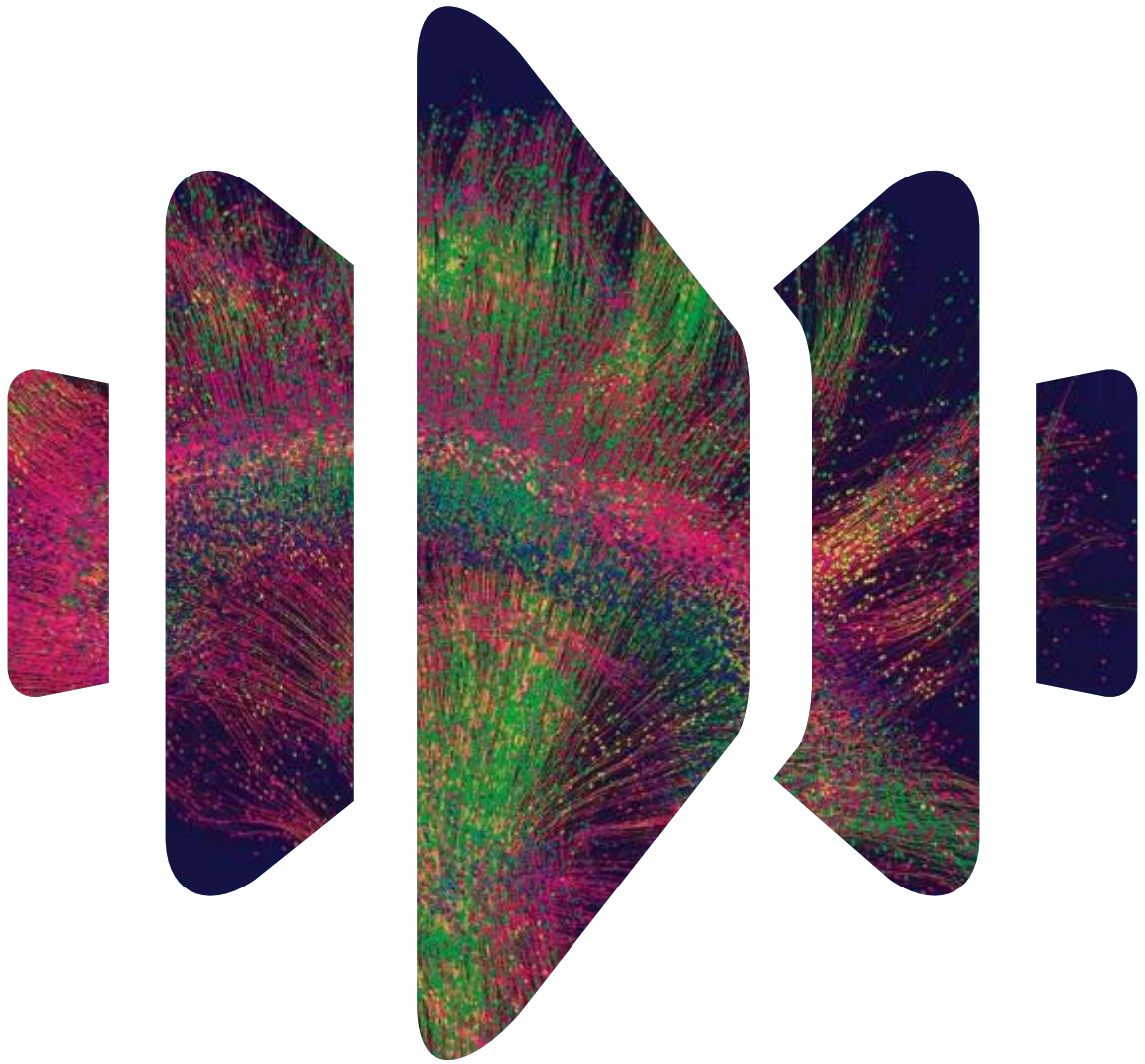


AI-Driven Classification of Alzheimer's Disease and Frontotemporal Dementia from Magnetic Resonance Imaging

