

Geometry-admissible Biological And Disease-progression Modeling In Alzheimer's Disease And Related Dementias

aaic2026.1f80329

Abhishek Bansal

Multimodal CSV evidence can be transformed into an interpretable biological-to-disease progression map for Alzheimer's Disease And Related Dementia modeling.

INTRODUCTION

Alzheimer's disease and related dementias involve overlapping biological, imaging, cognitive, and neuropathology evidence layers that require structured multimodal interpretation.

Objective : To demonstrate a geometry-admissible CSV-based workflow for organizing biological evidence and disease-progression signals into a bounded transition model (B-Bio → B-Disease).

METHODS

Proposed Novel B-Bio Theory, Frameworks and Pillars on SaMD- BVIDAL Clinical Software Suite

Multiple NACC/ADSP-derived CSV evidence layers were mapped by source coverage, feature-space width, Subject + overlap, biomarker/imaging density, neuropathology staging, and selected cross-layer correlations.

Source coverage

ADSP-PHC Demographics/Diagnosis: 175,701 rows
ADSP-PHC Cognition: 151,364 rows
ADSP-PHC FLAIR: 12,519 rows
ADSP-PHC T1 MUSE: 11,337 rows
commercial MRI: 10,618 rows
ADSP-PHC Neuropathology: 6,649 rows
ADSP-PHC T1 FS: 4,975 rows
ADSP-PHC Amyloid PET: 4,295 rows
ADSP-PHC Plasma: 3,827 rows
commercial CSF: 2,764 rows
ADSP-PHC CSF: 2,247 rows

Conclusion

The workflow shows that heterogeneous Alzheimer's Disease And Related Dementia evidence layers can be assembled into a review-ready multimodal disease-state representation, supporting future digital-twin style modeling while remaining conceptual and non-diagnostic.

