

Exploring the brain with explainable artificial intelligence

Characterizing diversity in patients with
dementia

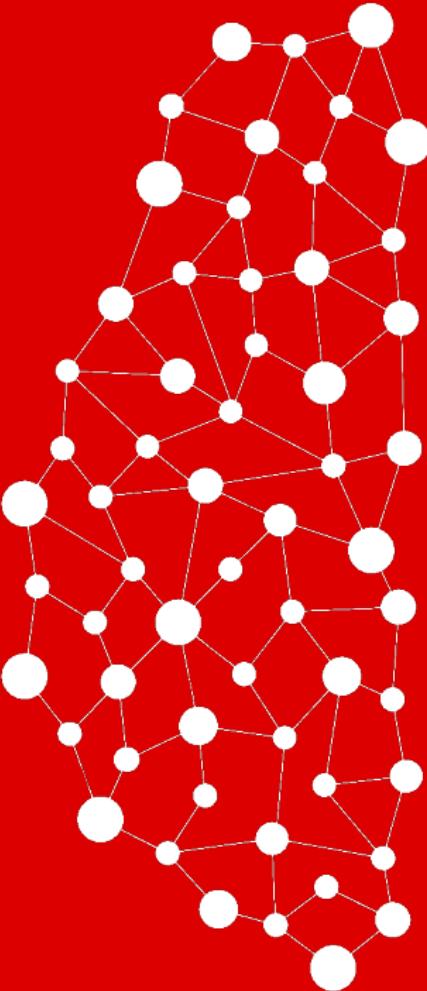


Esten H. Leonardsen

Postdoctoral research fellow, Department of
Psychology, University of Oslo
Chief Scientific Officer, baba.vision



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Dementia

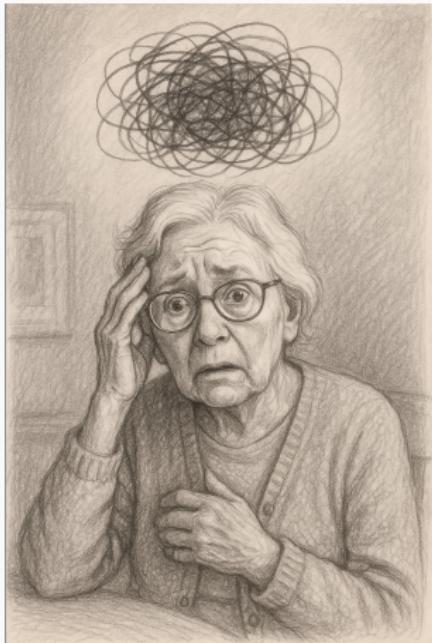
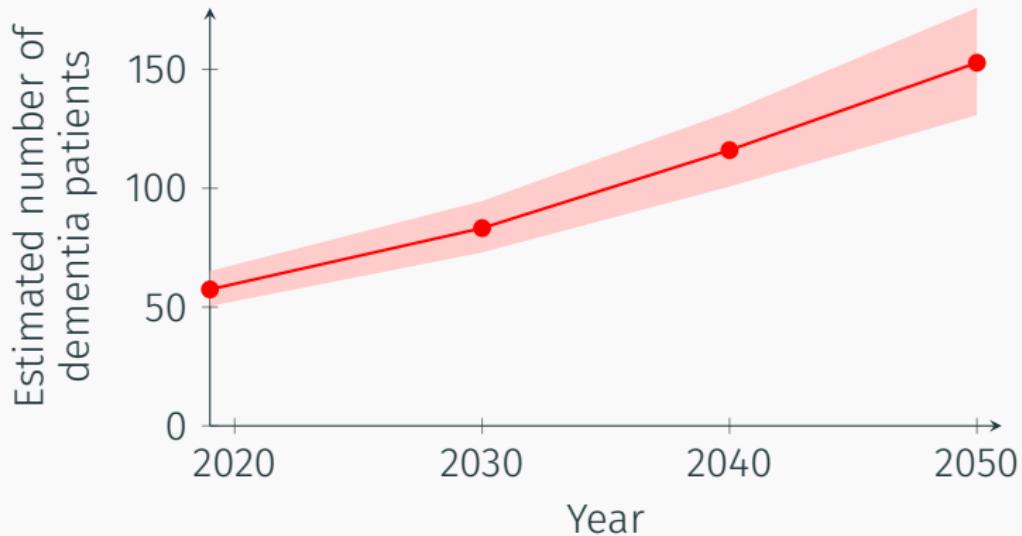


Image generated by GPT-4o

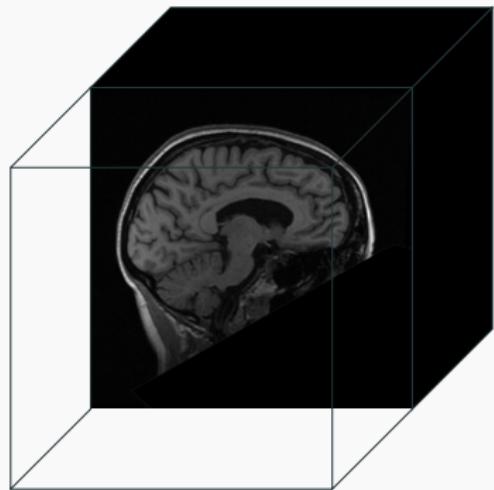
Dementia



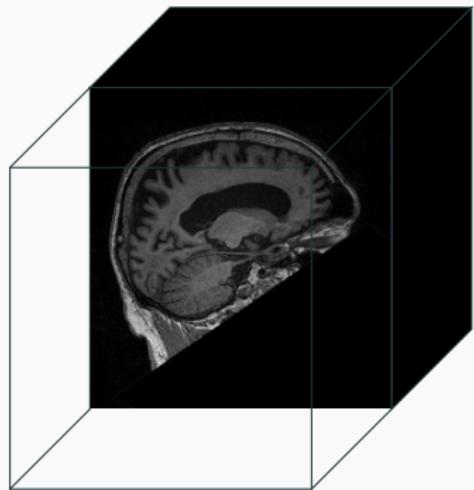
Adapted from Nichols, E., et al. (2022). Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. *The Lancet Public Health*, 7(2), e105-e125.