Robin Wolz, Richard Joules, Luis Peraza

1: IXICO, London, UK

Disclosures: All authors are full-time employees of IXICO

Lead Author

Luis Peraza, PhD

Dementia differential diagnosis

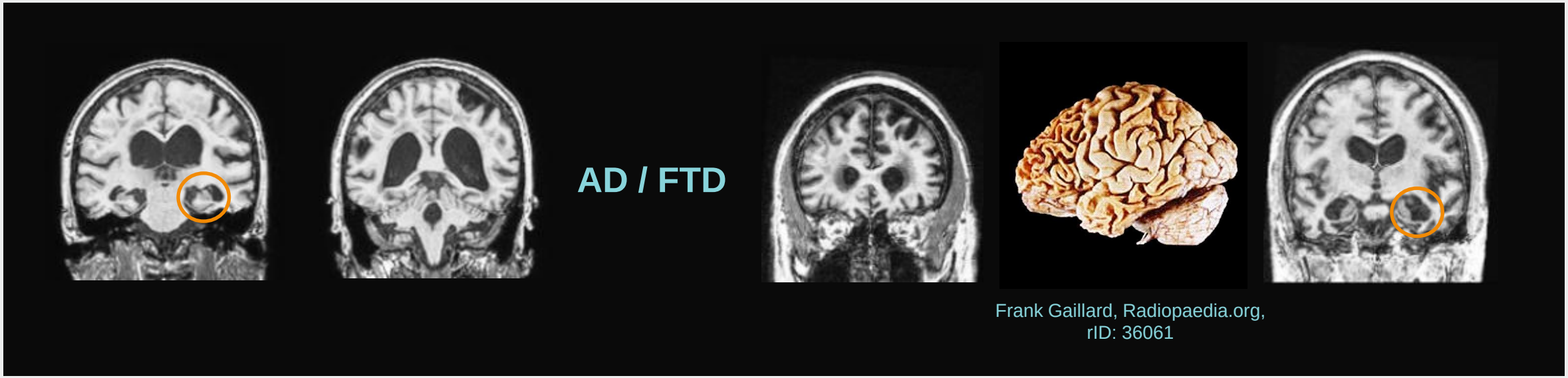
- Clinically, AD and FTD present with similar clinical symptoms, specifically at the mid and late stages of the disease
- Biomarker assessment is therefore a key requirement for accurate diagnosis and successful trial design
- While the ATN framework provides established criteria for AD diagnosis, there is no single definitive biomarker for FTD.

Dementia differential diagnosis

To support differential diagnosis of dementia types, multi-modal biomarker data can be deployed

As part of a wider framework, we have validated an MRI-based tool to help differentiate cases of Alzheimer's disease (AD) and frontotemporal dementia (FTD) for clinical trial enrolment.

