



Multimodal Brain Tumor Segmentation using 3D-U-Net

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ABSTRACT

Brain tumours are the tenth biggest cause of mortality in the world, killing thousands of people each year. Gliomas are the most frequent and severe kind of brain tumour, having a relatively short life expectancy. Thus, treatment planning is essential for improving the quality of life. Magnetic resonance imaging (MRI) is a frequent imaging modality for evaluating these tumours; however, the volume of data generated by MRI prevents manual segmentation in an acceptable amount of time. This demands the employment of automatic segmentation techniques; however, automatic segmentation is difficult due to the great spatial and structural heterogeneity among brain tumours. In this paper, we propose a 3D U-Net deep learning architecture for the semantic segmentation of gliomas. We train our model twice: the first time, we use the bias correction procedure and the minmax scaler normalization in the pre-processing stage, and the second time, we skip the bias field correction technique. Without using bias correction techniques, we found that we still obtained outstanding results. The precision, sensitivity, specificity, dice score, and accuracy metrics are used to evaluate the quality of the segmentation results. We trained and tested our model using the High-Grade Glioma (HGG) of the BRATs 2018 dataset. Our model achieved a maximum Dice score metric of 0.89 for the whole tumour, 0.95 for the core tumour, and 0.90 for the enhancing tumour, with a 98% accuracy rate.

Keywords: Brain Tumor; Segmentation; MRI; Deep Learning; Medical Image Analysis.

INTRODUCTION

Medical imaging is an umbrella term for a variety of non-invasive methods used to view inside the human body without causing any harm. It creates images of internal body organs by using various medical imaging procedures such as MRI, CT scan, ultrasound, and others [18] for diagnostic and treatment purposes and is essential for making proper decisions that will enhance health of millions of people. medical image segmentation plays a crucial role in

