Volumetric Multimodality Neural Network For Ischemic Stroke Segmentation

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Abstract. Brain lesion segmentation is one of the hardest tasks to be solved in computer vision with an emphasis on the medical field. We present a convolutional neural network that produces a semantic segmentation of ischemic stokes, capable of processing volumetric data along with information from multiple MRI modalities at the same time. This results in the ability to learn from small training datasets and highly imbalanced data. Our method is based on DeepMedic and V-Net,methods are part of the state of the art on medical image segmentation. We develop a new architecture with three identical parallel pathways, each one with six convolutional layers and two residual connections, to extract features on specific resolution levels. All the paths receive patches centered at the same voxel, but extracted from different versions of the image (original and downsampled by factors of three and five). The patches have input sizes of 27^3, 17^3 and 15^3 for the normal, medium and low resolution pathways, respectively. After those last two pathways, an upsample layer is used to make the three outputs of the same size. Finally, the results are concatenated and introduced in fully connected layers to be combined and then classified. The classification layer is a convolution with kernel size of 1^3. Finally as post-processing we use and CRF which uses the probabilities map per category and the different modalities to produce the final output.

Keywords: Semantic Segmentation, Ischemic Stroke, Deep Learning, MRI

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