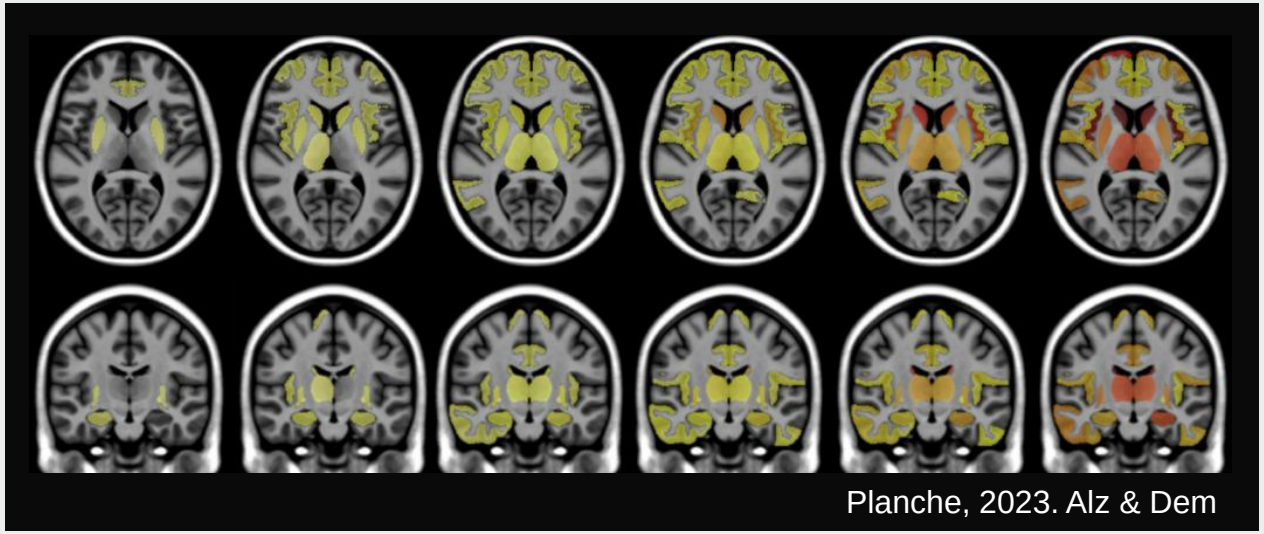
Structural brain changes in AD and FTD



Frank Gaillard, Radiopaedia.org,
rID: 36061

FTD affects primarily frontal lobes and temporal poles.

AD starts within the hippocampal and entorhinal cortices and from there the disease migrates to the rest of the cortex.