Biological burden

commercial CSF, ADSP-PHC CSF, plasma, amyloid PET, tau PET

Imaging geometry

commercial MRI, T1 FS, T1 MUSE, FLAIR, DTI

Disease-state anchors

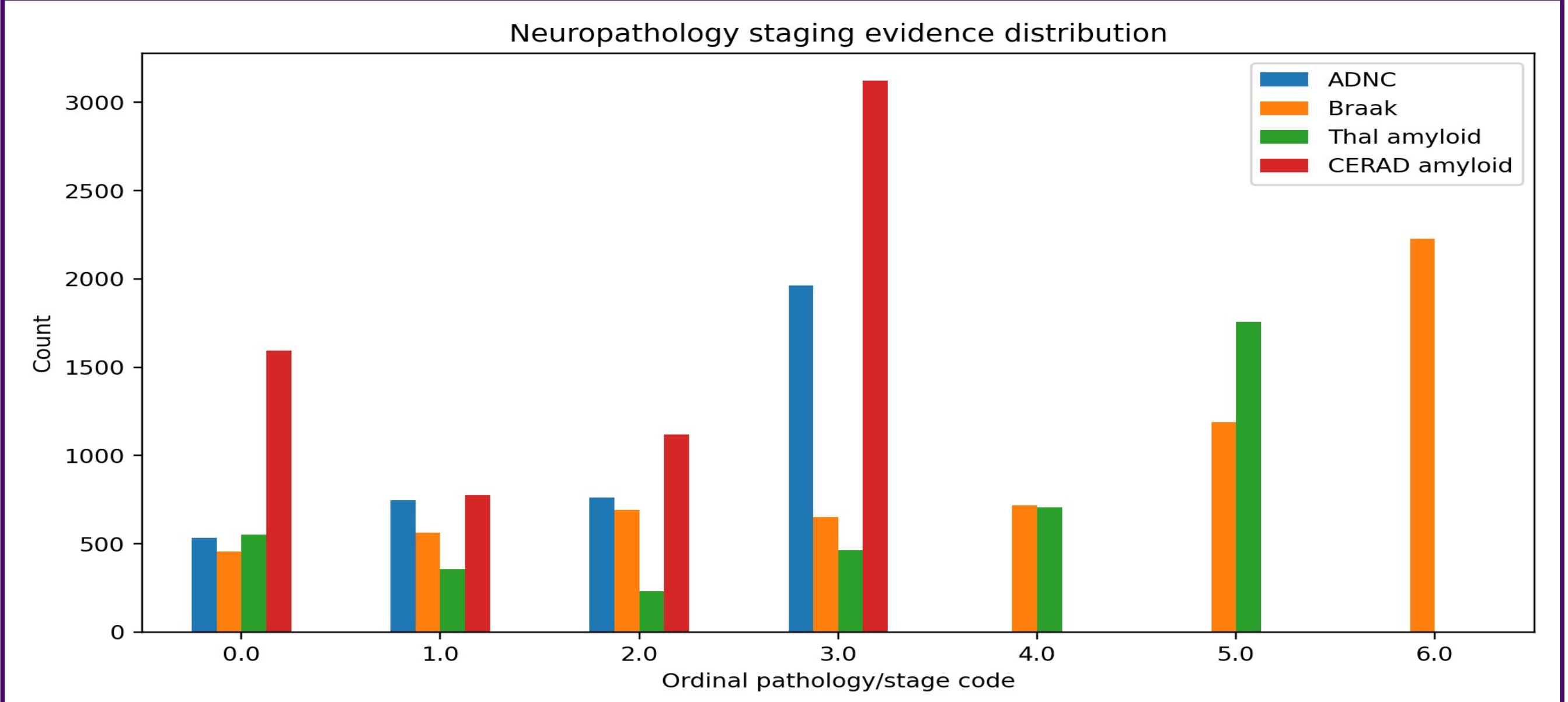
