Ensemble of convolutional neural networks for acute stroke anatomy differentiation

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Abstract. Imaging tasks involving stroke lesions are complex due to its relation with the vascular system and its dynamic evolution [1]. Deep learning architectures for stroke need to maximise the representational power of the employed parameters to be able to capture the complexity of the task while keeping overfitting to a minimum. Additionally, it is really important to address the issue of class imbalance for brain lesion segmentation with deliberate training patch sampling strategies.
We propose an ensemble of different convolutional neural networks based on the U-Net architecture [3]. Several submodels are made by using small architectural variations and a different subset of the training data. We propose also a novel patch sampling strategy more suited to the anatomy and pathophysiology of stroke lesions. The employed training patch sampling strategy alleviates class, lesion part and patient imbalance and promotes generalisability with the use of data augmentation. Since stroke lesions in the acute stage have three distinct lesion parts [2] (core, penumbra and benign oligemia), we aim to capture a more balanced representation of these different parts for the training set. Finally, data augmentation is applied only to patches containing lesions with a combination of mid-sagital mirroring and elastic deformation.

References

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