The Alzheimer's Disease Prediction Of Longitudinal Evolution

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TADPOLE Overview

The Alzheimer's Disease Prediction Of Longitudinal Evolution (TADPOLE) is a dataset created and formatted by EuroPOND consortium with funding from the European Union's Horizon 2020 research and innovation programme for use in a scientific challenge for senior high school students to develop machine learning algorithms to predict future evolution of individuals at risk of Alzheimer's Disease.

TADPOLE Overview

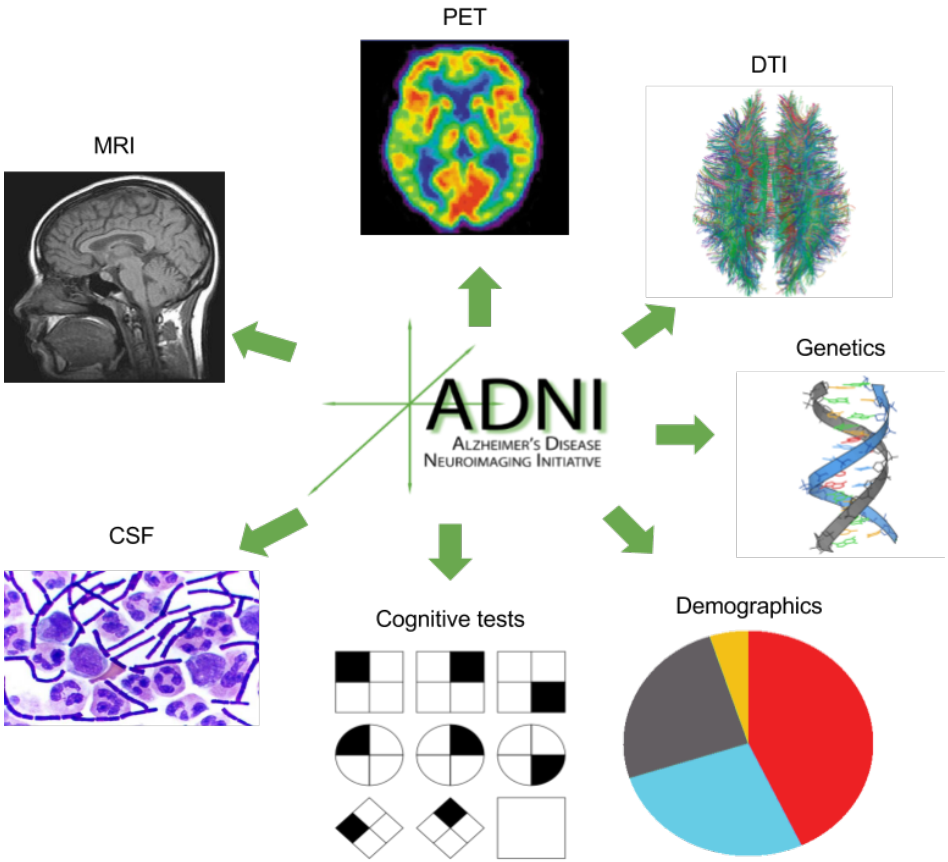


Diagram showing TADPOLE biomarkers. Source of individual images: Wikimedia Commons

TADPOLE is a longitudinal data derived from the ADNI dataset with

- preselected features
- fairly preprocessed
- well documented data descriptions at the tadpole website

Modalities Overview

- Diagnosis
- Demographics
- Cognitive Tests
- Genetic information
- MRI ROI
- PET ROI

Diagnosis

Longitudinal 1730/1737 Patients (99.6%)

The entries specify both the current diagnosis and the baseline so, for example "MCI to Dementia" means that the current diagnosis is Dementia, while the diagnosis at the previous visit was MCI.

