Team K2 Method Description

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1 Preprocessing

We used the registered images (located at pre folders) for training.

1.1 Atlas Registration

T1 image was registered to the PNL atlas [2] with b-spline registration. The computated transformation was used to move grey matter, white matter and CSF atlases and also position maps to the subject coordinate space.

1.2 Intensity normalization

We normalized the intensities per image to be within the range of [0, 1].

2 Models

We used fully convolutional neural networks with shortcut connections similar to the U-net [1] architecture with various input combinations from the provided T1, FLAIR, and IR modalities as well as registered grey matter, white matter and CSF atlases. Both 2D and 3D networks were used to do predictions. 2D FCNs were constructed using pre-trained VGG19 network trained on image-net. 3D FCNs were trained from scratch using the provided training dataset. To be able to fit the whole brain into the GPU memory the brain volumes were divided into 9 overlapping 3D cubes.

3 Training

We used seven fold cross-validation on the training data by leaving out one of the training subjects in each fold. For 2D FCNs the encoding part (pre-trained with image-net) was not trained. We only trained the decoder part of the network. For 3D FCNs training was done from scratch. Left right flipping was performed as augmentation technique to generate more training data.

4 Prediction

For prediction we use aggregation of predictions from different models (from different folds, different dimensions and sets of inputs). Voxel-based Majority voting is used to predict the final class label.

References

[1] Olaf Ronneberger, Philipp Fischer, and Thomas Brox. U-net: Convolutional networks for biomedical image segmentation. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pages 234–241. Springer, 2015.

[2] Ion-FlorinF. Talos, Marianna Jakab, Ron Kikinis, and MarthaE Shenton. Spl-pnl brain atlas. 03 2008.