Dementia



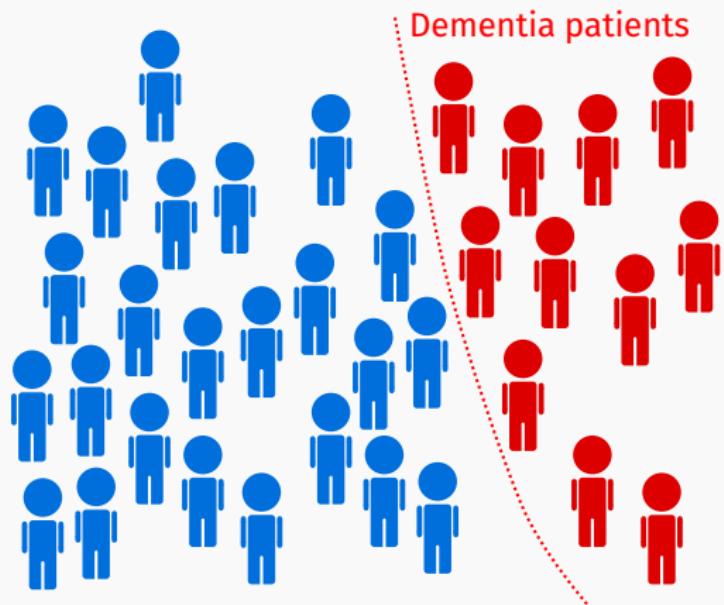
Healthy control



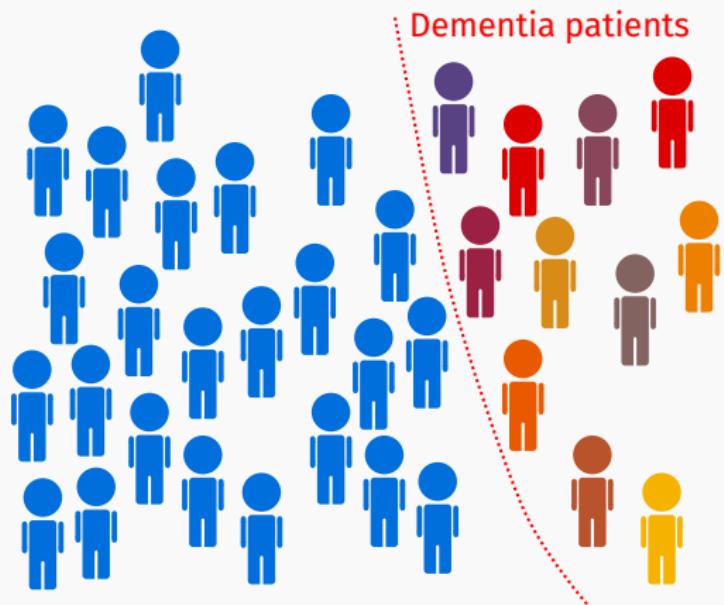
Dementia patient

Data from the Alzheimers Disease Neuroimaging Initiative (ADNI)

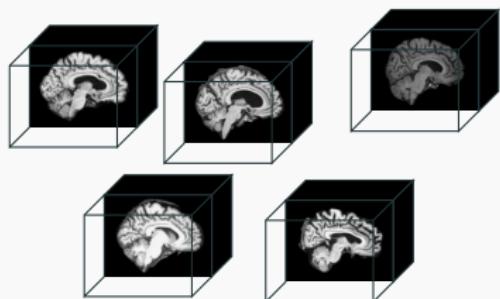
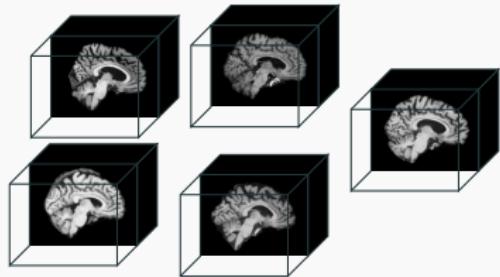
Dementia



Dementia

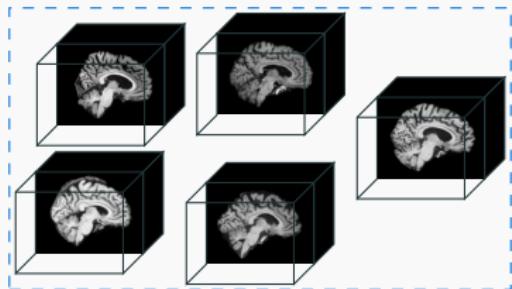


Methodology

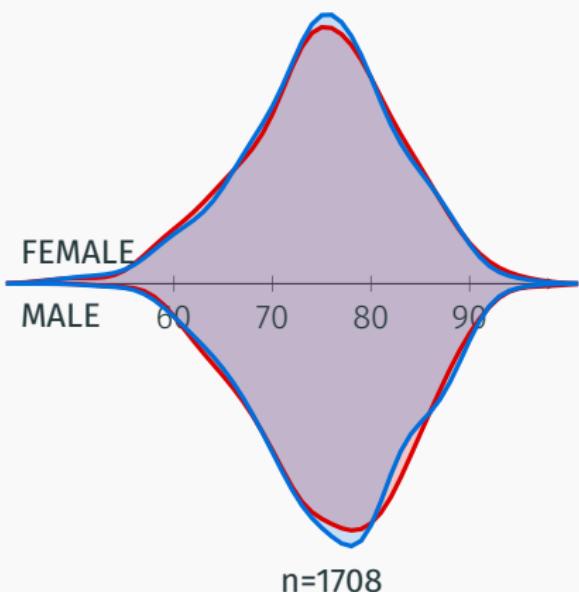
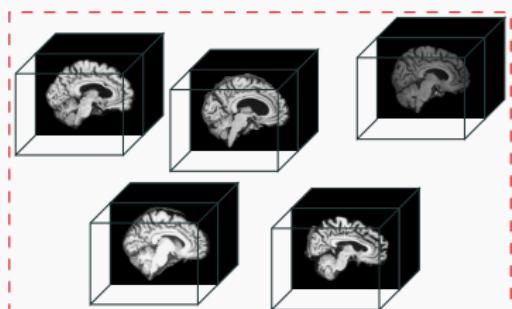


