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Authors: Patricio Andres Donnelly-Kehoe Guido Orlando Pascariello Juan Carlos Gomez, for the Alzheimers Disease Neuroimaging Initiative



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Looking for Alzheimer's Disease morphometric signatures using machine learning techniques

Donnelly-Kehoe, Patricio Andres^{☆,☆☆^a}, Pascariello, Guido Orlando^{☆^a}, Gomez, Juan Carlos^a, for the Alzheimers Disease Neuroimaging Initiative*

27 de Febrero 210 bis, Rosario, Argentina.

^aMultimedia Signal Processing Group - Neuroimage Division, French-Argentine International Center for Information and Systems Sciences (CIFASIS) - National Scientific and Technical Research Council (CONICET), Argentina

Abstract

Background: We present our results in the *International challenge for automated prediction of MCI from MRI data*. We evaluate the performance of MRI-based neuromorphometrics features (nMF) in the classification of Healthy Controls (HC), Mild Cognitive Impairment (MCI), converters MCI (cMCI) and Alzheimer's Disease (AD) patients.

New methods: We propose to segregate participants in three groups according to Mini Mental State Examination score (MMSEs), searching for the main nMF in each group. Then we use them to develop a Multi Classifier System (MCS). We compare the MCS against a single classifier scheme using both MMSEs+nMF and nMF only. We repeat this comparison using three state-of-the-art classification algorithms.

Results: The MCS showed the best performance on both Accuracy and Area Under the Receiver Operating Curve (AUC) in comparison with single classifiers. The multiclass AUC for the MCS classification on Test Dataset were 0.83 for HC, 0.76 for cMCI, 0.65 for MCI and 0.95 for AD. Furthermore, MCSs optimum accuracy on Neurodegenerative Disease (ND) detection (AD+cMCI vs MCI+HC) was 81.0% (AUC = 0.88), while the single classifiers got 71.3% (AUC = 0.86) and 63.1% (AUC = 0.79) for MMSEs+nMF and only nMF respectively.

Comparison with existing method: The proposed MCS showed a better performance than using all nMF into a single state-of-the-art classifier.

Conclusions: These findings suggest that using cognitive scoring, e.g. MMSEs, in the design of a Multi Classifier System improves performance by allowing a better selection of MRI-based features.

Key words: Neuroscience, Machine learning, Alzheimer's disease, Classification, Mild Cognitive Impairment, Morphometric analysis, Structural MRI

2010 MSC: 50-200, 70-800

Highlights

- We aimed to detect Alzheimer's Disease related disorders independently of MRI setup.
- We used T1 MRI derived morphometric features and demographic information.
- We developed a method based on cognitive profile segregation.
- We found group specific patterns of anatomical changes.

[☆]Both authors contributed equally to this work.

^{☆☆}Corresponding author. Tel.: +54 9341 2164799;

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Email addresses: patricio.donnelly@gmail.com (Donnelly-Kehoe, Patricio Andres^{☆,☆☆})

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