Planche, 2023. Alz & Dem

bvFTD structural stages

AI Modelling

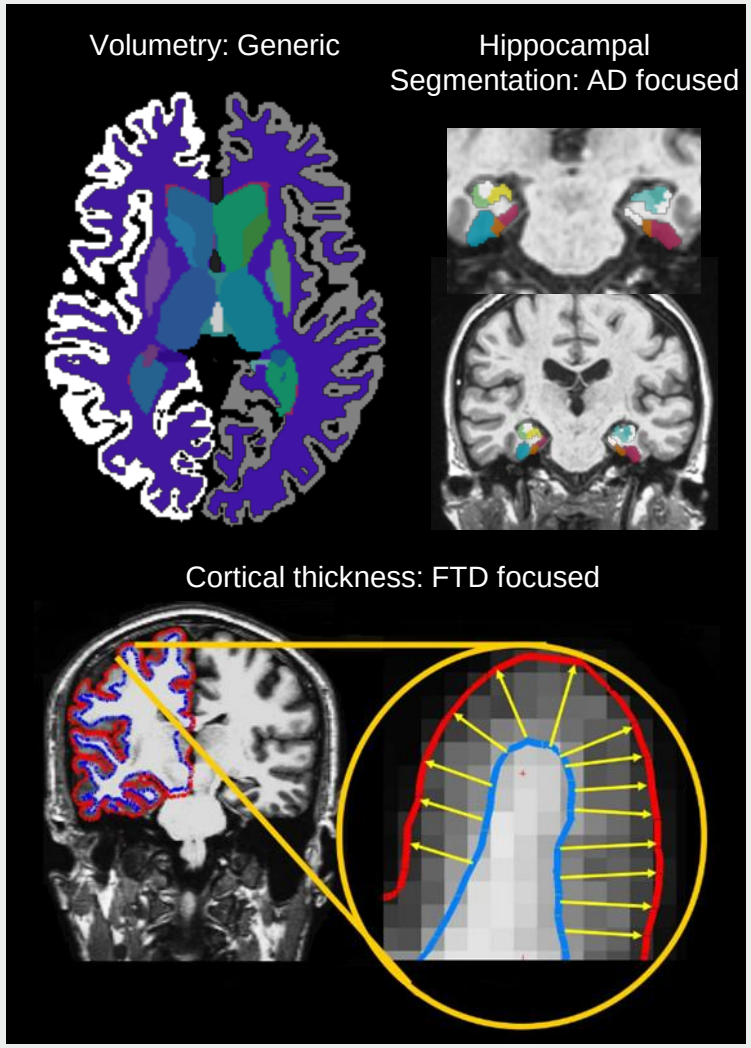
Structural Metrics

Brain Volumetrics

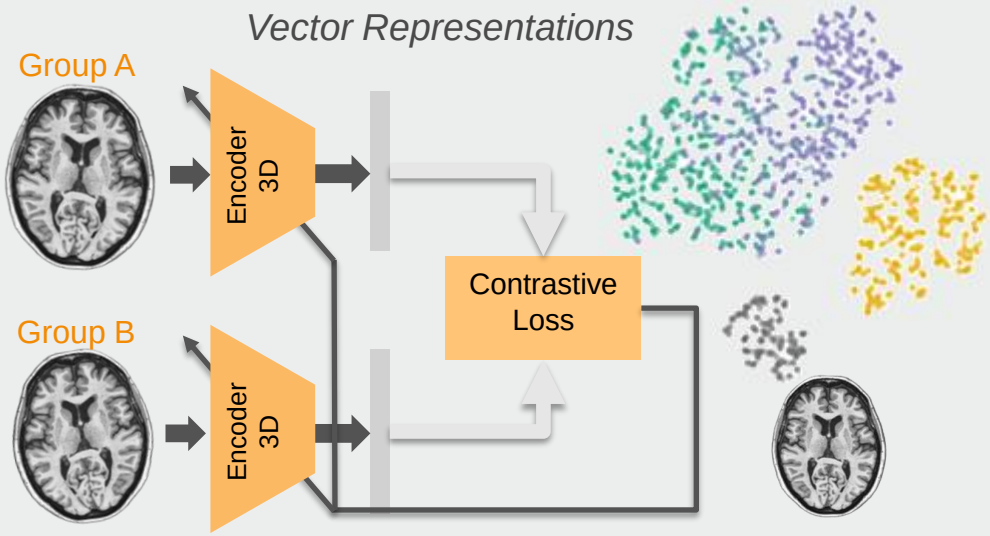
Brain Cortex
Hippocampus
Cerebellum

Cortical Thickness

Brain Cortex

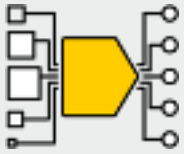


Deep-Learning Metrics



Classifier (CatBoost)

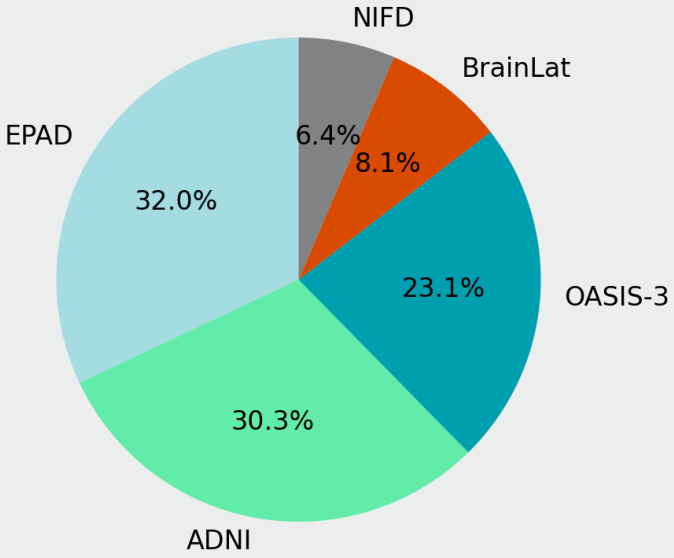
y ~ Structural Metrics + Deep-Learning Metrics + Age + Sex



Neuroimaging Datasets

	HC	AD	FTD	Other
N	1190	2520	182	120
Age	69(8.7)	71(8.8)	64(8)	67(16)
Sex (F%)	59%	53%	43%	33%
MMSE	29(1.1)	28(2.7)	25(4.2)	27(3.4)
HippVol	0.29% (0.03)	0.22% (0.04)	0.25% (0.04)	0.28% (0.02)