Methodology

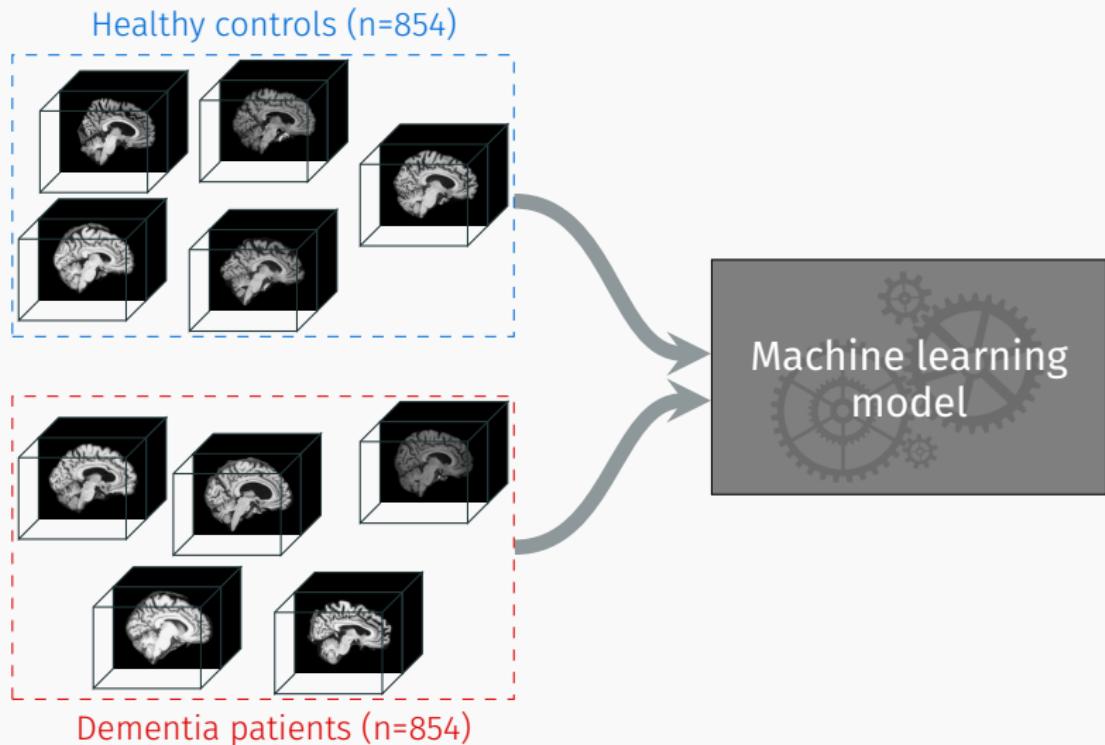
Healthy controls (n=854)



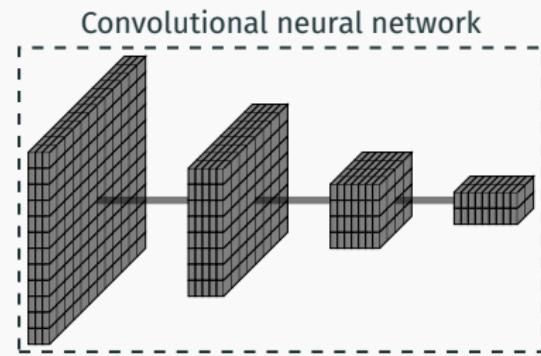
Dementia patients (n=854)



