A kernel-based Gaussian process for combined MRI-PET in Alzheimer's disease

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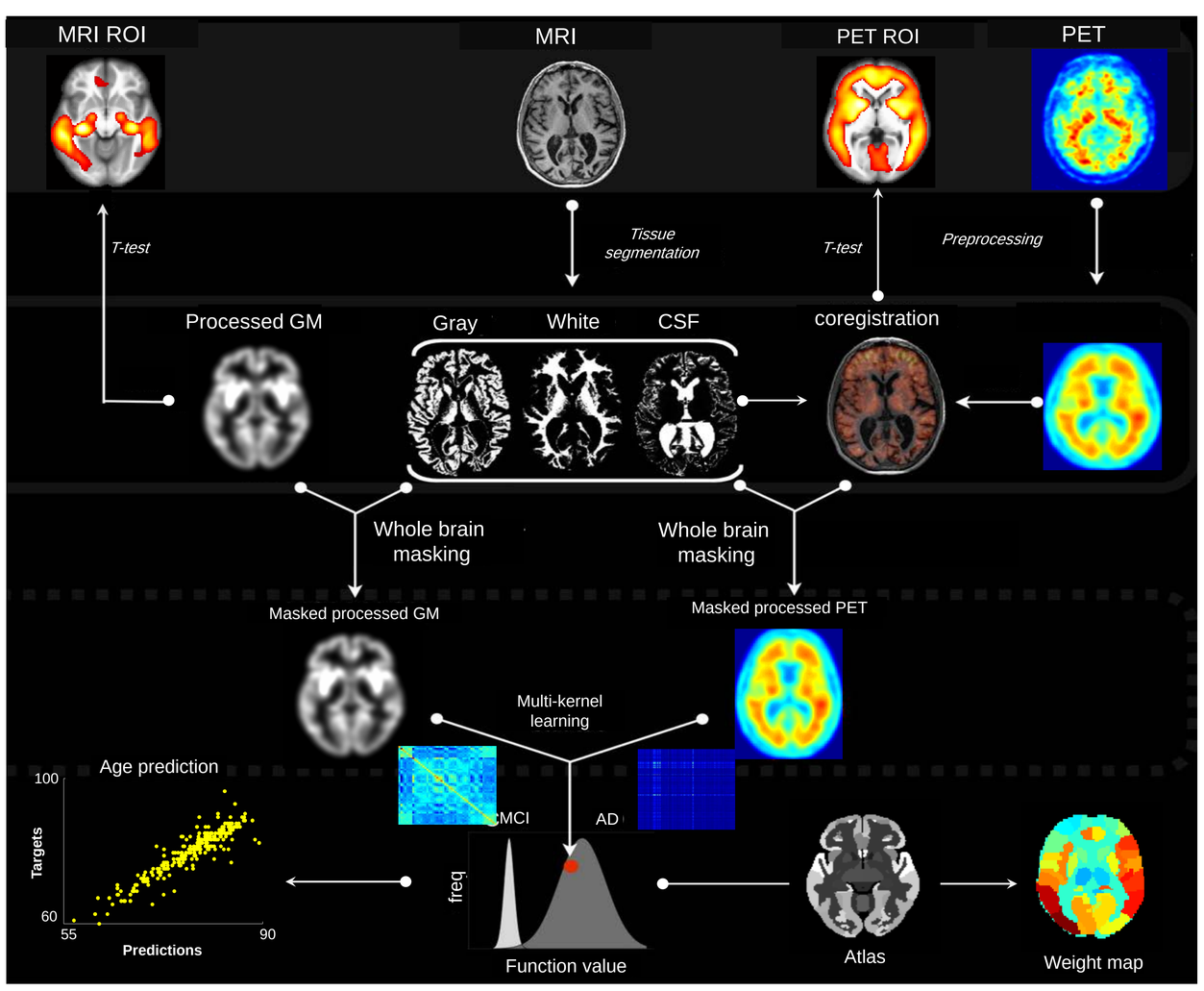
Introduction

MRI and PET imaging are routinely used for the diagnosis and prognosis of Alzheimer's disease (AD). However, each data represent a different type of structural or functional characteristics. In the present work, we introduce a multi-modal imaging machine-learning framework to enhance image processing and AD classification performance and age prediction by utilising DARTEL algorithm and multi-kernel learning (MKL)-support vector machine (SVM), respectively.

