Boosting diagnosis accuracy of Alzheimers disease using high dimensional recognition of longitudinal brain atrophy patterns

ABSTRACT

Objective: Boosting accuracy in automatically discriminating patients with Alzheimer's disease (AD) and normal controls (NC), based on multidimensional classification of longitudinal whole brain atrophy rates and their intermediate counterparts in analyzing magnetic resonance images (MRI). Method: Longitudinal percentage of brain volume changes (PBVC) in two-year follow up and its intermediate counterparts in early 6-month and late 18-month are used as features in supervised and unsupervised classification procedures based on *K*-mean, fuzzy clustering method (FCM) and support vector machine (SVM). The most relevant features for classification are selected using discriminative analysis (DA) of features and their principal components (PC). Accuracy of the proposed method is evaluated in a group of 30 patients with AD (16 males, 14 females, age ± standard-deviation (SD) = 75 ± 1.36 years) and 30 normal controls (15 males, 15 females, age ± SD = 77 ± 0.88 years) using leave-one-out cross-validation. Results: Results indicate superiority of supervised machine learning techniques over unsupervised ones in diagnosing AD and withal, predominance of RBF kernel over lineal one. Accuracies of 83.3%, 83.3%, 90% and 91.7% are achieved in classification by *K*-mean, FCM, linear SVM and SVM with radial based function (RBF) respectively. Conclusion: Evidence that SVM classification of longitudinal atrophy rates may results in high accuracy is given. Additionally, it is realized that use of intermediate atrophy rates and their principal components improves diagnostic accuracy.

Keyword: FCM; SVM; MRI; Alzheimer's disease; Diagnostic; Longitudinal atrophy