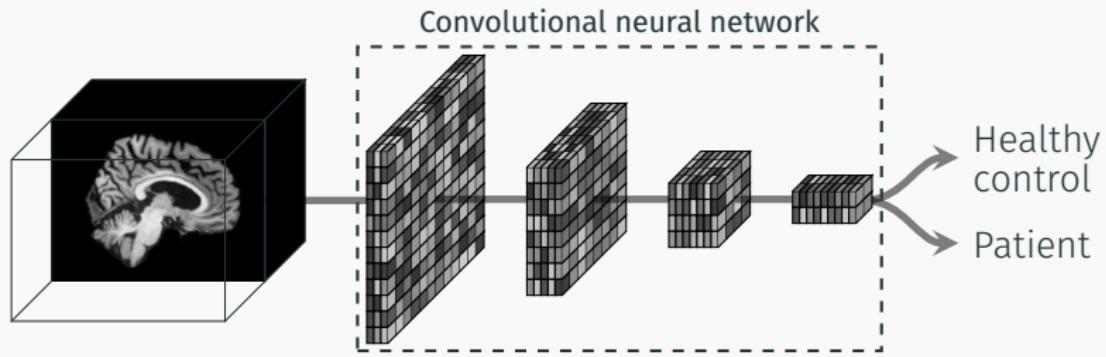
Methodology



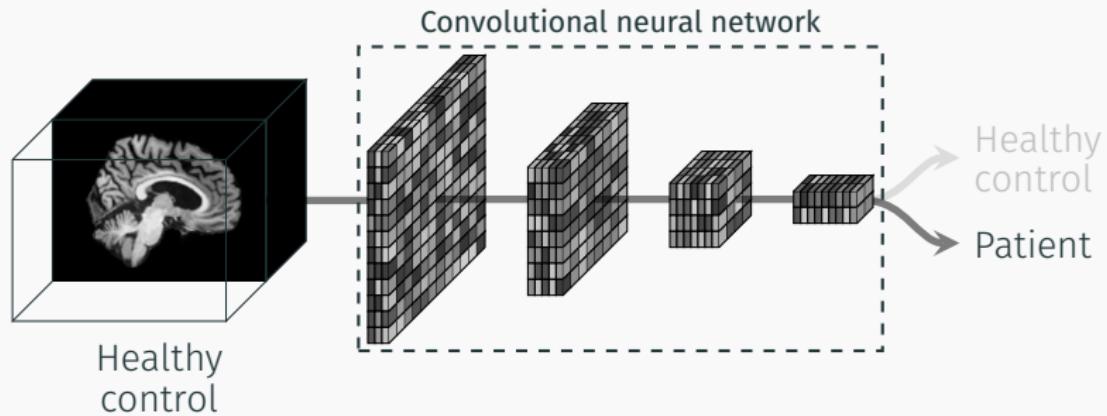
Methodology



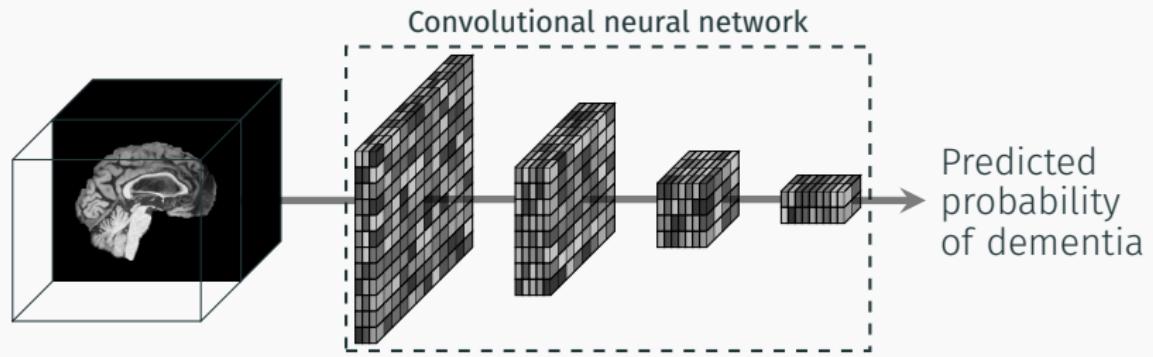
Methodology



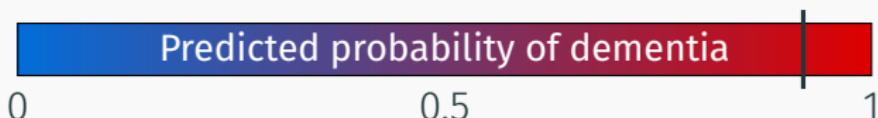
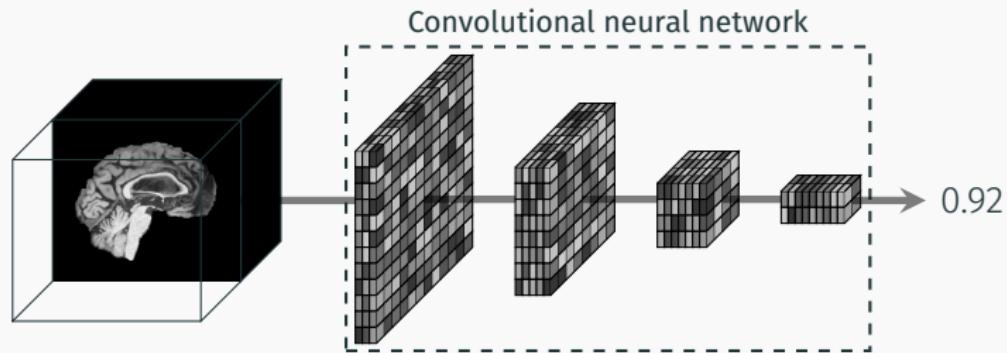
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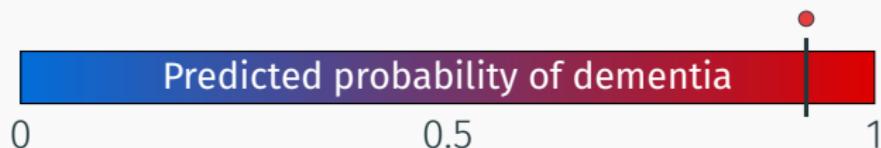
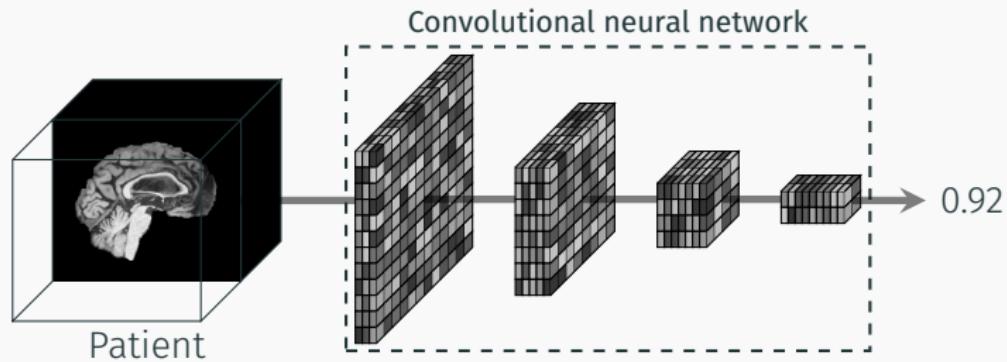
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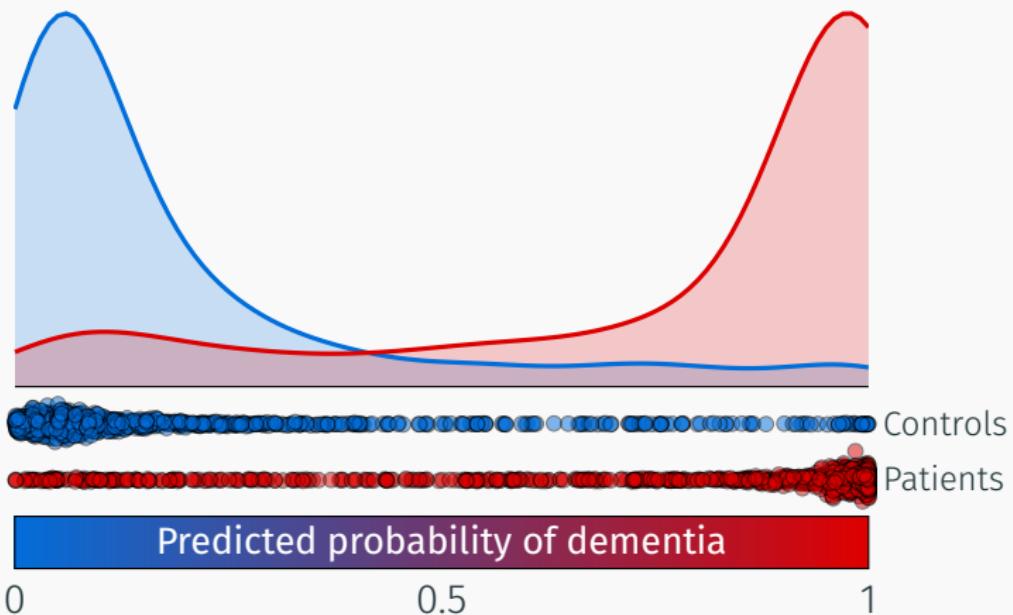
Methodology