*BrainLat dataset



ADNI Alzheimer's Disease Neuroimaging Initiative

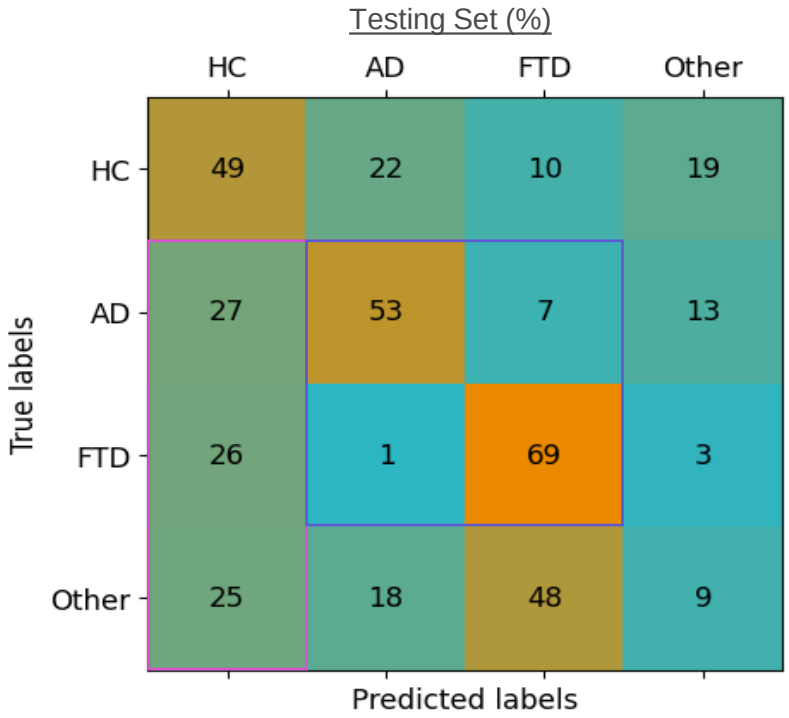
EPAD

OASIS-3 WashU

NIFD UCSF Weill Institute for Neurosciences

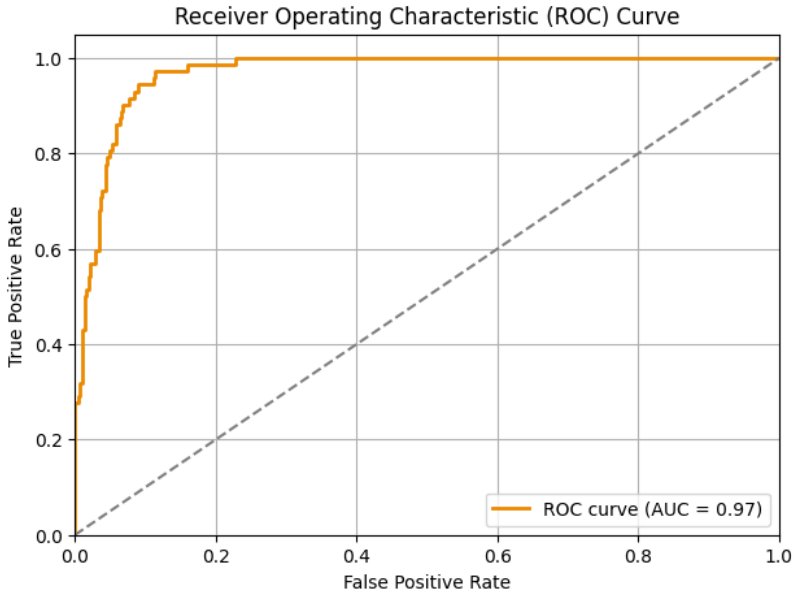
ReD-Lat Multi-Partner Consortium to Expand Dementia Research in Latin America