Materials and Methods

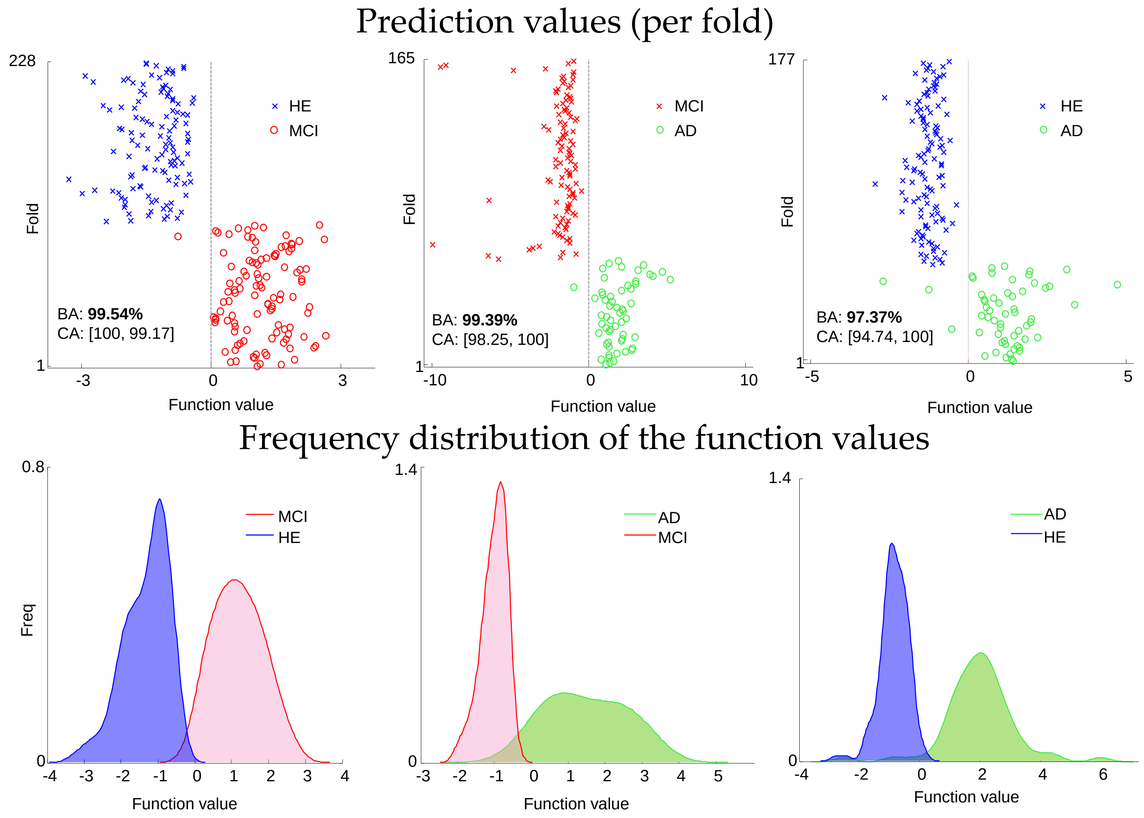
- DARTEL enhanced grey matters (GMs) and processed PiB-PET scans of 90 AD, 144 MCI and 170 healthy elderly (HE) from Australian Imaging Biomarkers and Lifestyle flagship study of ageing (AIBL) were used to build a kernel (similarity) matrix (see below Fig).
- "SimpleMKL" [1] was used to combine multiple kernels.
- Binary SVM with 10-folds cross-validation on subjects-per-class-out for classification.
- An atlas (90 ROIs) to construct the SVM weight map.
- Kernel ridge regression (KRR) to predict ages.



