

Brain Tissue Segmentation on Multi-Modality MRI with 2D U-Net

Sungwon Ham, Keewon Shin, Jinhoon Jeong, Beomhee Park, Namkug Kim*

Method

Pre-processing: We normalized T1, T1-IR and T2-FLAIR MRI images of each patient independently by subtracting the mean and dividing by the standard deviation. We then implemented the intensity windowing as follows. The 1% and 99% values of the histogram were evaluated, which was rescaled to $[0, 1]$, with the background set as 0.

Data augmentation: We applied on data augmentation with left-right flip, random elastic deformation with b-spline transforms, and random gaussian noise with various kinds of standard deviation (1 to 3).

U-Net Architecture: To segmentation each brain tissue including gray matter, white matter, and csf, we adapted a 2D U-Net to address the MRI brain including T1, T1-IR and T2-FLAIR tissue segmentation task. 2D U-Net consist of a reducing path (left side) and an extending path (right side) where this network concatenates down-sample layers and its counterpart of up sample layers. 2D U-Net is modified to accommodate three MRI modalities with 512 by 512 matrix as three input channels of the network, trained for each brain tissue independently in separated paths and integrated with sigmoid function with optimized thresholds for each brain tissue.