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Participant-specific interrogation of population-based data to predict cognitive decline from neuropsychiatric symptoms and neuroimaging biomarkers: A machine learning approach (P12-6.001)

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Abstract

Objective: Develop machine learning (ML) models to predict decline in global cognition and attention from neuroimaging biomarkers of Alzheimer's disease (AD) and neuropsychiatric symptoms (NPS).

Background: ML is increasingly being used in brain aging research.

Design/Methods: We developed four ML models (support vector machine, Gaussian process, random forest, Naïve Bayes) to predict z-scored global cognition and attention domain changes between first and last study visits of each participant. We used a stepwise approach to develop the prediction models by: 1) including AD biomarkers (PiB- & FDG-PET), education, and APOE ε4 status; followed by 2) adding measures of depression (Beck Depression Inventory-II; BDI-II), and anxiety (Beck Anxiety Inventory; BAI); then 3) adding 12 NPS including NPS severity as measured by Neuropsychiatric Inventory Questionnaire (NPI-Q).

Results: Data from 777 cognitively unimpaired (CU) participants for the outcome of global cognition z-score, and 795 CU participants for the outcome of attention z-score was available. 80% of the sample was randomly used to train the model, which was blind tested on the remaining 20%. For global cognition, the best model was able to predict 78% of participants with decreasing z-score using AD biomarkers, education, and APOE ε4 status. Adding BDI-II and BAI improved the prediction to 87%; and adding 12 NPS further improved the prediction to 96% of participants with decreasing z-scores. Including NPS severity did not improve the model's performance. For the attention domain, the best model predicted 89% of participants with decreasing z-score using AD biomarkers, education, and APOE ε4 status. After adding BDI-II and BAI measurements, the model was able to predict 97% of participants with decreasing z-scores. Adding 12 NPS, and NPI severity only marginally improved the model's performance to 98%.

Conclusions: ML has the potential to successfully predict global and domain-specific cognitive decline in community-dwelling persons, with NPS improving prediction compared to AD neuroimaging biomarkers alone.

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