Random forests for stroke lesion and clinical outcome prediction

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1 Introduction

Ischemic stroke is caused by an obstruction in the cerebral blood supply and, if diagnosed early, part of the under-perfused tissue can potentially be salvaged. Since the available treatment options are not risk-free, the decision has to be made individually, depending on the potential gain and under great time restriction. The prediction of the final lesion outcome in form of A binary mask (Task I) and the prediction of the clinical outcome in form of the modified Rankin Scale (mRS) (Task II) are therefore of great clinical interest. The ISLES 2016 challenge offers a public dataset and associated expert groundtruth to allow researchers to compare their methods in these two fields directly and fairly. Our contribution works with carefully selected features extracted from the MR sequences and used to train a random forest (RF).

2 Method

The data consists of multi-spectral (ADC, PWI maps and raw PWI 4D volumes) scans and associated clinical measures. The final lesion outcome as delineated in a 90 days follow-up scan (Task I) and the 90 days mRS score (Task II) serve as groundtruths. More details on the data can be found on `www.isles-challenge.org`.

Task I: Lesion outcome prediction From each MR sequence we extract the features previously presented in [1], but furthermore employ a hemispheric difference measure to make use of the pseudo-quantitative values provided by the PWI maps. For voxel-wise classification we employ RFs.

Task II: Clinical outcome prediction Based on the segmentation results from Task I, we extract lesion characteristics as well as local image features from the supplied cases to train a regression forest. Applied, this yields a prediction of the mRS score for a formerly unseen case.

3 Discussion

Our method has been shown to provide competitive lesion segmentation results in glimo segementation as well as acute and semi-acute stroke in the previous year's edition of the ISLES challenge. The results from this year's challenge will show if the advantages of our flexible design also extend to outcome prediction.

References

1. Maier, O., Wilms, M., et al.: Extra tree forests for sub-acute ischemic stroke lesion segmentation in MR sequences. Journal of Neuroscience Methods 240(0), 89–100 (2015)