Brain MRI segmentation and lesion detection using generalized Gaussian and Rician modeling

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Résumé en anglais	In this paper we propose a mixed noise modeling so as to segment the brain and to detect lesion. Indeed, accurate segmentation of multimodal (T1, T2 and Flair) brain MR images is of great interest for many brain disorders but requires to efficiently manage multivariate correlated noise between available modalities. We addressed this problem in1 by proposing an entirely unsupervised segmentation scheme, taking into account multivariate Gaussian noise, imaging artifacts,intrinsic tissue variation and partial volume effects in a Bayesian framework. Nevertheless, tissue classification remains a challenging task especially when one addresses the lesion detection during segmentation process2 as we did. In order to improve brain segmentation into White and Gray Matter (resp. WM and GM) and cerebro-spinal fluid (CSF), we propose to fit a Rician (RC) density distribution for CSF whereas Generalized Gaussian (GG) models are used to fit the likelihood between model and data corresponding to WM and GM. In this way, we present in this paper promising results showing that in a multimodal segmentation-detection scheme, this model fits better with the data and increases lesion detection rate. One of the main challenges consists in being able to take into account various pdf (Gaussian and non- Gaussian) for correlated noise between modalities and to show that lesion-detection is then clearly improved, probably because non-Gaussian noise better fits to the physic of MRI image acquisition.
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