



# Multimodal Structural MRI and SVM to assess MCI and predict conversion to Alzheimer's disease.

Fabrizio Fasano<sup>a,b</sup>, Simona Gardini<sup>a</sup>, Paolo Caffarra<sup>a,c</sup>.



(a) Neuroscience Department, Parma University, Parma, ITALY. (b) NeuroComm srl, Parma, ITALY (c) Centre for Cognitive Disorders, AUSL, Parma, ITALY.

## Introduction

MRI, in combination with machine learning analysis methods, represents a strong candidate to provide novel biomarkers able to identify early stage of Dementia and to predict conversion to Alzheimer's Disease. We applied this combination on a small cohort of patients suffering from amnesic Mild Cognitive Impairment (MCI).

## Methods

Twenty patients (MCI) and twenty age- and sex-matched healthy elderly control subjects (HC) underwent multimodal MRI investigation on a 3T GE MR750 scanner, including T1w, DTI, T2w and T2\*w sets (Fasano et. al. 2011). Processing and subsequent definition of 7 in GM and 4 VOIs in WM allowed for the computation of the mean values of modGM, R2, R2\*, ADC in GM VOIs and modWM, R2, R2\*, ADC, rADC, tADC, FA in WM ones, for a total of 112 features (see Fig.1,2). A Linear Kernel Support Vector Machine (SVM) was used to assess the classification power of the features set (MCI vs HC). Cross validation was performed by 10000 Stratified Shuffle Shift permutations of the original dataset (train set 75% and test set 25%). Sixteen patients underwent a 2-years cognitive re-assessment, one half of them manifesting conversion (CO). The above procedure was also applied to assess the conversion prediction power of the features set (CO vs NC, NC = non converted).

## Results

Classification accuracy was found to be 62% (stDev 16%), Prediction of conversion accuracy 92% (stDev 16%). See Table 1 and Fig.2 for more details.

## Conclusions

Even though the size of the sample of subjects undergone investigation was small, the feature set showed a good performance as predictor of conversion, suggesting multimodal acquisition in combination with SVM analysis being suitable to identify prodromal MCI patients in early phase of the disease.

## Bibliography

Fasano et al. Proc. Intl. Soc. Mag. Reson. Med. 19 (2011): p4545

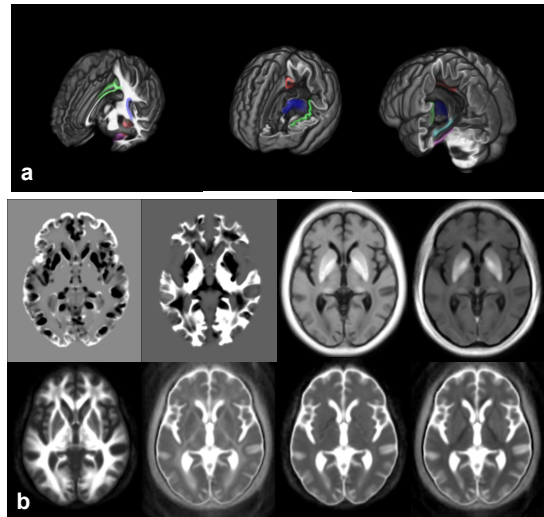


Figure 1 a) modGM, modWM, R2, R2\*, FA, ADC, tADC, rADC maps averaged on subjects. b) VOIs.

	T1	DTI	Relaxometry	ALL
MCIvsHC	65 (14) %	52 (14) %	53 (14) %	62 (14) %
COvsNC	72 (23) %	76 (23) %	94 (13) %	92 (16) %

Table 1) Mean (StDev) estimated accuracy of classifications and conversion prediction for all 112 features, and single modalities.

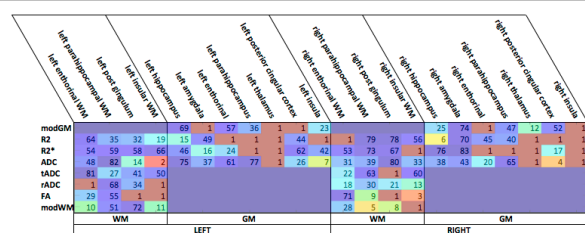


Figure 2) Feature ranking with recursive features elimination among modalities and regions of interest. The most important 30 features are scored 1 (red), the others scores indicate position in the ranking (red to blu) of the remaining features.

corresponding author

fabrizio.fasano@nemo.unipr.it