PRECTING BRAIN AMYLOIDOSIS WITH PLASMA B-AMYLOID42/40 AND MRI-BASED MORPHOMETRY FEATURES

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1. OBJECTIVE

Biomarker assisting early detection and intervention in Alzheimer's disease (AD) may be the key to therapeutic breakthroughs. One of the presymptomatic hallmarks of AD is the accumulation of beta-amyloid (Aβ) plaques in the human brain. However, current methods to detect brain Aβ pathology are either invasive (lumbar puncture) or quite costly and not widely available (amyloid PET). The blood-based biomarker, like plasma Aβ42/Aβ40, enables more rapid and inexpensive screening of potential participants for brain amyloidosis [1]. Additionally, our recent research has demonstrated that MRI-based hippocampal multivariate morphometry statistics (MMS) can be an effective neurodegenerative biomarker for predicting brain amyloid deposition [2]. In this study, we demonstrate that the combination of these two state-of-the-art biomarkers could achieve superior performance in predicting the brain Aβ burden assessed based on amyloid PET.

2. METHODS

In **Fig. 1**, MMS are first extracted from MR images. As MMS have a larger dimension than the sample size, we used our previously introduced sparse coding algorithm, Patch Analysis-based Surface Correntropy-induced Sparse coding and max-pooling (PASCS-MP), to generate a low-dimensional representation of hippocampal morphometry for each subject. We randomly but consistently over subjects select patches of MMS on the hippocampal surface. Then, sparse-coding and max-pooling are used to generate representations for these subjects. Finally, we train binary random forest classifiers on the representations and the measures of plasma Aβ42/40 from the people with different PET-based brain Aβ positivity status and evaluate these classifiers with 10-fold cross-validation.

3. EXPERIMENTAL RESULTS

From the Alzheimer's Disease Neuroimaging Initiative (ADNI) database (adni.loni.usc.edu), we identified 198 subjects with matching plasma Aβ42/40 measures, florbetapir PET and T1-MRI scans, 98 subjects were amyloid positive and 100 were amyloid negative based on florbetapir PET and previously discussed processing pipeline and positivity threshold [1]. And plasma Aβ42/40 was measured as [3].

We trained random forest classifiers on this dataset with different features, including plasma Aβ42/40, MMS separately or jointly. For each experiment, we performed 10-fold cross-validation five times, and the average results (sensitivity, specificity and accuracy) are shown in **Table. 1**.

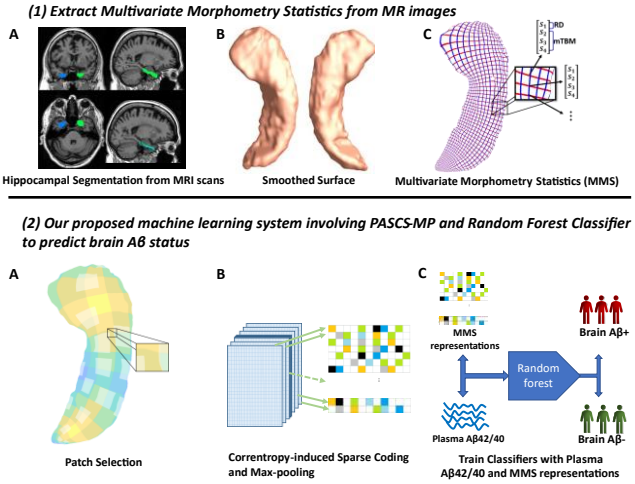

Fig. 1. Overview of the framework

Table 1. Classification Results.

	SPE	SEN	ACC
Plasma Aβ	0.70 ± 0.01	0.73 ± 0.01	0.72 ± 0.00
MMS	0.86 ± 0.01	0.75 ± 0.02	0.80 ± 0.01
MMS + Aβ	$\mathbf{0.92 \pm 0.01}$	$\mathbf{0.83 \pm 0.03}$	$\mathbf{0.87 \pm 0.01}$

Values are mean ± standard deviation where applicable.

4. CONCLUSION

Although plasma Aβ has been shown to be an adequate test to screen cognitively normal individuals for brain amyloidosis, combining it with our MRI-based hippocampal multivariate morphometry statistics may further improve the diagnosis accuracy of brain amyloidosis.

5. REFERENCES

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