CLASSIFICATION OF ALZHEIMER’S PATIENTS USING A RULE-OUT DIAGNOSTIC BASED APPROACH

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Background: There is growing interest in using structural magnetic resonance imaging(sMRI) and machine learning methods for robust and reliable classification of patients with Alzheimer’s disease(AD). Support Vector Machine(SVM) based classification can achieve high accuracy (85-95%) in distinguishing AD patients from healthy controls, however the accuracy against other types of dementia decreases dramatically. Another problem is that in routine clinical practice one follows a “rule-out” strategy by excluding many alternative diagnoses rather than making a binary decision.

Aims: We propose a one-class classification (O-CC) of sMRI for automated “rule-out” diagnosis. The specific aim is to distinguish one target class (e.g. Alzheimer’s disease) from all other possible cases, considered as outliers, disregarding other pathology

Methods: We analyse T1 weighted MRI of 38 pathologically proven AD, 18 pathologically proven Fronto-Temporal-Lobar-Degeneration (FTLD), 10 Mild-Cognitive -Impairment (MCI) patients and 80 healthy controls. Separate O-CC with radial basis function (RBF) kernel are trained on a subset of the data for each dementia type. The remaining data are used to compute the individual accuracy of each classifier.

Results: We demonstrate particular specificity of the O-CC with high accuracy(90%) for AD and FTLD classification opposed to low accuracy (10%) for MCI.

Conclusion: Our findings confirm the feasibility of O-CC for diagnostic classification of sMRI in dementia. We interpret the differences of classification accuracy as due to variability in the anatomical pattern of atrophy within the very same dementia type. We predict higher accuracy of O-CC using mixture model approach in order to control for the observed anatomical heterogeneity.