Code	Meaning
LMCI	Late Mild Cognitive Impairment
CN	Normal Aging/Cogntively Normal
EMCI	Early Mild Cognitive Impairment
AD	Alzheimer's disease
SMC	Significant Memory Concern

Demographics and Genetic

Demographics Static 1737/1737 Patients (100%)

- Age
- Sex
- Education
- Ethnicity
- Race
- Marital Status

Genetic (ApoE4) Static 1725/1737 Patients (99.3%)

- The alipoprotein E4 variant (APOE E4) is a gene that is the largest known risk factor for AD. Subjects with APOE E4 have a risk 10 to 30 times higher of developing AD compared to non-carriers (i.e. subjects without the gene).

Two of the biggest two known risk factors associated with Alzheimer's Disease are Age and APOE4

Cognitive Tests

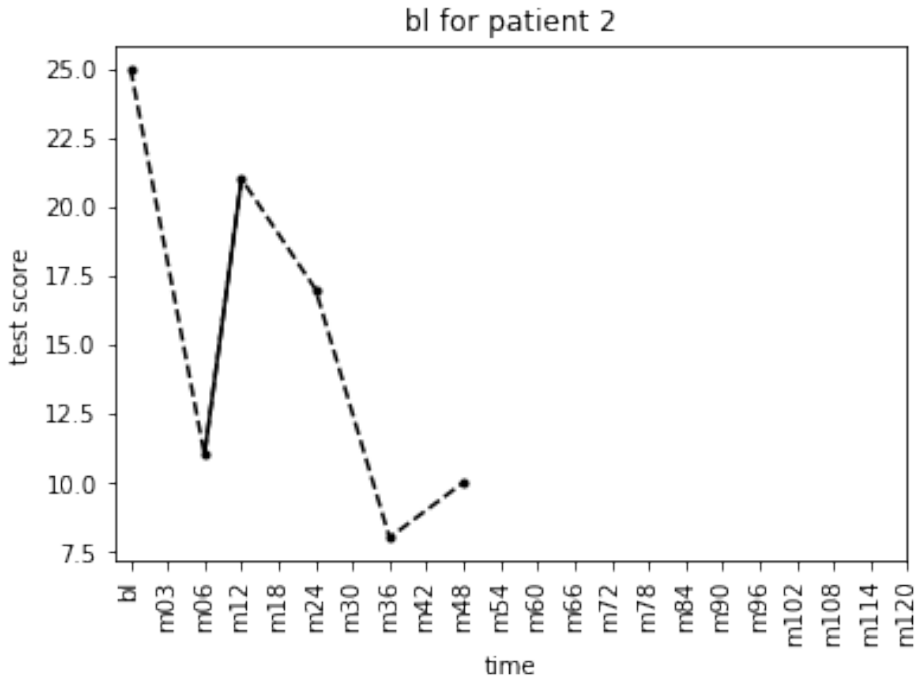
Longitudinal 1737/1737 Patients (100%)

Measure cognitive decline in a direct and quantifiable manner.