Model Diagnostic Results

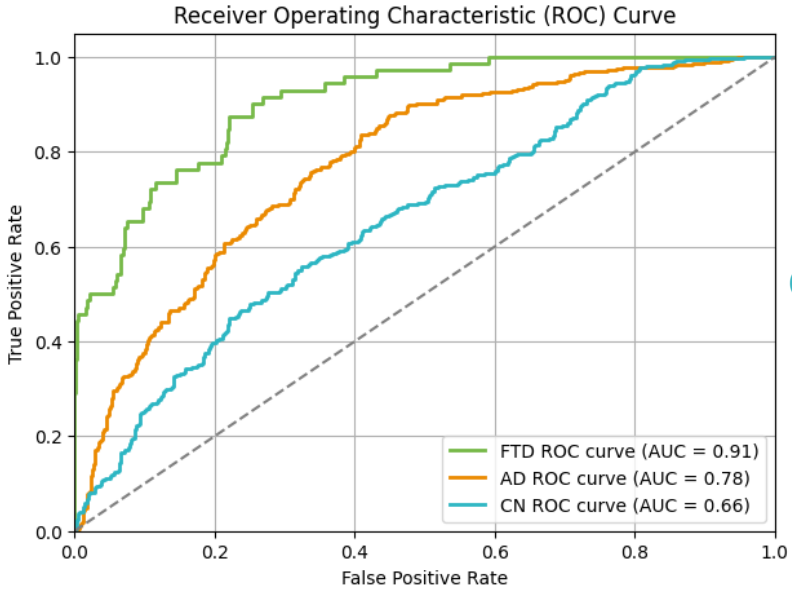


Balanced Accuracy

FTD-vs-Rest	**79%**
AD-vs-Rest	**67%**
HC-vs-Rest	**61%**
FTD-vs-AD	**92%**

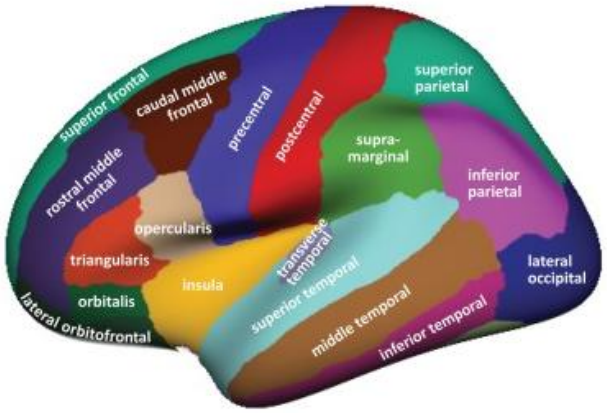