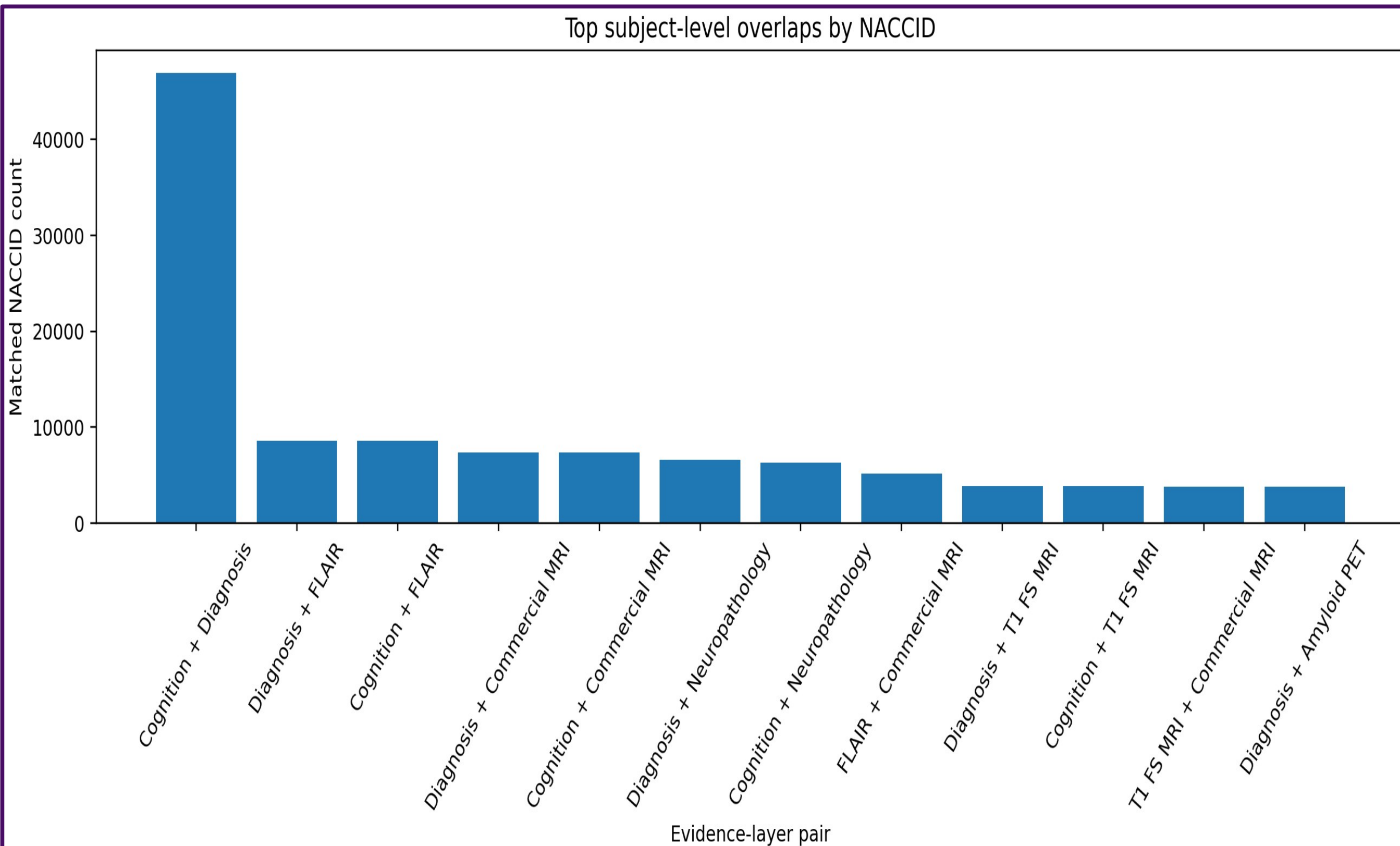
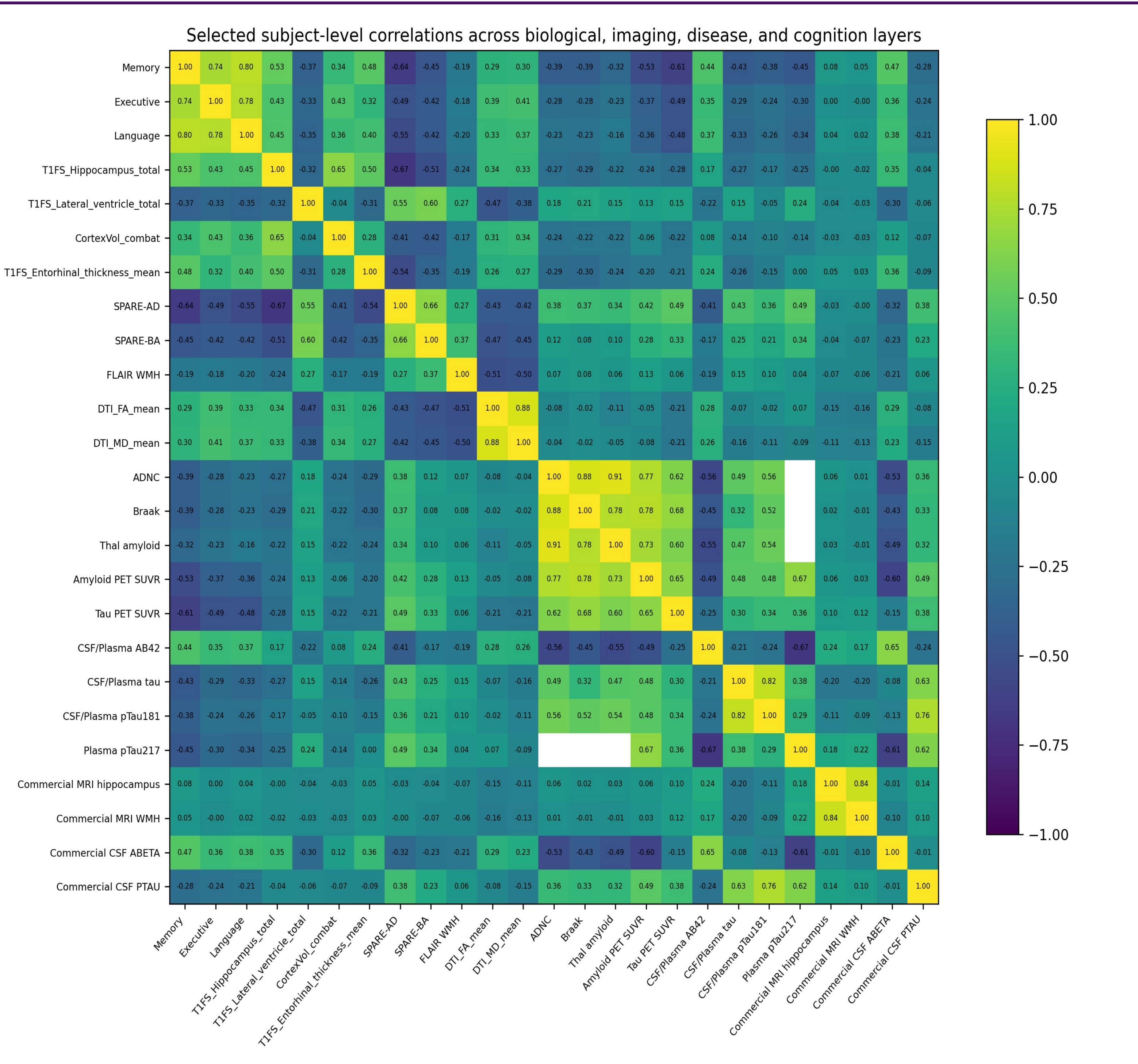
