Unsupervised MR Brain Images Segmentation Based on Fuzzy Sliced Sufficient Dimension Reduction

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Abstract

In this study, we propose an iterative segmentation approach for human brain MR images using fuzzy c-means (FCM) based on the fuzzy sliced sufficient dimension reduction (SDR) techniques. Firstly, FCM is conducted to obtain the initial cluster memberships of the image pixels. Then the fuzzy versions of the sliced sufficient dimension reduction such as the sliced inverse regression (SIR) and the sliced average variance estimation (SAVE) are performed to extract the features of the image based on these memberships. The resulting features are served as the input for the next computation of FCM. The iteration stops until the improvement is within a tolerance. The proposed method is evaluated on a set of benchmarks of the simulated images and the clinical MR brain images. The evaluation results indicate that the fuzzy sliced SDR as a feature extractor provides a significant improvement of image segmentation over the methods to be compared using the classical FCM without SDR.

Keyword: Feature extraction, Fuzzy c-means clustering, Sliced inverse regression, Sliced average variance estimation, Unsupervised image segmentation.