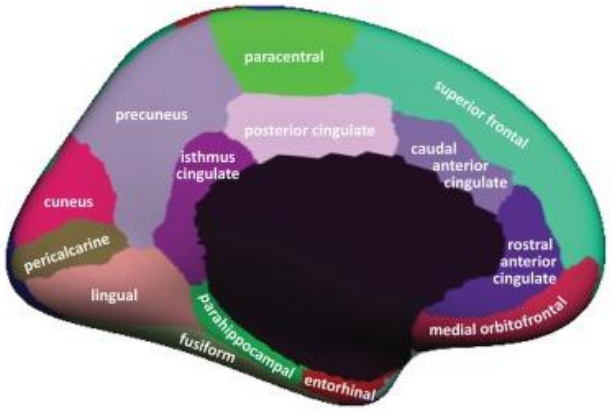
FTD vs AD

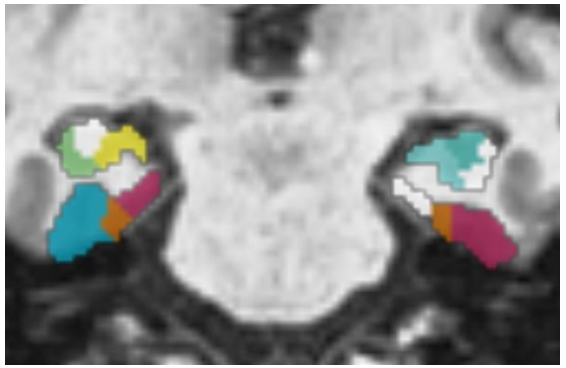


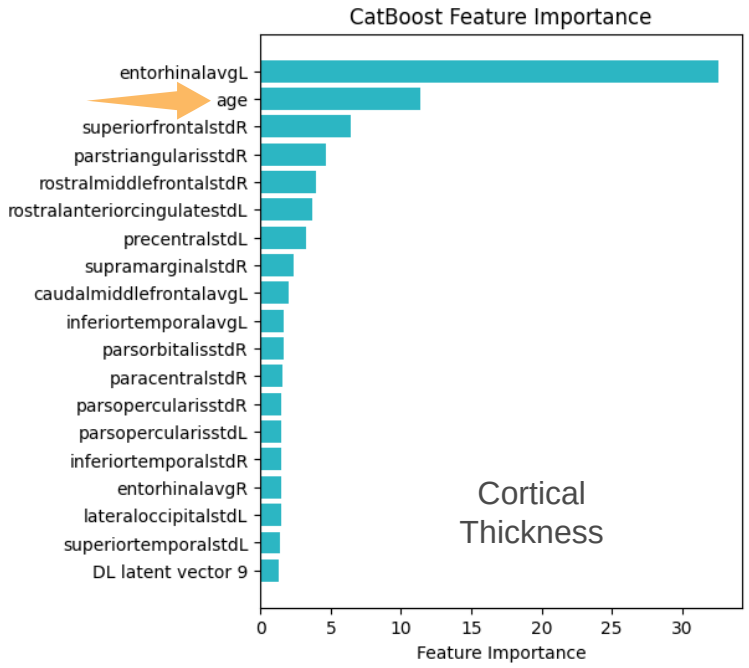
One vs Rest

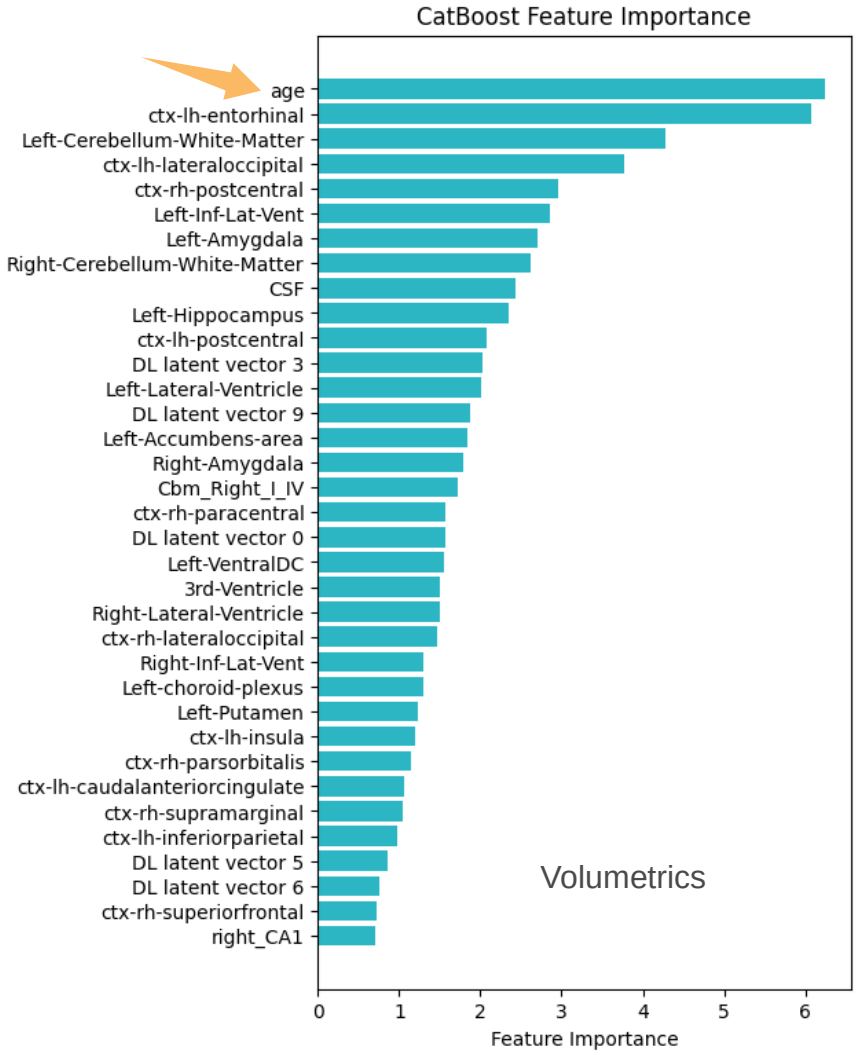
Brain Volume and Thickness Metric Importance



