Stroke Lesion Segmentation with 2D Convolutional Neutral Network and Novel Loss Function

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Abstract. Recently, CT perfusion(CTP) has been used to triage ischemic stroke patients in the early stage, because of its speed, availability, and lack of contraindications. But CTP data is too simple to describe the regions of lesion location precisely. We propose a CTP data analysis technique that can define the regions of ischemic stroke lesion based on convolutional neutral network and a novel loss function with ground-truth drawn on MR_DWI modality scans manually. We use a 2D U-Net[1] with residual connections as our model backbone. The main contribution of our work is that we propose a novel loss function that contains a weighted cross-entropy loss and generalized dice loss[2] to balance the gradients of the positive and negative areas in the training phase. And the weighted cross entropy loss can highlight the area of stroke lesion effectively to enhance the structural information. The data augmentation and warm-up learning rate policy are used in the training phase. Through experiments, we found that the training results of this novel hybrid loss are more stabilized. Compared with cross entropy loss, the average dice coefficient with four-fold cross-validation is increased approximately by 2%. So far, our best performance of average dice coefficient is 55.23% on our defined validation sets. From the result of our experiments, the weighted cross entropy loss with generalized dice loss can achieve a better performance in CTP data set.

Keywords: 2D U-Net, residual connection, cross-entropy loss, generalized dice loss

References

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