Summer 7-1-2020

Hyper Attentive Res-UNet for Semantic Segmentation of Brain Tumors

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An abnormal development of tissues in the brain causes brain tumor, hence becoming a notable reason for morbidity and mortality. These tumors do not have a uniform structure and differ with respect to shape, intensity and size in each patient. The radiologists need to diagnose these tumors accurately to decide the best course of treatment for the patients. The manual segmentation requires a lot of expertise and skills, but still sometimes it can be erroneous. However, the automatic segmentation techniques of brain tumors help in precise diagnosis and subsequently devise a proper treatment. We present a new architecture called *Hyper-Attentive Res-Unet*, which inculcates attention gates and hypercolumn in residual learning based UNet (Res-Unet). Skip connections in UNet help improve the accuracy by combining the spatial and contextual information. Attention gates and hypercolumn can improve localization and the model's ability to capture the semantics precisely. The attention gates focus on the activations of relevant information instead of allowing all information to pass through the skip connections in the Res-Unet. The hypercolumn merges the important contextual and spatial information distributed in all the layers of the decoder. In this way, rather than using only the last layer, it utilizes the information present in all layers of decoder for better localization. We have evaluated our model on the BraTS 2019 dataset, where the proposed model, Hyper Attentive Res-UNet has outperformed its individual counterparts Res-UNet, Res-UNet with Attention Gate and Res-UNet with Hypercolumn. Based on experimental results, our new model gives competitive performance than the existing popular models such as U-Net [5], QuickNAT [28], SegNet [39] and DenseNet [44]. The proposed Hyper Attentive Res-UNet has achieved Dice Scores of 0.881, 0.841 and 0.759 on the Whole tumor, Tumor core and Enhancing tumor segmentations respectively on unseen test data.