UNSUPERVISED BRAIN ANOMALY DETECTION  
IN MR IMAGES

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Propositions

* Deviations from the normal pattern of structural brain asymmetries are useful insights of neurological pathologies.
* Automatic detection of abnormal brain asymmetries supports neurologists during medical diagnosis, surgical planning, and treatment assessment.
* Unsupervised brain asymmetry detection methods are generic in detecting any lesions, e.g., coming from multiple diseases, as long as these notably differ from healthy training samples.
* Brain image segmentation supports automatic asymmetry detection by removing non-brain tissues (e.g., skull, eyes, and neck) during analysis.
* Convolutional Autoencoders can model normal hippocampal asymmetries from 3D patches of healthy subjects to detect abnormal asymmetries.
* Supervoxels provide meaningful regions of interest that fit lesions and tissues, with minimum heterogeneous information.
* Using specialized one-class per-supervoxel classifiers for each patient image, trained from texture features (asymmetries), can detect abnormal asymmetries accurately.
* Modeling normal patterns of image registration errors from healthy subjects can be useful to detect outliers associated with symmetric and asymmetric brain lesions.