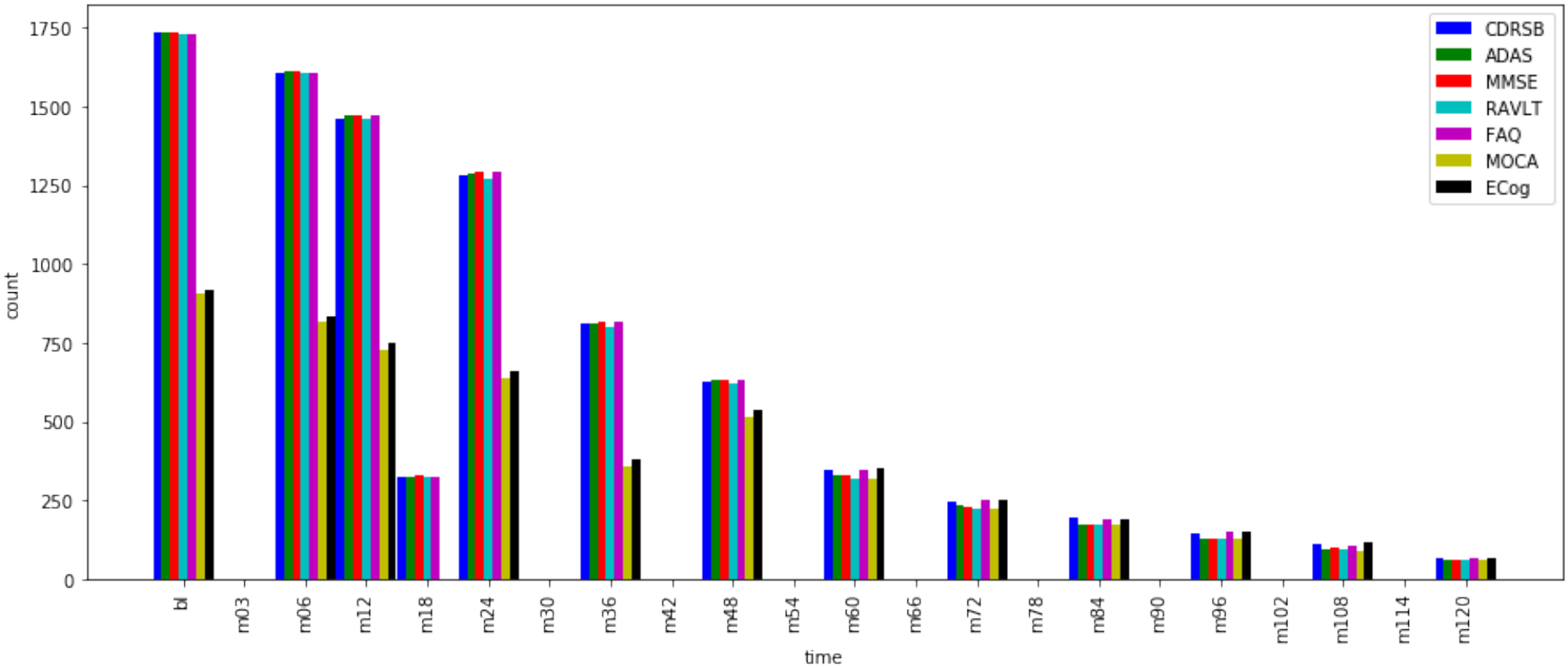
- CDR Sum of Boxes 1737/1737 Patients (100%)
  - Clinical Dementia Rating Scale Sum of Boxes
- ADAS11, ADAS13 1734/1737 Patients (99.8%)
  - Alzheimer's Disease Assessment Scale
- MMSE 1737/1737 Patients (100%)
  - Mini–Mental State Examination
- RAVLT 1735/1737 Patients (99.9%)
  - Rey Auditory Verbal Learning Test

Cognitive Tests

- MOCA 1202/1737 Patients (69.2%)
  - Montreal Cognitive Assessment
- FAQ 1732/1737 Patients (100%)
  - Functional Activities Questionnaire
- Ecog 1219/1737 Patients (70.2%)
  - Everyday Cognition



