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Autor(en) des Beitrags: Schmidt, P; Gaser, C; Arsic, M; Buck, D; Förschler, A; Berthele, A; Hoshi, M; Ilg, R; Schmid, VJ; Zimmer, C; Hemmer, B; Mühlau, M

Titel des Beitrags: An automated tool for detection of FLAIR-hyperintense white-matter lesions in Multiple Sclerosis.

Abstract: In Multiple Sclerosis (MS), detection of T2-hyperintense white matter (WM) lesions on magnetic resonance imaging (MRI) has become a crucial criterion for diagnosis and predicting prognosis in early disease. Automated lesion detection is not only desirable with regard to time and cost effectiveness but also constitutes a prerequisite to minimize user bias. Here, we developed and evaluated an algorithm for automated lesion detection requiring a three-dimensional (3D) gradient echo (GRE) T1-weighted and a FLAIR image at 3 Tesla (T). Our tool determines the three tissue classes of gray matter (GM) and WM as well as cerebrospinal fluid (CSF) from the T1-weighted image, and, then, the FLAIR intensity distribution of each tissue class in order to detect outliers, which are interpreted as lesion beliefs. Next, a conservative lesion belief is expanded toward a liberal lesion belief. To this end, neighboring voxels are analyzed and assigned to lesions under certain conditions. This is done iteratively until no further voxels are assigned to lesions. Herein, the likelihood of belonging to WM or GM is weighed against the likelihood of belonging to lesions. We evaluated our algorithm in 53 MS patients with different lesion volumes, in 10 patients with posterior fossa lesions, and 18 control subjects that were all scanned at the same 3T scanner (Achieva, Philips, Netherlands). We found good
agreement with lesions determined by manual tracing (R2 values of over 0.93 independent of FLAIR slice thickness up to 6mm). These results require validation with data from other protocols based on a conventional FLAIR sequence and a 3D GRE T1-weighted sequence. Yet, we believe that our tool allows fast and reliable segmentation of FLAIR-hyperintense lesions, which might simplify the quantification of lesions in basic research and even clinical trials.