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**Voxel-MARS and CMARS:
Early Warning of Alzheimer's Disease by Classification of Structural Brain MRI**

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Abstract

Neuroscience is of emerging importance along with the contributions of OR to the practices of diagnosing neurodegenerative diseases with computer-aided systems based on brain image analysis. Although multiple biomarkers derived from Magnetic Resonance Imaging (MRI) data have proven to be effective in diagnosing Alzheimer's disease (AD) and mild cognitive impairment (MCI), no specific system has yet been a part of routine clinical practice. We introduce a fully-automated voxelbased procedure, Voxel-MARS (and CMARS), for detection of AD and MCI in early stages of progression. Performance was evaluated on a dataset of 508 MRI volumes gathered from the Alzheimer's Disease Neuroimaging Initiative database. Data were transformed into a high-dimensional space through a feature extraction process. A novel 3-step feature selection procedure was applied. Multivariate Adaptive Regression Splines method was used as a classifier for the first time in the field of brain MRI analysis. The results were compared to those presented in a previous study on 28 voxel-based methods in terms of their ability to separate control normal (CN) subjects from the ones diagnosed with AD and MCI. It was observed that our method outperformed all of the others in sensitivity with acceptable specificity values. Furthermore, the method worked for discriminating MCI patients which converted to AD in 18 months (MCIc) from non-converters (MCInc) with a sensitivity outcome better than 27 of 28 methods.

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