Cognitive Tests

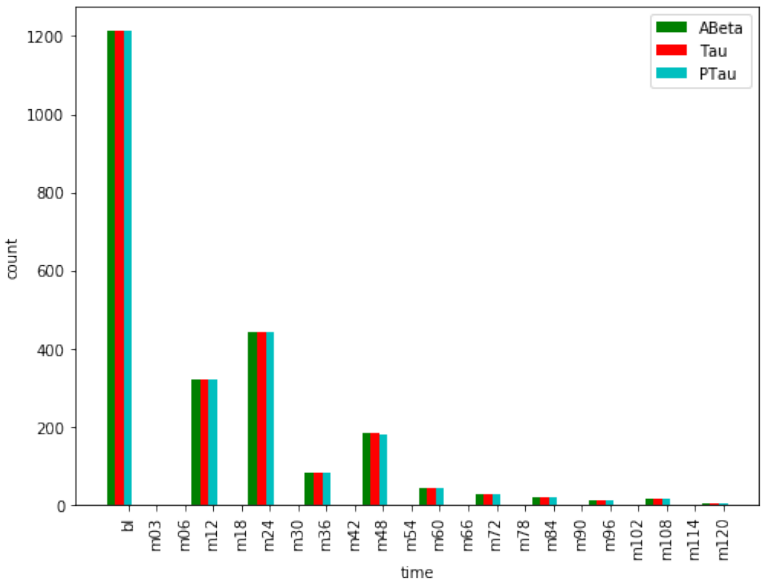


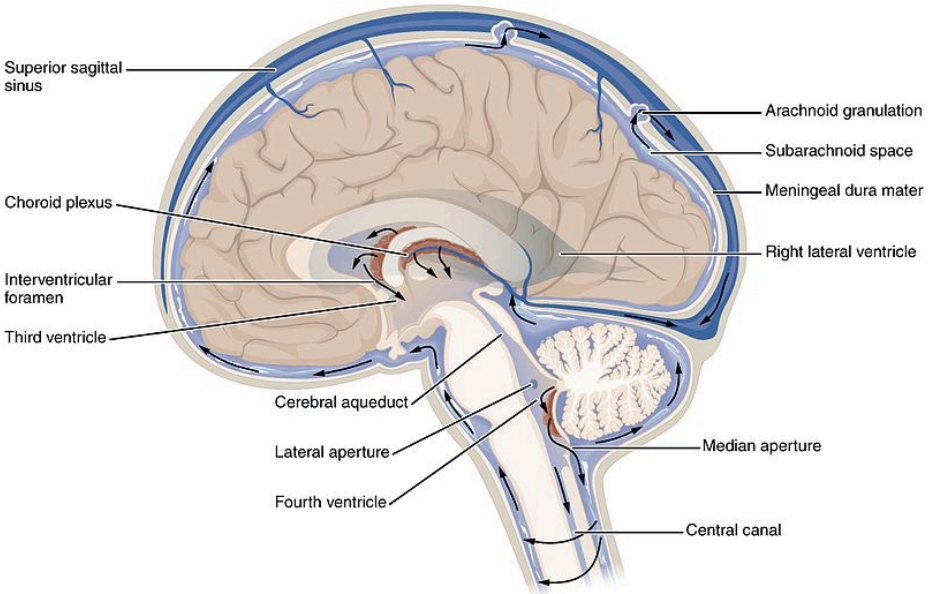
CSF

Longitudinal 1255/1737 (72.3%)

Abnormal levels of certain proteins in the cerebrospinal fluid (CSF) are some of the earliest signs of Alzheimer's disease and can indicate abnormalities many years before symptom onset.

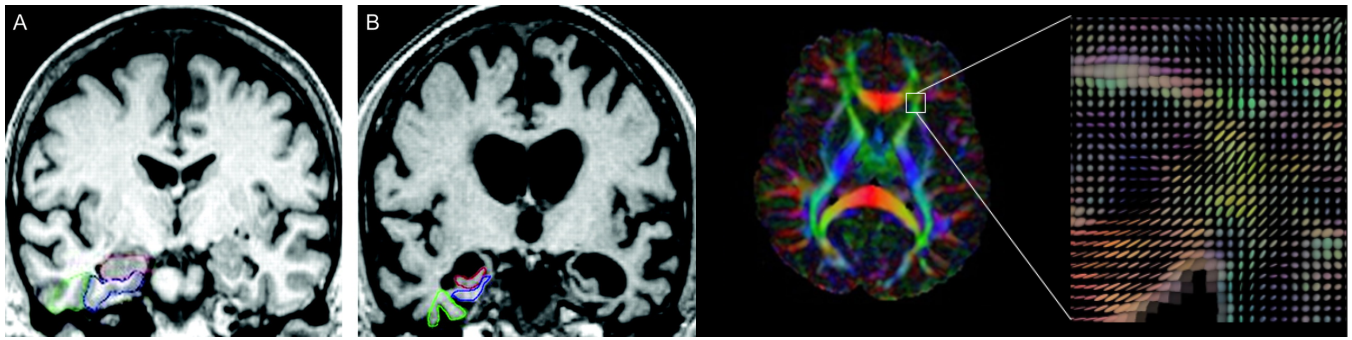
This dataset contains amyloid-beta level, tau level, and phosphorylated tau level.