Methodology

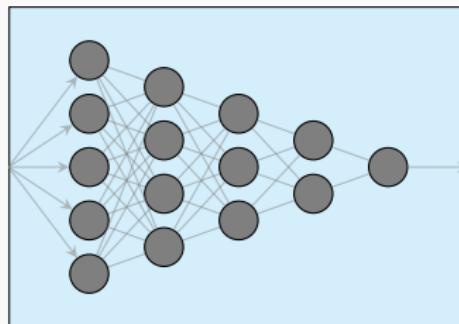


Methodology

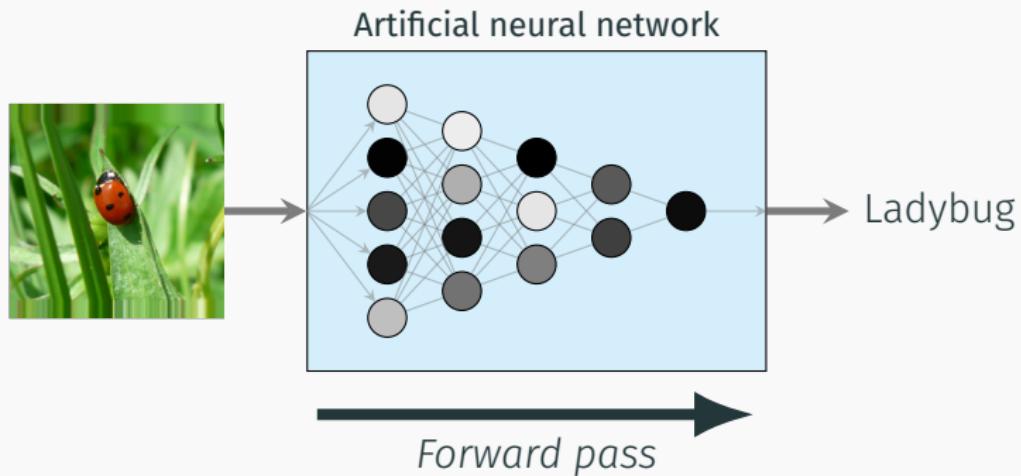


Explainable artificial intelligence

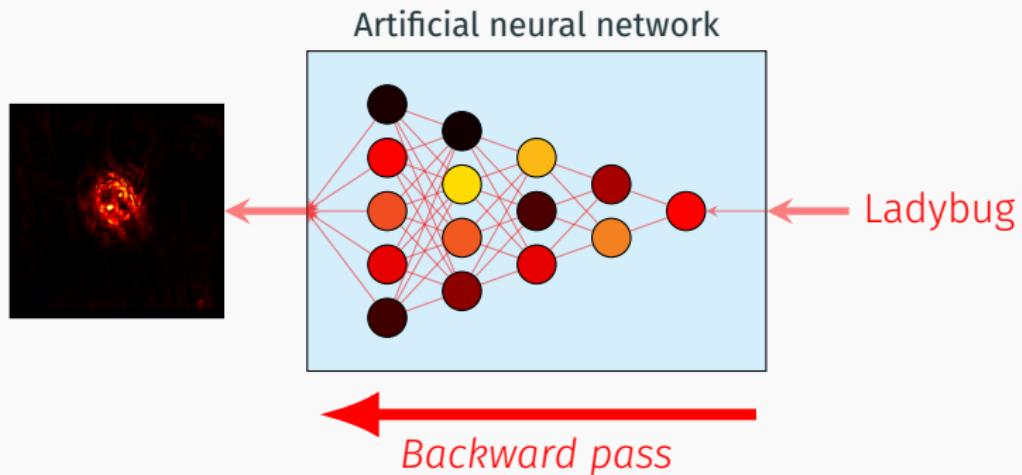
Artificial neural network



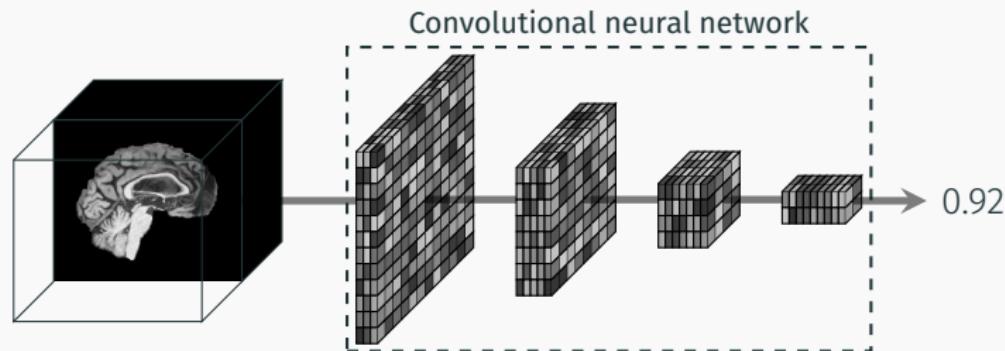
Explainable artificial intelligence



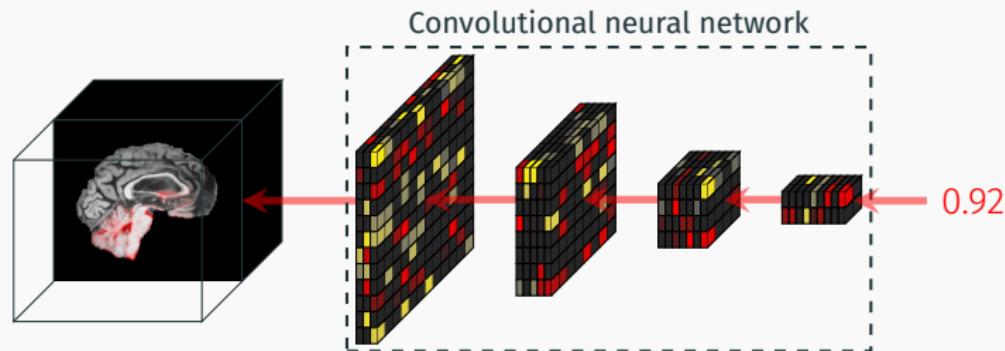
Explainable artificial intelligence



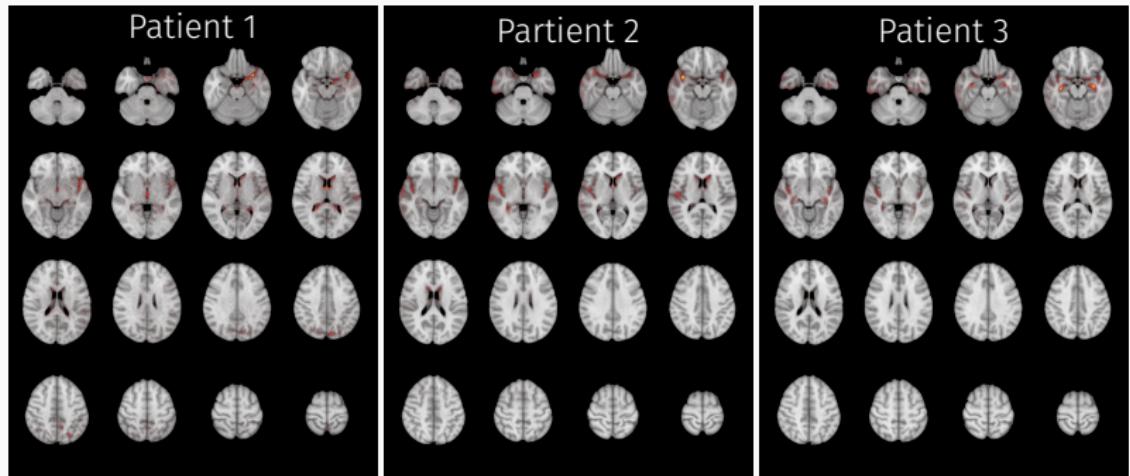
Explainable AI and dementia



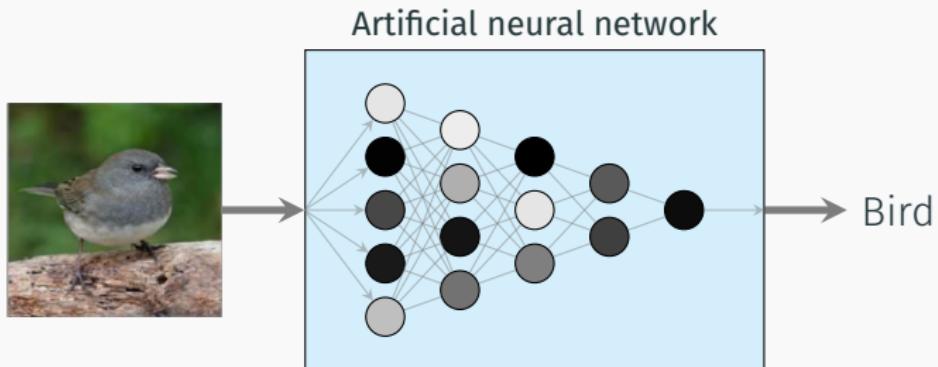
Explainable AI and dementia



Explainable AI and dementia

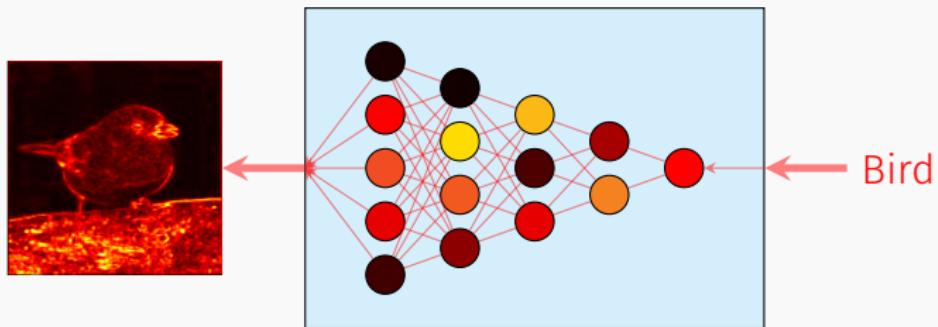


Explainable AI: Caveats



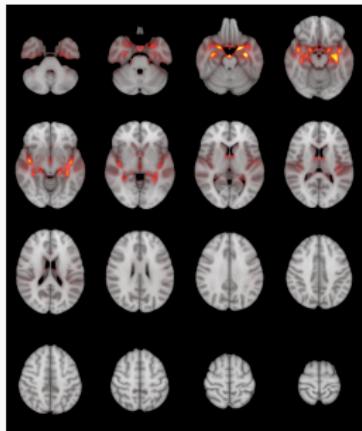
Explainable AI: Caveats

Artificial neural network



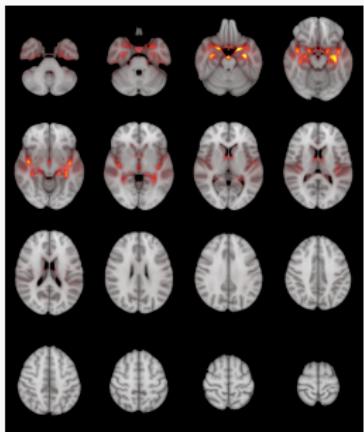
Explainable AI and dementia