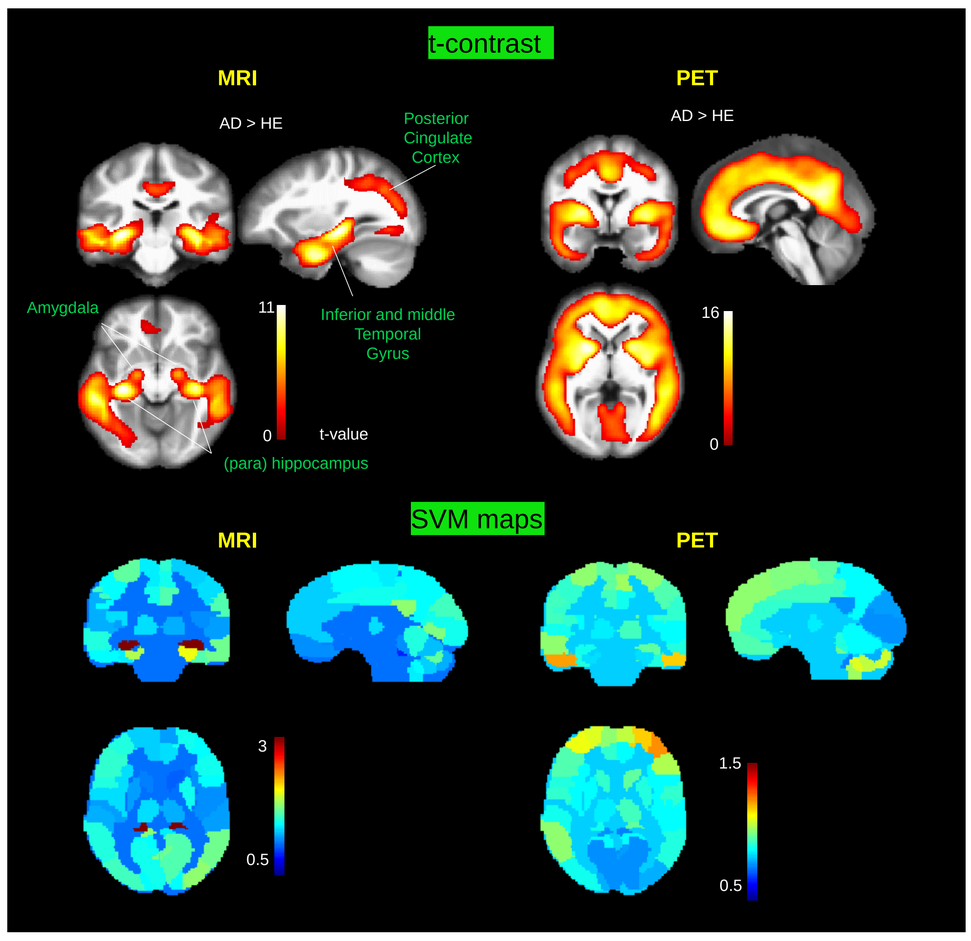
Results

Age prediction was improved by MKL-KRR

AD classification was improved by MKL-SVM



Consistent ROIs between t-contrasts and SVM maps



Conclusion

- **DARTEL as an advance spatial normalisation algorithm can enhance image processing of cohort imaging data.**
- **MKL-SVM is an effective technique to enhance interpretability and classification accuracy of multi-modal imaging.**

Acknowledgment & funding

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Reference

[1] Rakotomamonjy, et al, "SimpleMKL," J. Mach. Learn. Res., vol. 9, pp. 2491–2521, 2008