3D Multi-scale U-Net with Atrous Convolution for Ischemic Stroke Lesion Segmentation

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Abstract. We proposed a novel 3D multi-scale U-shape network with atrous convolution[1] for ischemic stroke lesion segmentation. This network uses skip connections to combine low-level feature maps with higher-level ones, and multi-scale loss functions to constraint the back-propagation of the network. These methods enables precise pixel-level localization. The modalities of CBF, CBV, MTT, Tmax and PWI are used as input of our network. In order to overcome the over-fitting, the data augmentation (e.g. random rotations, random crop and radial distortion) and dropout techniques are used in training phase. Usually, the problem of data unbalance is encountered in medical image segmentation. Therefore, we choose Jaccard index[2] (Intersection Over Union) and binary cross entropy together as loss function to handle unbalanced data in ISLES2018. Finally, to minimize this hybrid loss function, we simultaneously maximize probabilities for true positive lesion pixels to be predicted and maximize the intersection of predicted region and ground-truth region. In the experiment, we separated the ISLES2018 data into two parts:75% for training and 25% for validation. By constantly adjusting the network's hyperparameters, our model can achieved a DICE coefficient of 55.86% on the validation set.

Keywords: 3D multi-scale U-shape network, atrous convolution, Jaccard index, binary cross entropy

References

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