Explainable AI

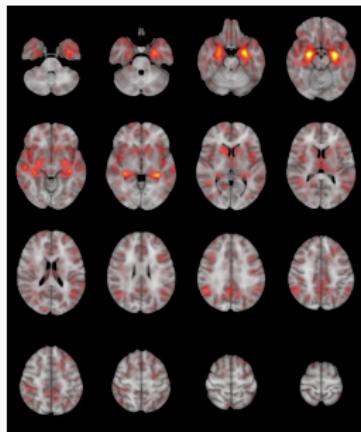


Explainable AI and dementia

Explainable AI



Human researchers



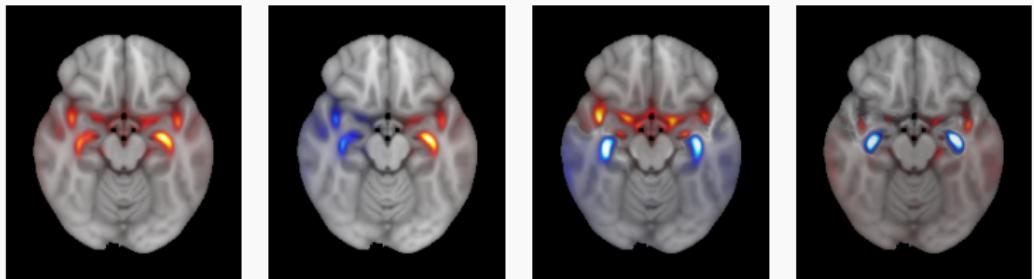
Explainable AI and dementia

Test battery	Domain	Name	Description
Functional Activities Questionnaire		FAQTOTAL	Measures instrumental activities from everyday life
ADSP Phenotype Harmonization Consortium	Language	PHC_LAN	Composite language score
UW - Neuropsych Summary Scores	Executive functioning	ADNI_EF	Composite score for executive functioning
UW - Neuropsych Summary Scores	Memory	ADNI_MEM	Composite score for memory

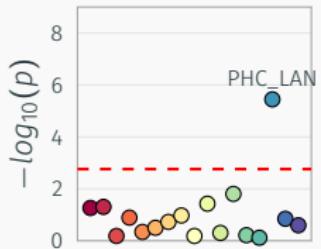
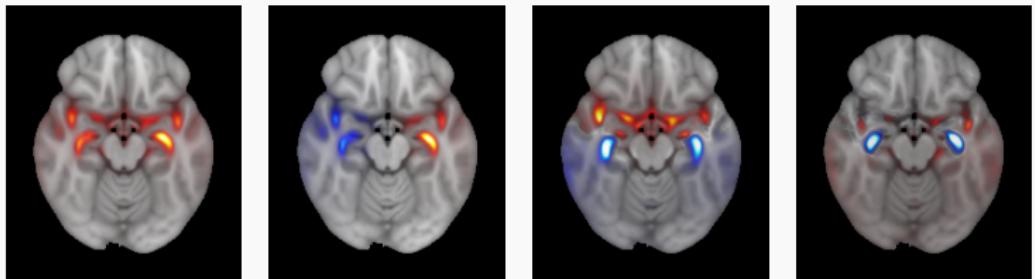
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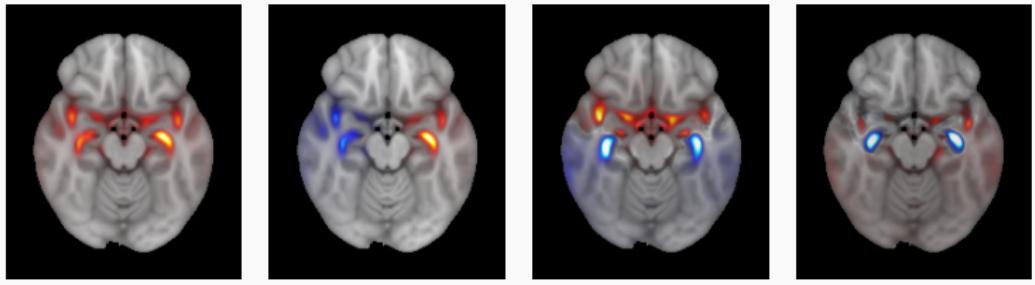
Explainable AI and dementia



