Multi-region analysis of longitudinal FDG-PET enables accurate AD classification

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Introduction
Imaging biomarkers for AD are desirable for improved diagnosis and monitoring, as well as drug discovery. Automated image-based classification of individual patients could provide useful diagnostic support for clinicians, alongside cognitive assessment scores. The Alzheimer’s Disease Neuroimaging Initiative (ADNI) is a valuable resource, providing longitudinal clinical and imaging data from patients with AD and MCI, as well as healthy controls (HC). We investigate the value of combining cross-sectional and longitudinal FDG-PET information for classification. We extract regional features from baseline and 12-month follow-up FDG-PET images, and investigate their combined use for image-based classification of ADNI participants.

Imaging Data
Imaging data are from 221 ADNI participants for whom baseline and 12-month FDG-PET and MR images were available. MCI participants either progressed to AD (pMCI), or remained stable (sMCI). The mean age at baseline (73.7 ± 6.3 years) is not significantly different (p>0.01) between clinical groups.

Results
Cross-sectional regional features:
- baseline PET signal intensities (BL)
- 12-month PET signal intensities (M12)

Longitudinal regional features:
- percentage changes over 12 months (Ch)

Highly significant (p<0.001) increases in classification accuracy are achieved when using 12-month signal intensities compared with the accuracy obtained using baseline signal intensities.

Further significant (p<0.05) increases in accuracy are achieved by combining 12-month signal intensities with the percentage changes over 12 months.

Longitudinal features (change) alone give relatively poor classification performance.

Conclusions
These results surpass many state-of-the-art image-based classification methods. This study demonstrates that information extracted from serial FDG-PET through regional analysis can accurately discriminate diagnostic groups, a finding that may be useful applied in the diagnosis of AD, predicting disease course in individuals with MCI, and in the selection of participants for clinical trials.

References

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