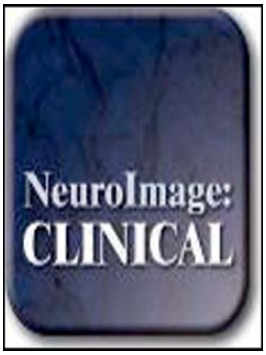

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Evaluation of a deep learning approach for the segmentation of brain tissues and white matter hyperintensities of presumed vascular origin in MRI

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Abstract

Automatic segmentation of brain tissues and white matter hyperintensities of presumed vascular origin (WMH) in MRI of older patients is widely described in the literature. Although brain abnormalities and motion artefacts are common in this age group, most segmentation methods are not evaluated in a setting that includes these items. In the present study, our tissue segmentation method for brain MRI was extended and evaluated for additional WMH segmentation. Furthermore, our method was evaluated in two large cohorts with a realistic variation in brain abnormalities and motion artefacts.

The method uses a multi-scale convolutional neural network with a T_1-weighted image, a T_2-weighted fluid attenuated inversion recovery (FLAIR) image and a T_1-weighted inversion recovery (IR) image as input. The method automatically segments white matter (WM), cortical grey matter (cGM), basal ganglia and thalami (BGT), cerebellum (CB), brain stem (BS), lateral ventricular cerebrospinal fluid (lvCSF), peripheral cerebrospinal fluid (pCSF), and WMH.

Our method was evaluated quantitatively with images publicly available from the MRBrainS13 challenge ($n = 20$), quantitatively and qualitatively in relatively healthy older subjects ($n = 96$), and qualitatively in patients from a memory clinic ($n = 110$). The method can accurately segment WMH

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