Neural Networks Ensembles for Ischemic Stroke Lesion Segmentation

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We use four different architectures of convolutional neural networks: a modification of ENet1, DeepMedic2 and two modifications of UNet3. All the models were specially designed for image segmentation. Moreover DeepMedic was the network that won the ISLES-2015 Challenge 2.

ISLES-2017 is a challenging task because of a strong anisotropy of the data: a typical voxel size is about $1 \times 1 \times 6mm^3$. That's why ENet and UNet were used as 2D-segmentation networks: 2D slices along the axial plane were fed into them at both training and inference steps, and DeepMedic was used as a 3D-segmentation network.

Based on these networks we built several models with different hyperparameters and quite various geometry of predicted regions, e.g. smooth/rough edges, smaller/bigger regions. We reduced this variability by using a weighted sum of final models' predictions.

As a **preprocessing** step we cropped all the brain images to their bounding boxes and rescaled them to the shape 192×192 in the plane xOy.

In order to overcome the dataset size limitations we use two different **data augmentation** techniques: spatial transformations (e.g. random rotations, random flips along the coronal and sagittal planes) and coregistration: we took several healthy patients' brain images from the Alzheimers Disease National Initiative (ADNI) dataset (adni.loni.usc.edu) and used them as a template for the coregistration in presence of lesions step using the Advanced Normalization Tools package (http://stnava.github.io/ANTs).

I am the corresponding author of the abstract and in the name of all co-authors I declare that MICCAI has the right to distribute the submitted material to MICCAI members and workshop, challenge and MICCAI conference attendees.

References

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