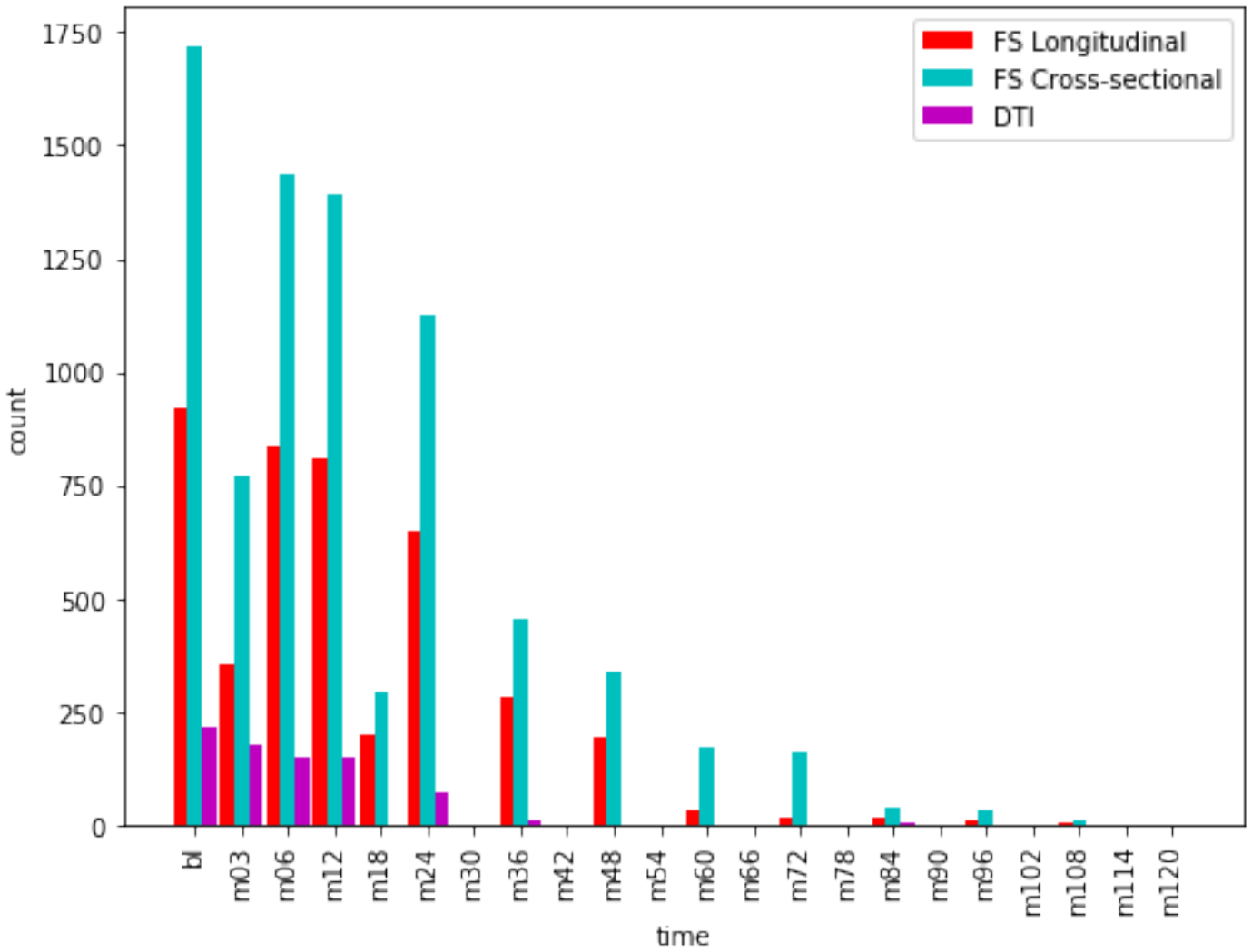


MRI

- MRI
  TADPOLE datasets include three main types of structural MRI markers of atrophy: 1. ROI volumes 2. ROI cortical thicknesses 3. ROI surface areas
  - FreeSurfer (cross-sectional) 1735/1737 Patients (99.9%)
  - FreeSurfer (longitudinal) 1105/1737 Patients (63.6%)
- Diffusion Tensor Imaging (DTI) 249/1737 Patients (14.3%)
  DTI can measure the degeneration of white matter (connections between neurons) in the brain. This is done by analyzing the diffusion of water molecules along the neuron fibre connections.