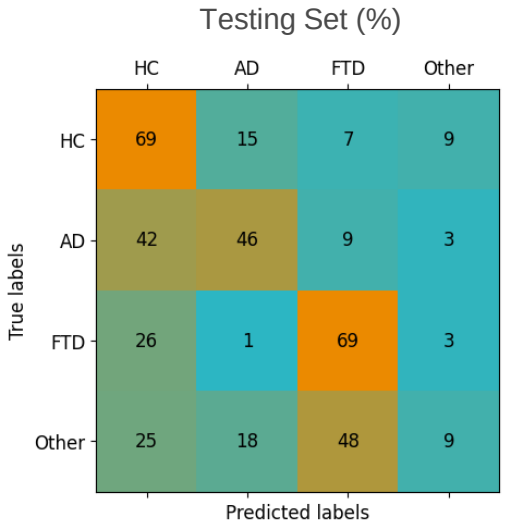


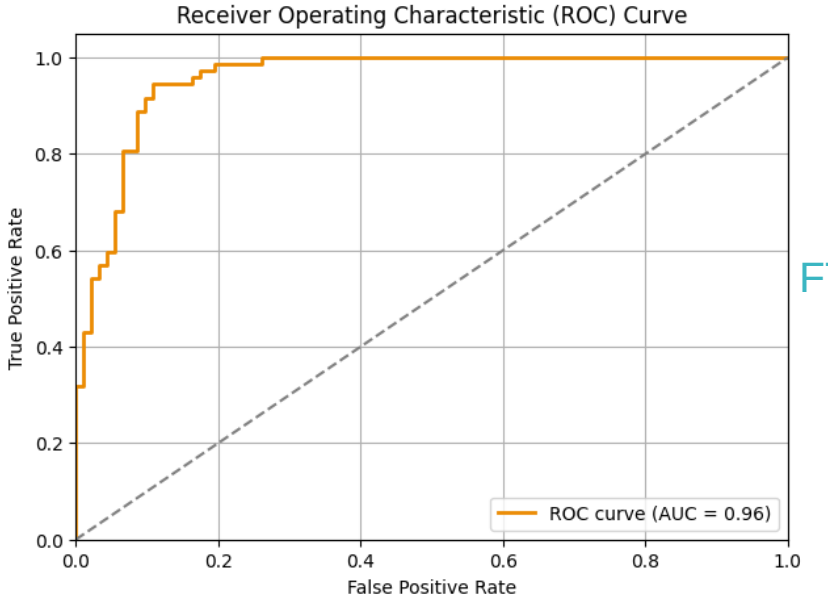






Model Diagnostic Results (Age-matched)



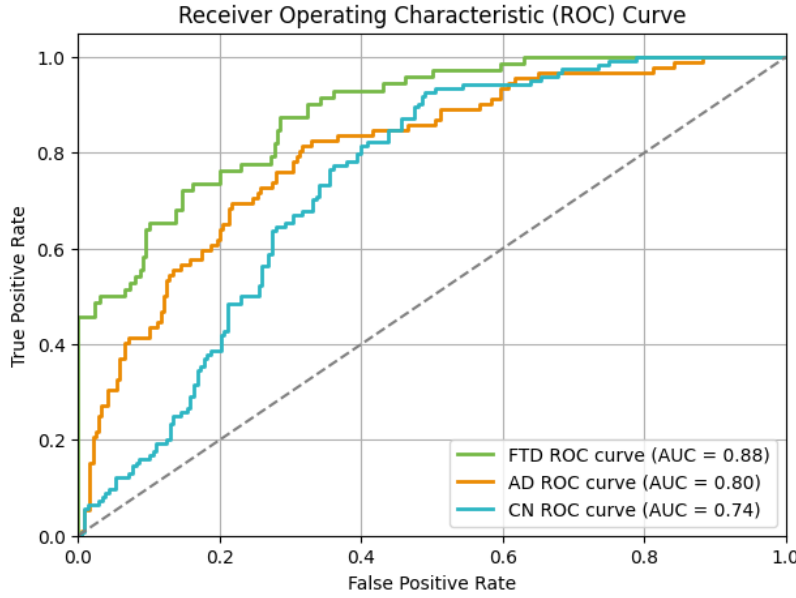


FTD vs AD

Group	Age mean (std)	Age P-value
NC	62.39 (6.45)	AD vs NC: 0.96
AD	62.40 (3.05)	AD vs FTD: 0.57
FTD	62.70 (6.49)	NC vs FTD: 0.56

Balanced Accuracy

FTD-vs-Rest	**77%**
AD-vs-Rest	**67%**
HC-vs-Rest	**68%**
FTD-vs-AD	**91%**



One vs Rest

Conclusions and future work

The proposed MRI-based model shows good potential to support differential diagnosis between AD and FTD subjects.

Ongoing work is looking at

- Performance testing on additional datasets
- Combinatorial use with other biomarkers (e.g. amyloid BBM / PET)
- Assess impact on clinical trial recruitment