OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

MEDIZINISCHE FAKULTÄT UNIVERSITÄTSKLINIKUM MAGDEBURG A.ö.R.

MedDigit

DZNE
Deutsches Zentrum für Neurodegenerative Erkrankungen
in der Helmholtz-Gemeinschaft

Bachelor Thesis

„Comprehensive Comparison of state-of-the-art White Matter Hyperintensity Segmentation Methods on a Clinical Cohort"

Upper figure: example of an MRI with FLAIR contrast.
Lower figure: comparison of the results of a method based on [2] (red) and [3] (green). Agreement between the different methods in blue.

Neurodegenerative diseases such as Alzheimer's disease commonly coexist with cerebrovascular disease in older people. Cerebral small vessel disease (CSVD) is the most common vascular cause of dementia, a major contributor to mixed dementia, and responsible for about a fifth of all strokes worldwide. White matter hyperintensities (WMHs) are among the signs of SVD on conventional MRI [1]. There are numerous promising methods for the automated segmentation of WMHs, such as recent Deep Learning-based ones [2] or more classical approaches [3], but their performance on a clinical cohort as well as in early stages of CSVD (with less pronounced WMHs) in the presence of other angiopathies remains to be investigated.

[1] Wardlaw et al., Neuroimaging Standards for Research into Small Vessel Disease and its Contribution to Ageing and Neurodegeneration, The Lancet Neurology, 2013, 12, 822-838
[2] Li et al., Fully convolutional network ensembles for white matter hyperintensities segmentation in MR images, NeuroImage, 2018, 183, 650-665
[3] Schmidt et al., An automated tool for detection of FLAIR-hyperintense white-matter lesions in Multiple Sclerosis, NeuroImage, 2012, 59,3774-3784

In this thesis, relevant automated algorithms for segmentation of WMHs shall be compared for their performance on a clinical cohort. The cohort was carefully chosen to cover the large variety of possible shapes, locations, textures and intensities, that WMHs can exhibit. Special attention shall be payed to the results in cases of early stages of WMHs and CSVD in general as well as in case of the presence of other similar angiopathies.

The effort will be part of the collaboration of the "MedDigit" (Medicine and Digitalization) working group, the "Mixed cerebral pathologies and cognitive aging" research groups and the German Center for Neurodegenerative Diseases (DZNE), a multi-disciplinary team with profound expertise in both, the technical as well as the medical and neuroscientific aspects of this project. The groups are based at the campus of the University Hospital in Magdeburg.

We offer:
- participation in cutting-edge, clinically relevant research
- cooperation with clinical partners, joint publication of results
- assistance and approachable supervision with thesis implementation und writing
- pleasant and supportive atmosphere

We expect:
- good programming knowledge (Python)
- basic knowledge of (medical) image processing
- good study achievements (Computerscience or Neuroscience related)

Additional information:

Please send your relevant and persuasive application together with an actual transcript of grades per e-mail to:

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