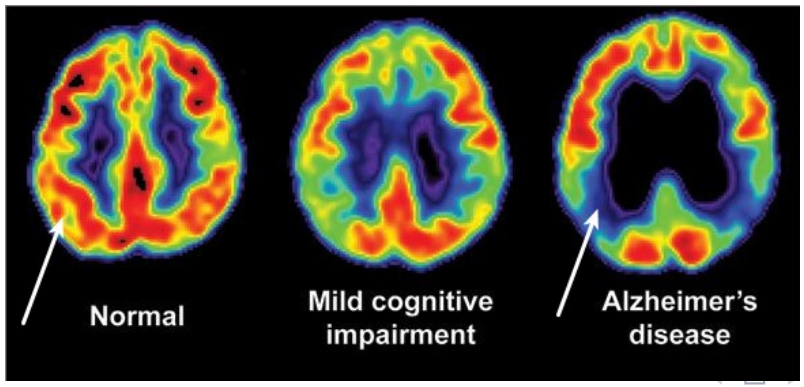


MRI

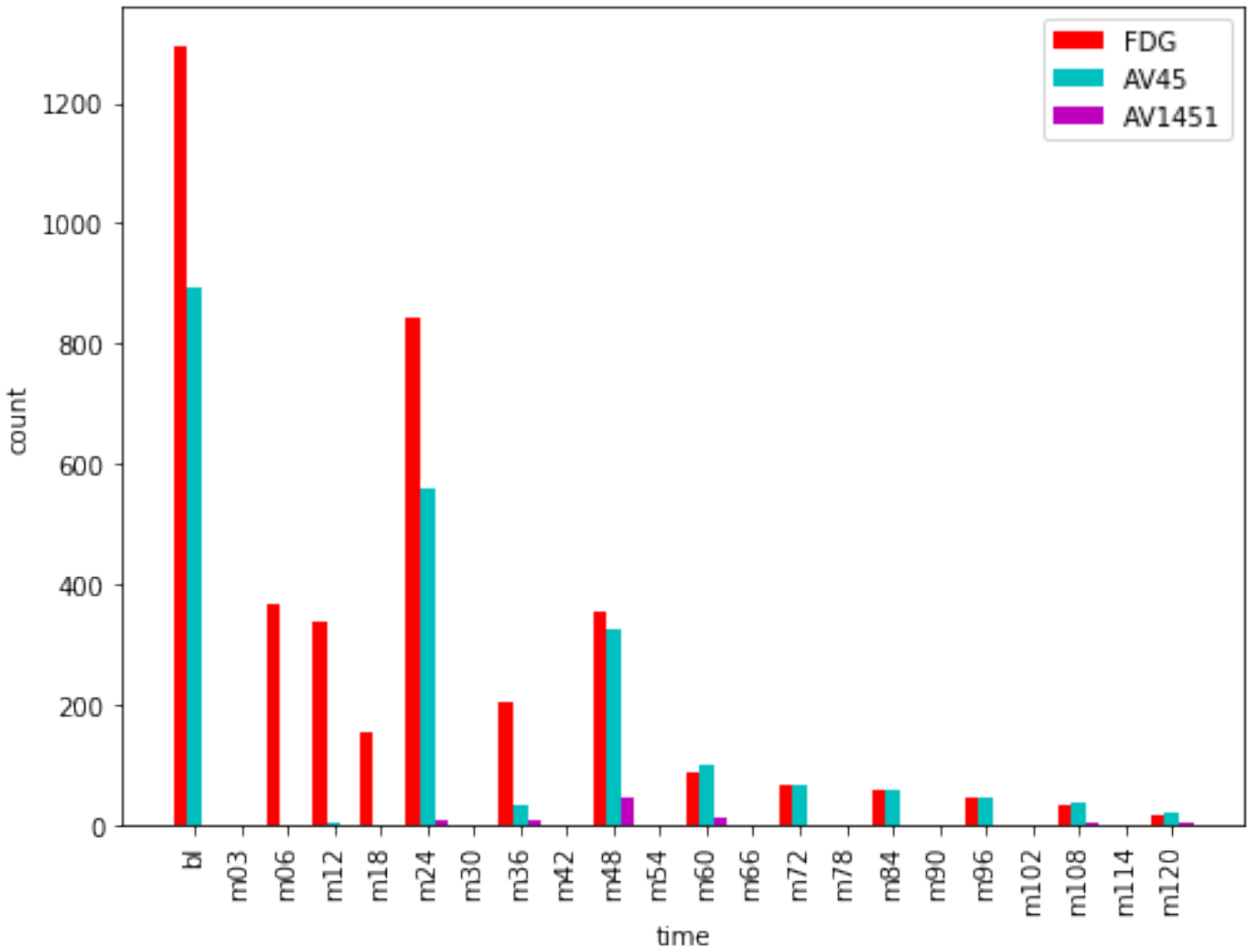

FS Longitudinal
FS Cross-sectional
DTI
count
time
0
250
500
750
1000
1250
1500
1750
bl
m03
m06
m12
m18
m24
m30
m36
m42
m48
m54
m60
m66
m72
m78
m84
m90
m96
m102
m108
m114
m120

PET

- FDG PET ROI Averages 1401/1737 Patients (80.7%)
  measure cell metabolism, where cells affected by AD show reduced metabolism
- AV45 PET ROI averages 1094/1737 Patients (63.0%)
  measures amyloid-beta load in the brain, where amyloid-beta is a protein that mis-folds (i.e. its 3D structure is not properly constructed), which then leads to AD
- AV1451 PET ROI 85/1737 Patients (4.9%)
  measures tau load in the brain, where tau is another protein which, when abnormal, damages neurons and thus leads to AD