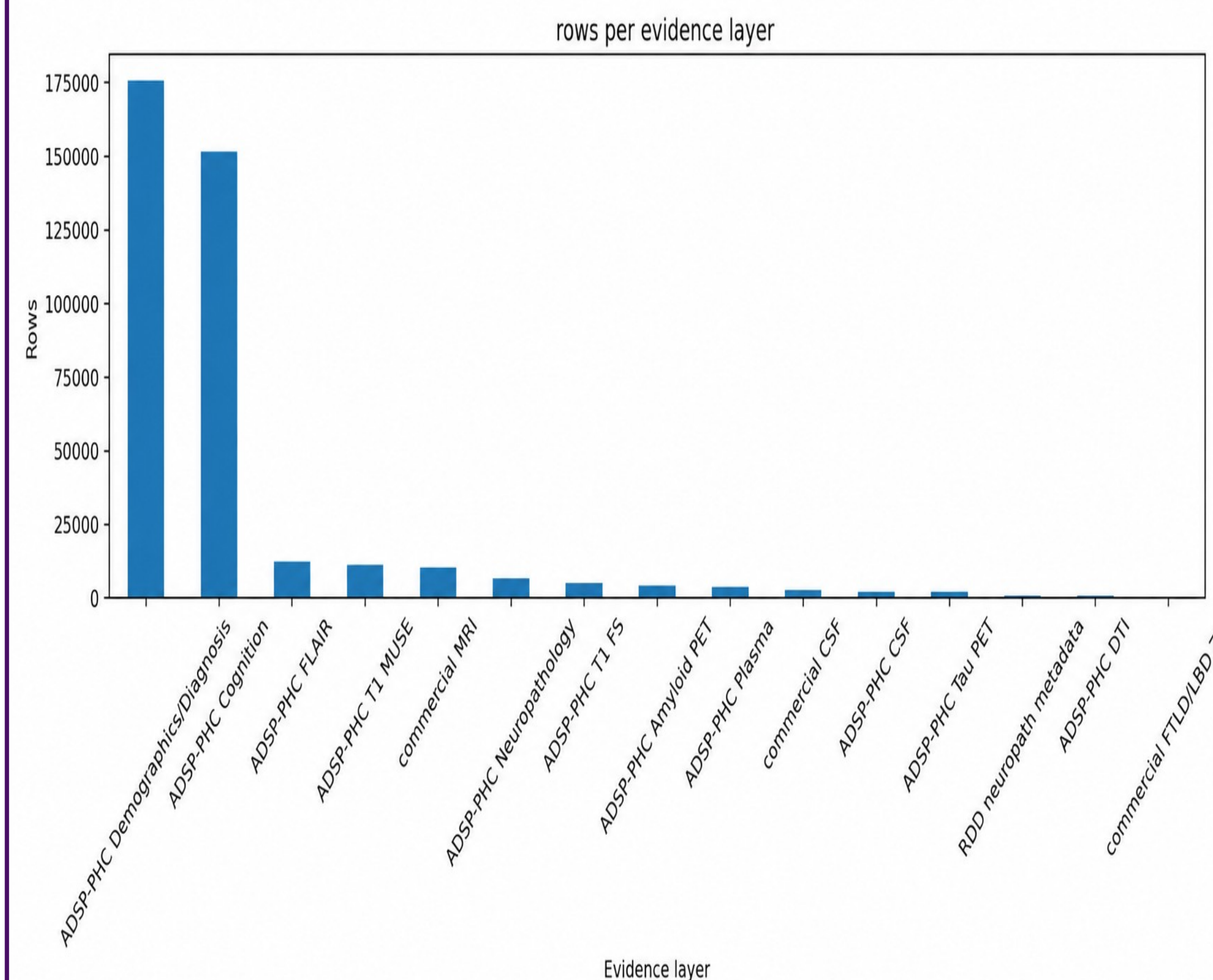
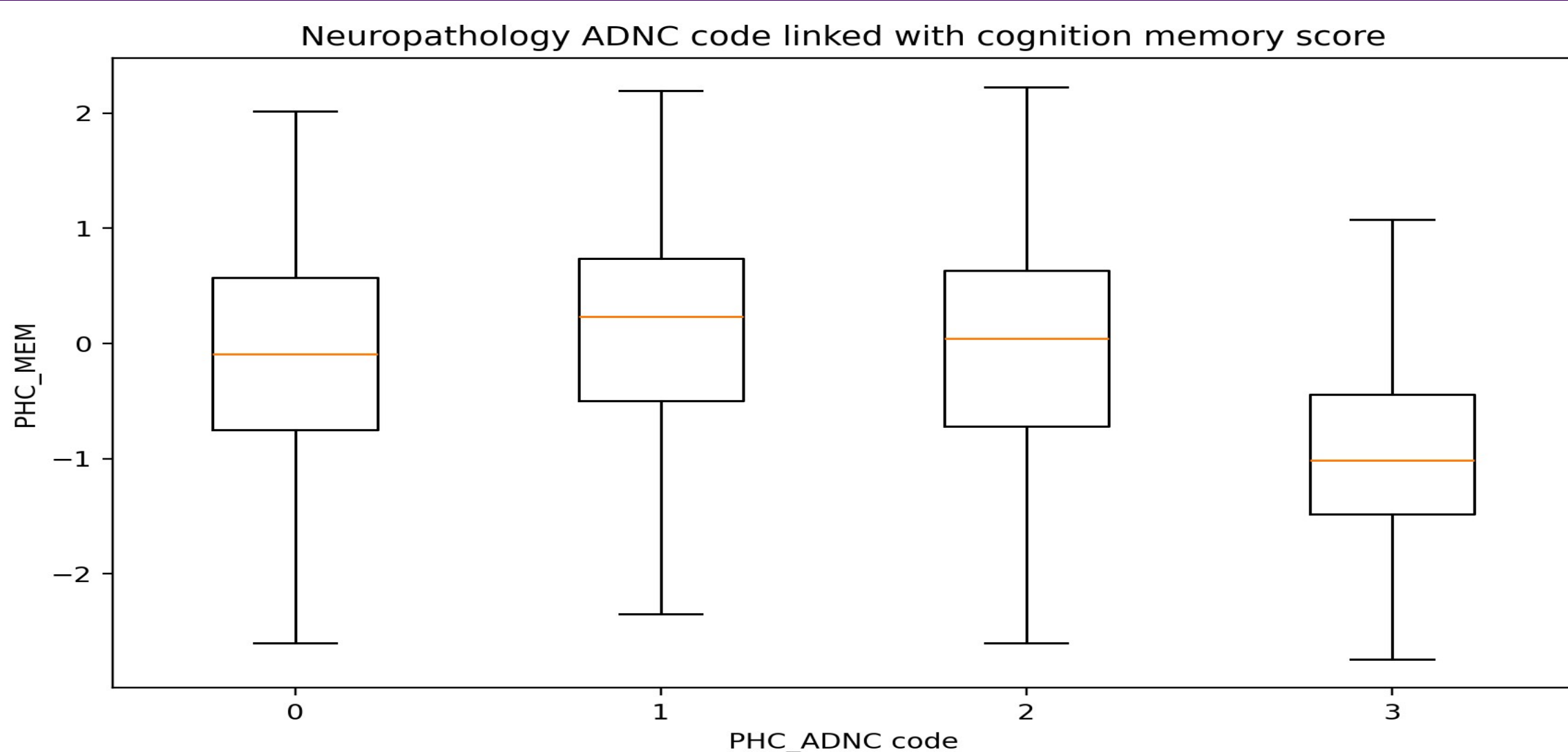
