

EP1299**A toolbox for segmenting multiple sclerosis lesions using T1w and FLAIR images**

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Background: Conventional magnetic resonance imaging (MRI) techniques are highly sensitive to detect multiple sclerosis (MS) plaques, enabling a quantitative assessment of inflammatory activity and lesion load. Automated approaches to segment lesions can become an objective tool for clinical practice, avoiding the manual lesion delineation which is not only a tedious and time-consuming task but has a high intra/inter variability between experts.

Aim: To develop an automatic MS lesion segmentation toolbox over fluid attenuated inversion recovery (FLAIR) images, which integrates into the SPM8/12 platform.

Methods: 14 data sets (1.5T) from one MRI center, 70 clinically isolated syndrome data sets (3T) from another one, and 43 data sets (3T) from the MS lesion segmentation Challenge 2008, which enables a comparison with the state of the art methods, were used to evaluate our approach. Manual annotations were provided by trained technicians over PD/FLAIR images. The evaluation was done using the following measures: true positive rate (TPR) and positive prediction value (PPV) for lesion detection, and Dice similarity coefficient (DSC) for lesion segmentation accuracy. Our approach involved the following pre-processing steps: skull stripping, image noise reduction and bias correction in both T1w and FLAIR images, and inter subject rigid registration (FLAIR registered to T1w). Then, tissue segmentation was performed using SPM over T1w images. From this segmentation, MS lesions were segmented by an outlier intensity thresholding process with respect to normal apparent gray matter tissue over the FLAIR images. Finally, to improve this initial result, spatial information coming from the neighbouring tissue labels was used to refine the final lesion segmentation.

Results: The following values were obtained for the 1.5T data sets: 51% of TPR, 79% of PPV and 0.43 of DSC. Regarding the 70 images (3T) the values were: 44% of TPR, 58% of PPV and 0.32 of DSC. Regarding the MS training Challenge data, we obtained the following values: 52% of TPR and 53% of PPV and 0.34 of DSC, being better than those reported by the state of the art. In terms of testing data (23 patients), the automatic overall score provided by the Challenge organization was 82.34, being the first one, from all the participants, using an unsupervised approach.

Conclusion: This new MS lesion segmentation toolbox, which is freely available, has been tested over more than 100 cases providing satisfactory results.

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