3D U-Net Ensembles

Yunqiao Yang, Yi Lin

No Institute Given

1 Data Preprocessing

First, all cases are resampled to the median voxel spacing, where third order spline interpolation is used for image data and nearest neighbor interpolation for the corresponding segmentation mask. Then, the intensities were clipped based on the 0.5% and 99.5% percentile and normalized by subtracting the mean and dividing by the standard deviation of the intensity values.

2 Methods

2.1 Data Augmentation

Random affine transform (rotation, scaling, and elastic deformations), flipping and gamma correction augmentation were employed for online data augmentation.

2.2 Model

The model is a 3D CNN similar to No New-Net [2]. Compared to the original 3D U-Net, we made some small modification. first, Batch Normalization [1] was replaced by Group Normalization [3]; second, we used leaky ReLUs instead of original ReLU; third, we used Dice ranking loss to improve the segmentation of small lesions.

2.3 Training

This submission did not use any data other than the official training set. And the model was initialized randomly. Random patches of size $192 \times 224 \times 56$ were sampled from the images and used for training with a batch size of 6. The Adam algorithm was used for optimization with an initial learning rate of 3e-4. We also used weight decay with 1e-5 and cosine annealing strategy. Specially, we trained our models with one modality input(TOF-MRA) and two modalities by concatenating them in the feature dimension, respectively. Also We trained our model to predict only label 1 and both label 1 and label 2, respectively.

2.4 Ensemble model

To improve the robustness of our model, an ensemble method was employed for the final segmentation. Predictions were made by four separate models and ensembled together with majority voting.

References

1. Ioffe, S., Szegedy, C.: Batch normalization: Accelerating deep network training by reducing internal covariate shift. arXiv preprint arXiv:1502.03167 (2015)
2. Isensee, F., Jäger, P.F., Kohl, S.A., Petersen, J., Maier-Hein, K.H.: Automated design of deep learning methods for biomedical image segmentation. arXiv preprint arXiv:1904.08128 (2019)
3. Wu, Y., He, K.: Group normalization. In: Proceedings of the European conference on computer vision (ECCV). pp. 3–19 (2018)