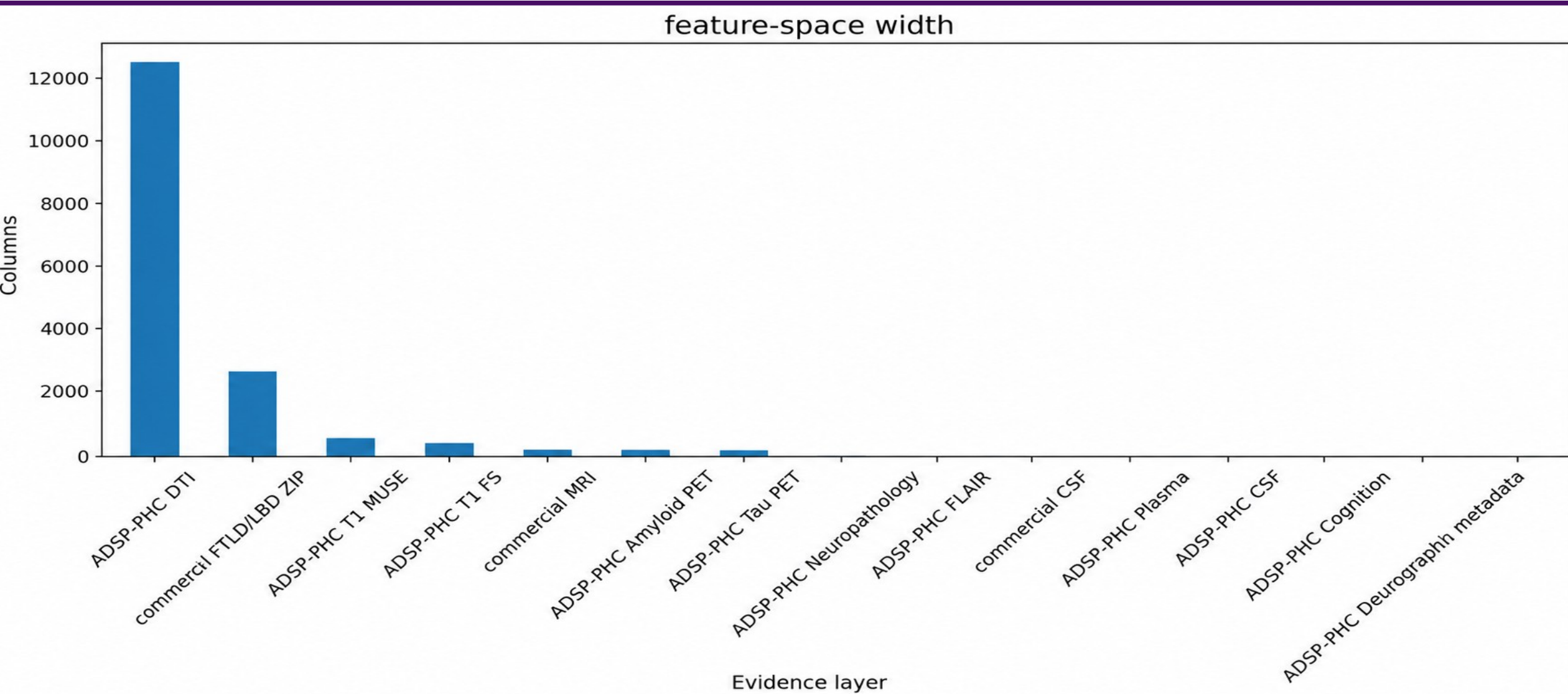
neuropathology ADNC, Braak, Thal, CERAD, Lewy/TDP/CVD; commercial FTLD/LBD

