

OUC Brain Team

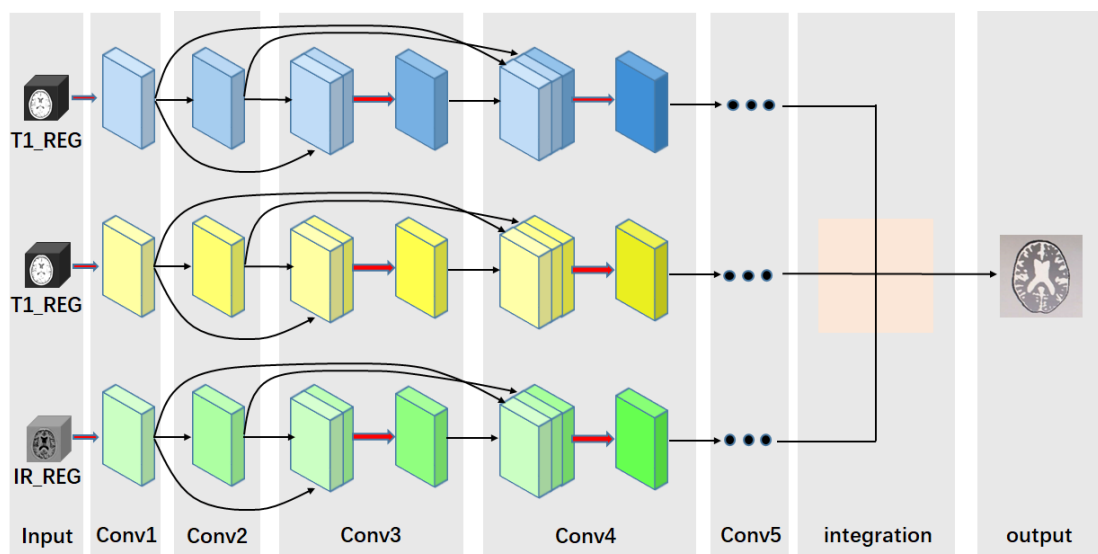
MultiDenseNet: A Novel Brain Tissue Segmentation DenseNet for Multi-modalities

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In MRBrainS 2018 Challenge, OUC Brain Team proposed one kind of MultiDenseNet framework for tissue segmentation (3-classes) in brain MRI images with multiple modalities, T1, IR, and FLAIR. The framework tries to make full use of the multi-modality advantages in MRI images on basis of Dense Convolutional Network (DenseNet) architecture, which introduces flow improvements in CNN with direct **dense connectivity** from each layer to their subsequent ones. The output of MultiDenseNet is composed of the fusion from 3 parallel paths, including the brain tissue segmentation process of DenseNet networks for Gray Matter and White Matter, as well as Cerebrospinal Fluid(CSF) extraction. The overall flowchart of our proposed scheme is shown in Figure 1.



Our brain tissue segmentation framework mainly concentrates on the sufficient feature extraction and deep learning towards 2 types of MRI brain images, so that we feed into our MulitiDensenet with 3D MRI image patches from T1-weighted scan and Inversion Recovery scan after bias field correction, respectively registered to T2-FLAIR. The manual labels were first merged into gray matter, white matter and CSF classes. Three automated parallel channels are organized with the help of DenseNet and quite a few imaging feature statistical analysis between T1 and IR images. Each single DenseNet consists of 13 layers in total, with 9 Convolutional layers, 3 Fully-Connected layers, and the classification layer. 3 parallel paths will be integrated to acquire more accurate tissue segmentation with the underlying corelation exploration between multi-modalities for brain MRI images. Both training and test process were performed in a server equipped computer with NVIDIA GPU.

Evaluation metric	Evaluation		
	DC	HD	VS
GM	0.72	19.02	0.86
WM	0.78	19.25	0.93
CSF	0.78	3.18	0.94

Table 1: Results analysis