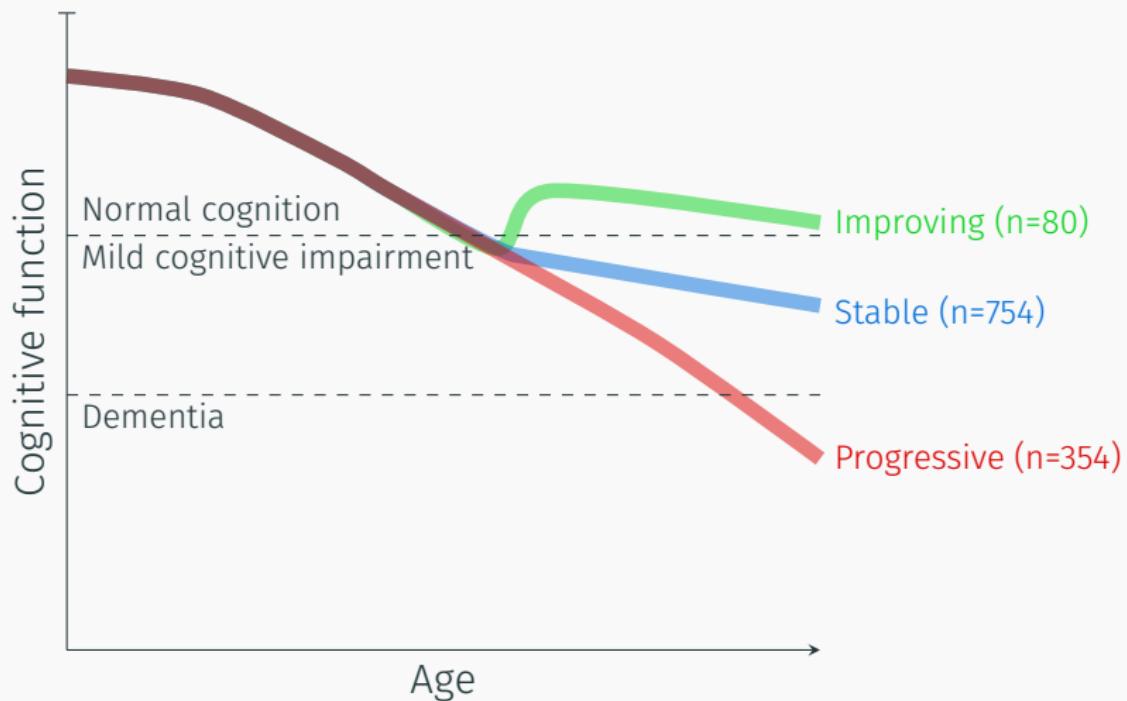
Explainable AI and dementia



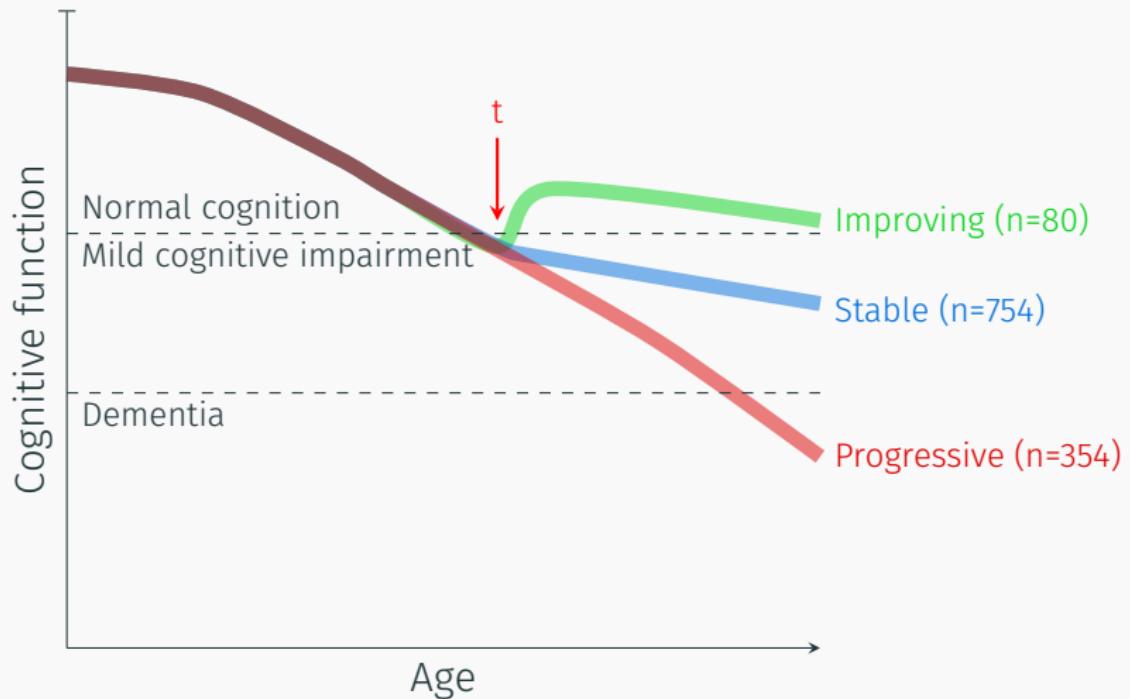
Explainable AI and dementia



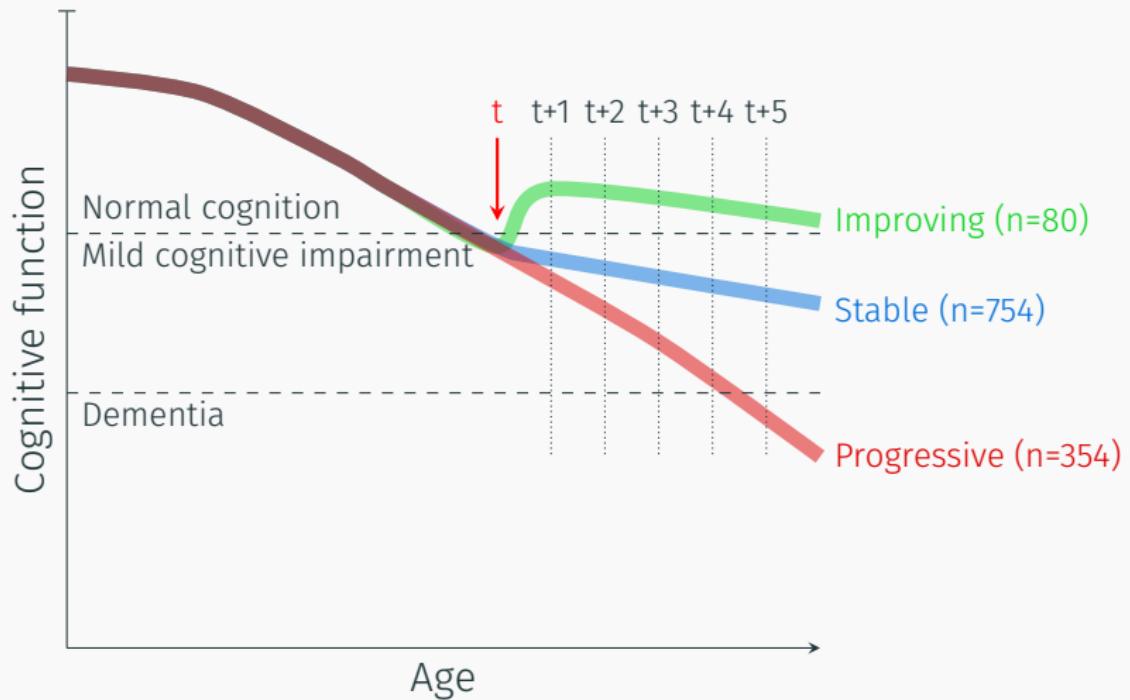
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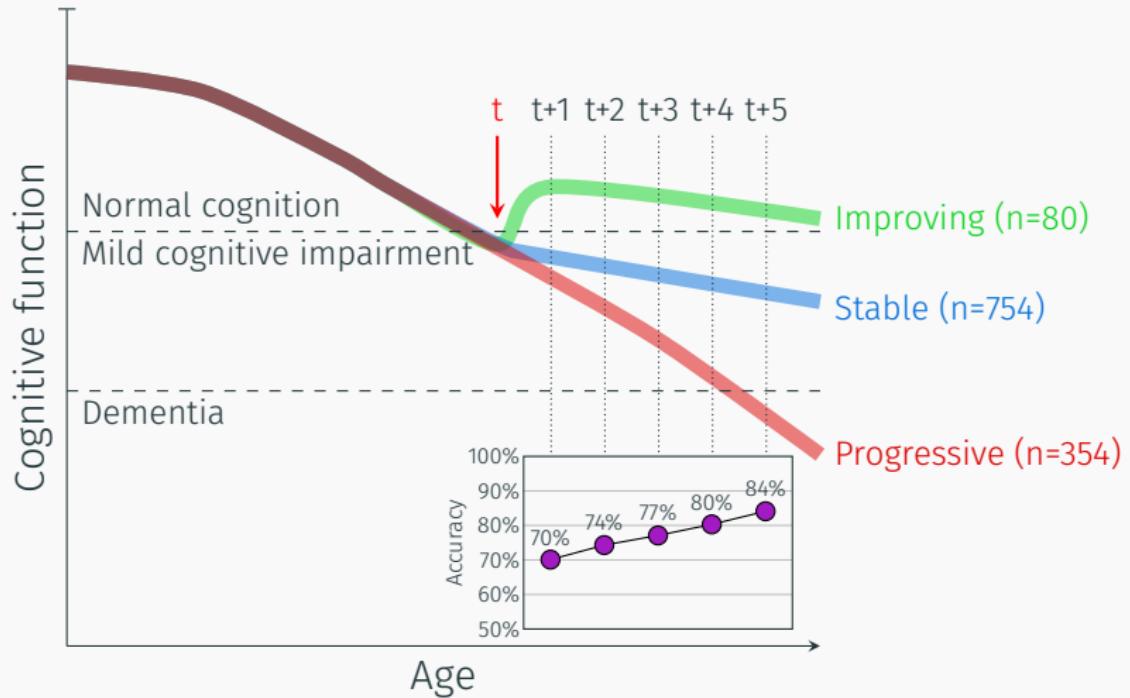
Explainable AI and dementia



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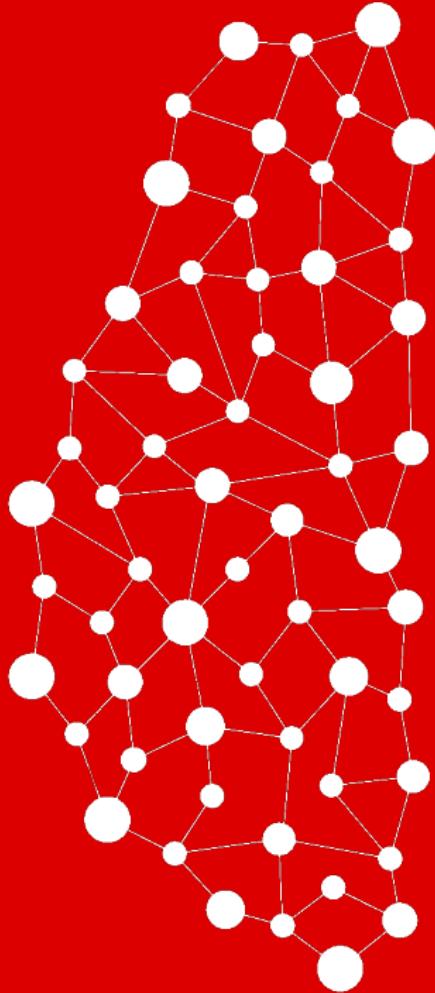
Summary

We used explainable artificial intelligence to generate heatmaps that characterized the manifestation of dementia in the brains of individual patients.

- The heatmaps focused on brain regions known to be afflicted in dementia
- Variability in the heatmaps was associated with neuropsychological variation
- The localization of dementia-related aberrations enabled by the heatmaps allowed us to accurately predict progression from mild cognitive impairment to dementia



Thank you for your attention!
estenhl@ui.no



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