Clinical expression

cognition and demographics/diagnosis tables

Top selected correlation signals

ADNC ↔ Thal amyloid: $r=0.91$
ADNC ↔ Braak: $r=0.88$
DTI_FA_mean ↔ DTI_MD_mean: $r=0.88$
Commercial MRI hippocampus ↔ Commercial MRI WMH: $r=0.84$
CSF/Plasma tau ↔ CSF/Plasma pTau181: $r=0.82$
Memory ↔ Language: $r=0.80$
Braak ↔ Amyloid PET SUVR: $r=0.78$
Executive ↔ Language: $r=0.78$



Acknowledgements

This research did not receive any institutional, technical, or financial assistance. The work was entirely self-funded and independently conducted by me, the solo presenter and the author including the development of novel frameworks and fully free SaMD with only objective to help. For NACC[2], as per agreement for the data/results explicit display, ADSP-PHC is acknowledged as being funded by the NIA(U24 AG074855, U01 AG068057, and R01 AG059716) and NIAGADS(U24 AG04 1689) at the University of Pennsylvania.The NACC database is funded by NIA/NIH Grant U24 AG072122.

REFERENCES

- 1.IEEE DataPort, Abhishek Bansal, "Data:B-Bio Models-2 ", doi: 10.21227/pvxx-7p34
2. Selected NAAC : commercial_fcsf_nacc73.csv, NACC_CS_ADSP_PHC_CSF_2026.02.18.csv , NACC_CS_ADSP_PHC_Plasma_2026.02.18.csv commercial_ftldlbd_nacc73.csv,NACC_CS_ADSP_PHC_Demographics_Diagnosis_2026.02.18.csv,NA CC_CS_ADSP_PHC_T1_FS_2026.02.18.csv,commercial_mri_nacc73.csv,NACC_CS_ADSP_PHC_DTI_2026.02.18.csv,NACC_CS_ADSP_PHC_T1_MUSE_2026.02.18.csv,NACC_CS_ADSP_PHC_Amyloid_Detailed_2026.02.18.csv,NACC_CS_ADSP_PHC_FLAIR_2026.02.18.csv,NACC_CS_ADSP_PHC_Tau_2026.02.18.csv,NACC_CS_ADSP_PHC_Cognition_2026.02.18.csv,NACC_CS_ADSP_PHC_Neuropath_2026.02.18.csv, rdd-np.csv

CONTACT Email :

abhishekbansal006@gmail.com

