MRI image into Benign, Malignant and Normal image. Then, segmentation algorithm further segments the brain tissues of enhanced image into white matter, Gray matter and cerebrospinal fluid (CSF) to detect the tumor region.

Manual classification of tumor is done by technician by looking at Magnetic resonance image which leads to incorrect prediction of tumor and suggesting wrong medicine to patients. It is a time consuming and needs expert persons to identify the tumor. Classification deals with human life which should be accurate. We used two techniques for accurate classification such as Neural Network and Adaptive neuro-fuzzy inference system. If both classification results are same, then it should be given to segmentation step. New input MR image would be taken, if results are not same.

El-Dansham et al. (2010) have proposed three steps; they are feature extraction, dimensionality reduction, classification. Here, features are extracted from MR image using DWT. Features are selected by principal component analysis and classification is done by using artificial neural network and k-nearest neighbour. The limitation of this work is that it requires fresh training when there is an increase in image database. Jianzhong Wang et al. (2008) describe a modified fuzzy-c means algorithm for image segmentation. Modified fuzzy-clustering means outperforms than standard FCM. This algorithm is computationally expensive and it is not suitable to apply for large 3D data. Wushuai jian et al. (2012) proposed a technique to detect tumor in MR Image which consists of two steps such as feature extraction and classification. Features are extracted based on DT-CWT and classification using SVM. DT-CWT achieved accuracy of 96% when classified normal and abnormal images.

Salim lahmiri et al. (2013) presents an automatic feature extraction and classification from MR image. Features are extracted using DWT and classification is done by SVM. Ze-xuan ji et al. (2011) presented a modified method for improve accuracy with respect to noise and intensity in-homogeneity. Results show that the proposed method is more robust for different level of noise and more accuracy for both 2D and 3d brain MR image segmentation. A segmentation technique for segmenting the Magnetic resonance image into multiple clusters using multi objective fuzzy clustering technique presented in (Mukhopadhyaya et al., 2011).

Forouzanfar et al. (2010) proposed a technique to detect the tumor from magnetic resonance image. Genetic algorithm and particle swarm optimization to calculate the value of neighbourhood attraction includes location and features of neighbouring pixels. An automatic brain image segmentation method is presented in (Demirhan et al. and Guler, 2011). It consists of preprocessing, feature extraction, segmentation and evaluation stages. Statistical wavelet transform is used for feature extraction and Self-organization map is used for segmentation.

A hierarchical FCM algorithm, based on template matching techniques was suggested in (Kwon et al., 2003). But its main problem is a need to an exact framework. A combination of anisotropic diffusion model for enhancing the image quality, and k-means clustering technique for extracting the cancerous tissue was used in (Ahmed and Mohamad, 2008).

Murugavalli and Rajamani (2007) described a neuro-fuzzy segmentation process was used to detect various tissues such as white matter, gray matter and cerebrospinal fluid. Singhai and Ladhake (2013) presented a technique to detect tumor using watershed segmentation algorithm which is termed as the most effective algorithm for segmentation. Awe and Philips (2001) deals with the minimum error thresholding and the FCM for the MRI brain image segmentation. Distribution matching approach was used to detect the tumor in the image found in (Njeh et al., 2012).