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Automated Region Growing Approach for Brain Tumor Segmentation in 3D MR Images

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The proposed paper discusses an automated region growing approach for segmenting tumor from 3D FLAIR (FLuid -Attenuated Inversion Recovery) and corresponding T2 MR brain images. For segmenting brain tumor and its components, the proposed framework exploits a technique based on multiple thresholding to obtain the seed points for applying region growing approach on volumetric images. The methodology is divided into three major phases. In first phase, preprocessing is done on 3D FLAIR images and T2 images to reduce the noise, effect of speckles and to enhance the image contrast. The next phase includes implementation of thresholding technique in order to extract the set of seed points for region growing algorithm. In order to apply thresholding technique, thresholding values have been calculated using the image formed by combination of FLAIR and T2 input images. In the final phase, region growing approach is applied using multiple seed points obtained earlier to extract tumor out of the brain image. A publicly available dataset of Glioma patients tumor from BRAT Segmentation Challenge 2012 has been used for the segmentation process and the segmentation results are evaluated against their ground truth. The experiment shows that the proposed framework detects the accurate range of slices of the brain having tumor.

Keywords : Automated Region Growing, Brain Tumor Segmentation, FLAIR-MRI, Multiple Thresholding, T2 MRI, Volume Rendering.

1. INTRODUCTION

Rapid automation and advancement in medical imaging has led to tremendous focus of researchers towards the automated detection and segmentation of pathological tissues. Brain tumor segmentation is one such problem. Delineating brain tumor is an important task as it forms a platform for physicians for diagnosis of anatomical structures and to plan treatments, surgeries and radiotherapies. Presently, brain tumor is detected manually which is very time consuming and needs a lot of human expertise and efforts. Automation in tracing the boundaries of brain tumor can overcome these drawbacks. But poor image contrast, diffused boundaries of soft tissues and significant variations in size, shape, intensity and position of tumor (Figure 1) have made it a challenging task. This figure presents the single slice of various cases (after preprocessing) where the tumor is highlighted by enclosing it with a red color boundary. It can be seen that in some of the cases (Figure 1(a)), even when the brain has not developed completely, the tumor starts appearing while in other cases, tumor appears on the complete development of brain (Figure 1(c)). Sometimes, the intensity of tumor is very close to the intensity of the brain (Figure 1(e)) or other structures of brain like edges (Figure 1(d)) which makes tumor detection very difficult. Few MR images have incomplete brain structures as shown in figure (Figure 1(b), (e), (f)) due to which it is hard to use brain atlas for identifying the pathological tissues.

Large amount of complexities have given rise to numerous approaches for automated brain tumor segmentation. H. Andac *et al.* [1] have developed a semi-automated framework based on seeded cellular automata technique for segmenting brain tumor. However for seed selection, user intervention is required by manually

be to separate out both the swelling and tumor part from the brain 3D volumetric image.

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