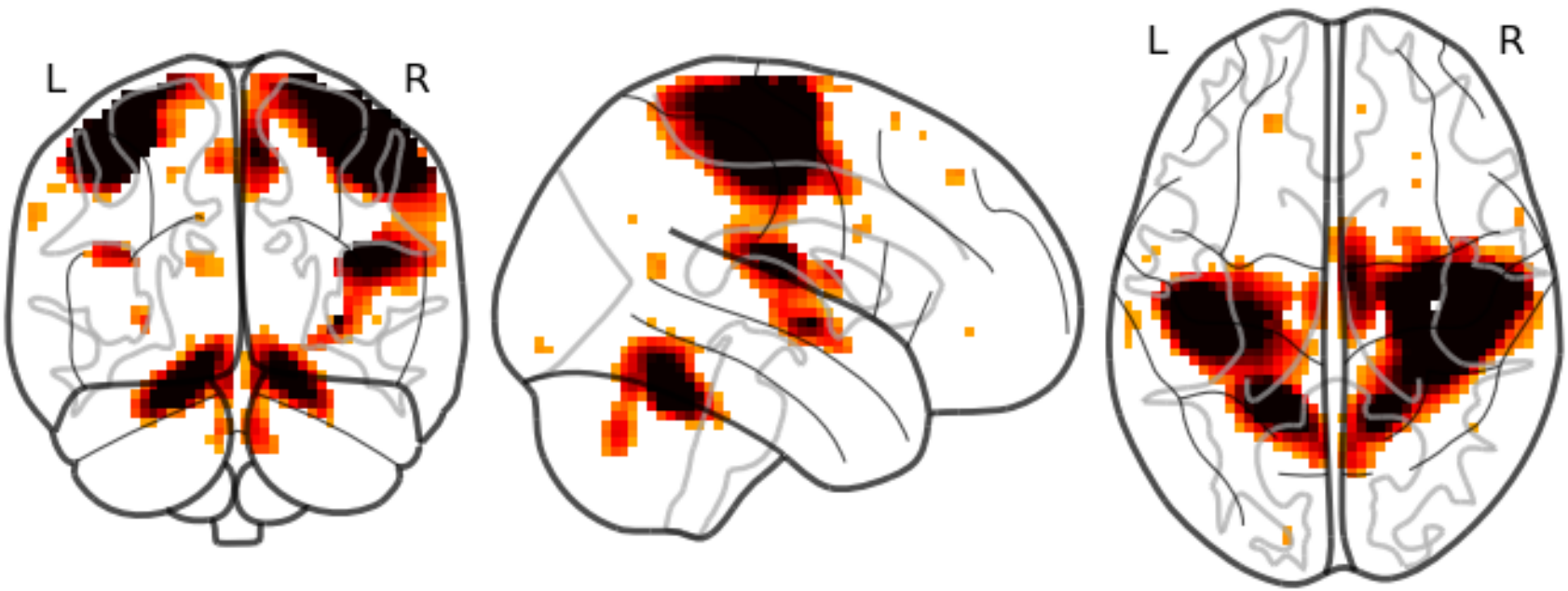


PET

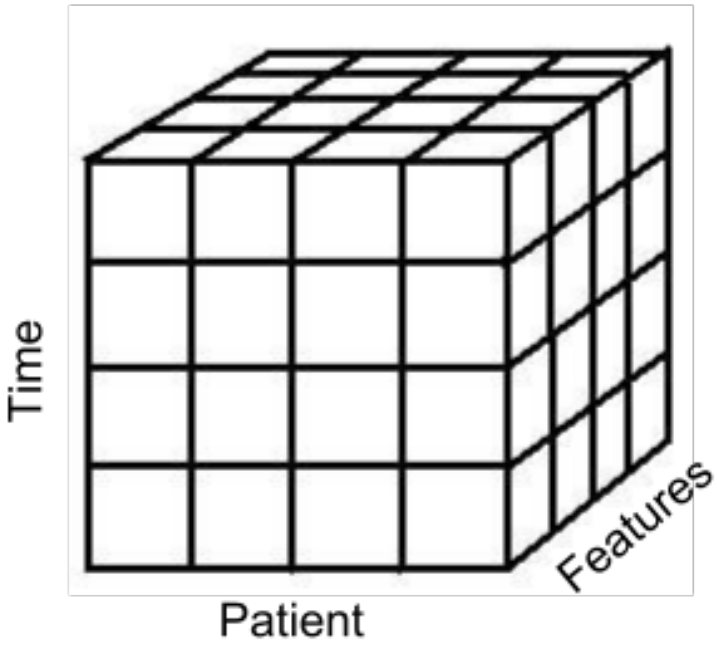

FDG
AV45
AV1451
count
0
200
400
600
800
1000
1200
bl
m03
m06
m12
m18
m24
m30
m36
m42
m48
m54
m60
m66
m72
m78
m84
m90
m96
m102
m108
m114
m120
time

Brain Visualization

All brain imaging data, MRI, DTI, and PET, has been sectioned into regions of interest ROIs, and such can be visualized with the python nilearn package.



Data Access



- Linked on Slack
- Data and Name Files for all Modalities
  - finished_(modaility)_dat.npy
  - (modaility)tags.npy
- Dimensions: (patient, time, features)
- Size: (1737 x 22 x feature length)

Links

- TADPOLE Website Data Information
- TADPOLE Challenge Paper

Questions