Predicting Cognitive Decline through Structural MRI biomarkers

Results from the EMIF-AD Biomarker Discovery Study

Silvia Ingala, MD, PhD student
Dept. Radiology and Nuclear Medicine
Amsterdam UMC – Location VUmc

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Introduction

- Alzheimer's disease (AD) has a long preclinical phase which provides an opportunity for secondary prevention of dementia
- To effectively design trials in non-demented subjects, there is a need for identifying subjects at risk of cognitive decline
- The two projects EMIF-AD and EPAD collaborate in delivering a fit for purpose infrastructure for secondary prevention trials in Europe via sharing of datasets and knowledge

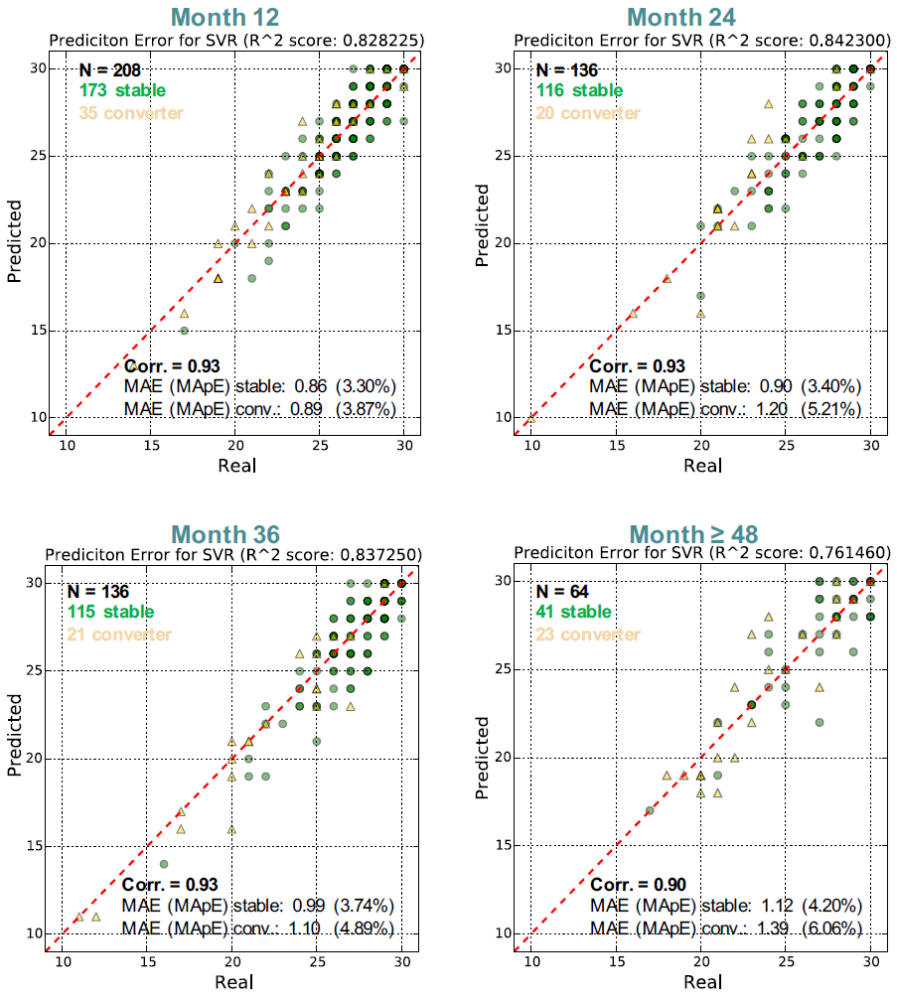
AIM: to predict cognitive decline in a preclinical and prodromal AD population based on baseline clinical, MRI, and cognitive data using machine-learning techniques.

Materials and Methods

Goal: identify predictors of cognitive decline in a non demented population

- Individuals were selected from the **EMIF-AD Multimodal Biomarker Discovery study**
  - 389 subjects: CN (n = 92) + MCI (n = 297)
  - Inclusion criteria: MRI scan + at least 1 follow-up
  - Cognition was assessed by the MMSE
- **Candidate predictors of cognitive decline**
  - Demographics: age, sex, education
  - Cognitive performance at baseline
  - APOE ε4 genotype
  - MR predictors: results of visual ratings and cortical thickness, subcortical volumes and surface area from FreeSurfer (v5.3)

Results



HIGHEST IMPORTANCE

1. Future FU
2. Education
3. Total TAU
4. Isthmus cingulate thickness
5. Inferior temporal gyrus surface
6. Pericalcarine gyrus thickness
7. Cortical thickness
8. Precuneus surface
9. Priority Language Z-score
10. Parahippocampal gyrus surface
11. Lingual gyrus thickness
12. Paracentral gyrus surface
13. Cuneus surface
14. Insula thickness
15. Frontalpole thickness
16. MMSE at baseline
17. Inferior parietal gyrus surface
18. Priority Attention Z-score
19. Cortical thickness in AD-signature regions
20. Priority Memory Immediate Z-score
21. Posterior Cingulate thickness average
22. Lateral orbitofrontal gyrus thickness
23. Rostral anterior cingulate gyrus surface
24. Diagnosis at baseline

LOWEST IMPORTANCE

Discussion

- Correlation between real and predicted follow-up MMSE scores was 0.93 at M12, M36, and M4 and 0.90 at M≥48
- The prediction accuracy was high and similar in the stable (mean absolute error: 0.45-1.24) and converter groups (mean absolute error: 1.07-1.78)
- Findings will be used to improve the criteria for selection of suitable research participants from EMIF Parent Cohorts into the EPAD Register

CONCLUSION: We predicted future MMSE scores with high confidence. This could be of aid in the selection of at-risk subjects for AD dementia secondary prevention trials.

Cross collaboration and partnership between EMIF-AD and EPAD has been a key enabler of this work