

Geometry-Aware Artificial Intelligence for Interpretable Modeling of Alzheimer's Disease and Related Dementias

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Abhishek Bansal

PyTorch and Bansal Frameworks (B-AI)-based geometry-aware AI converts OASIS MRI, segmentation, and multimodal NACC/ADSP-PHC CSV evidence into interpretable projected evidence states for review-only modeling.

INTRODUCTION

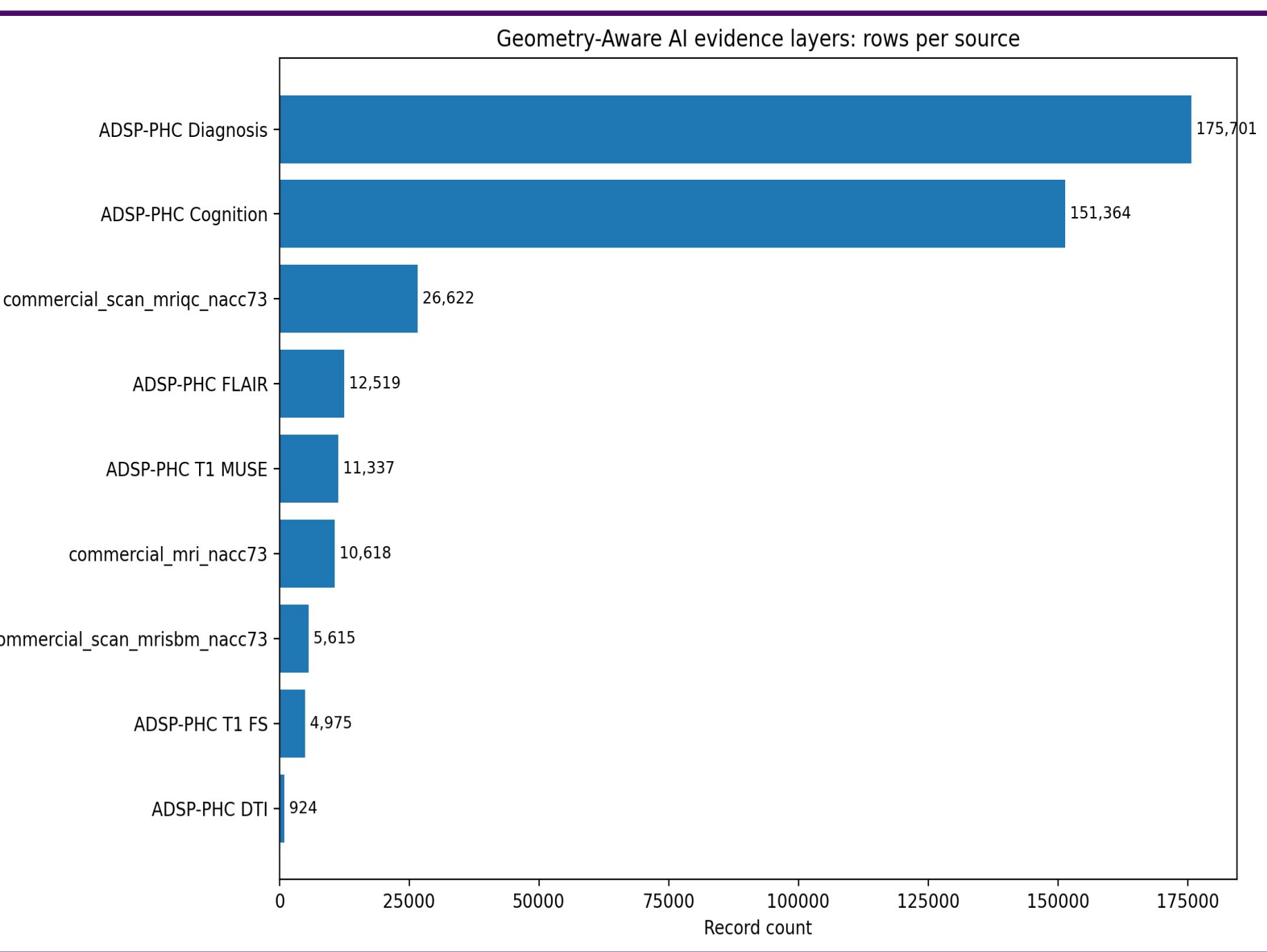
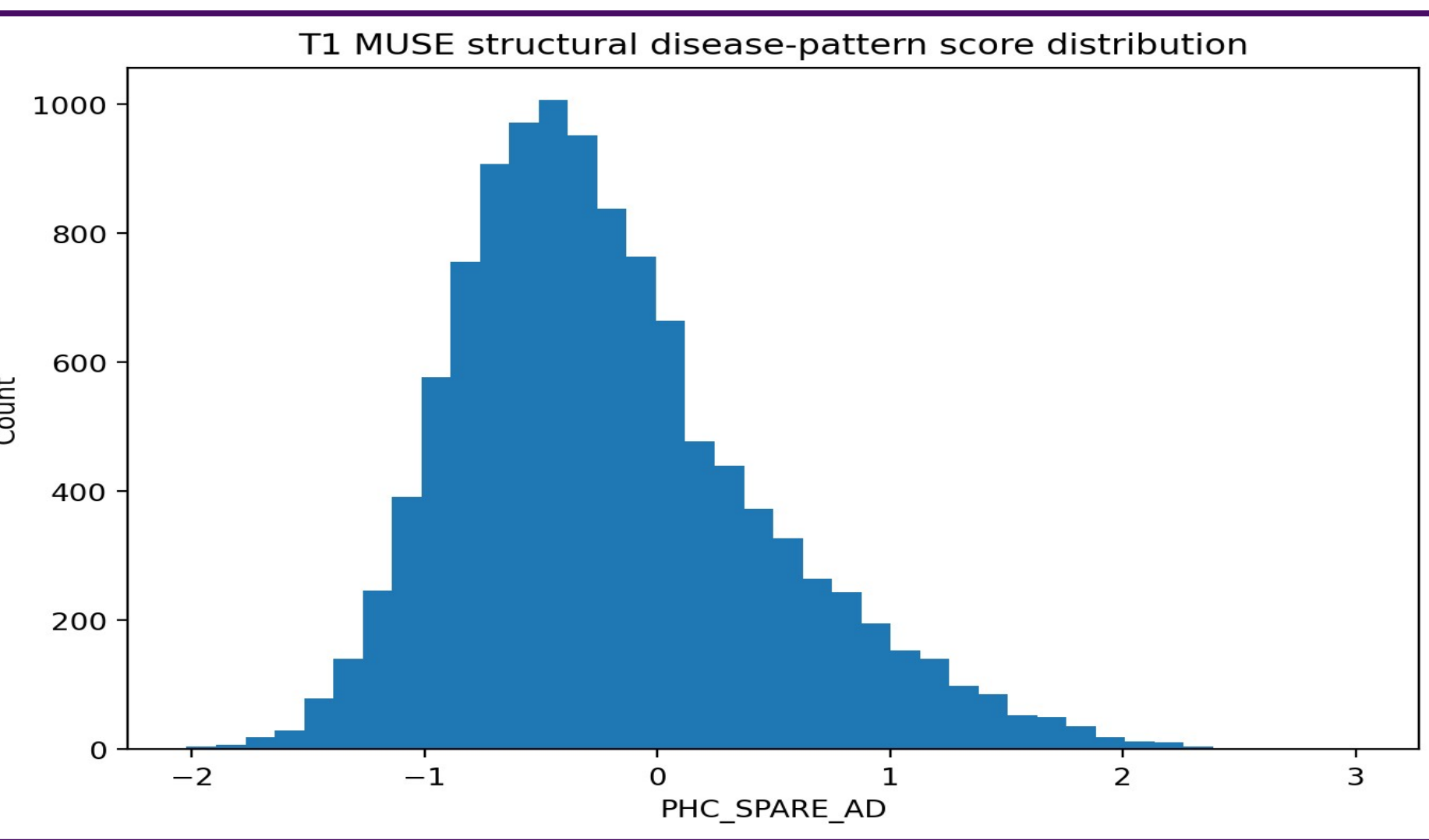
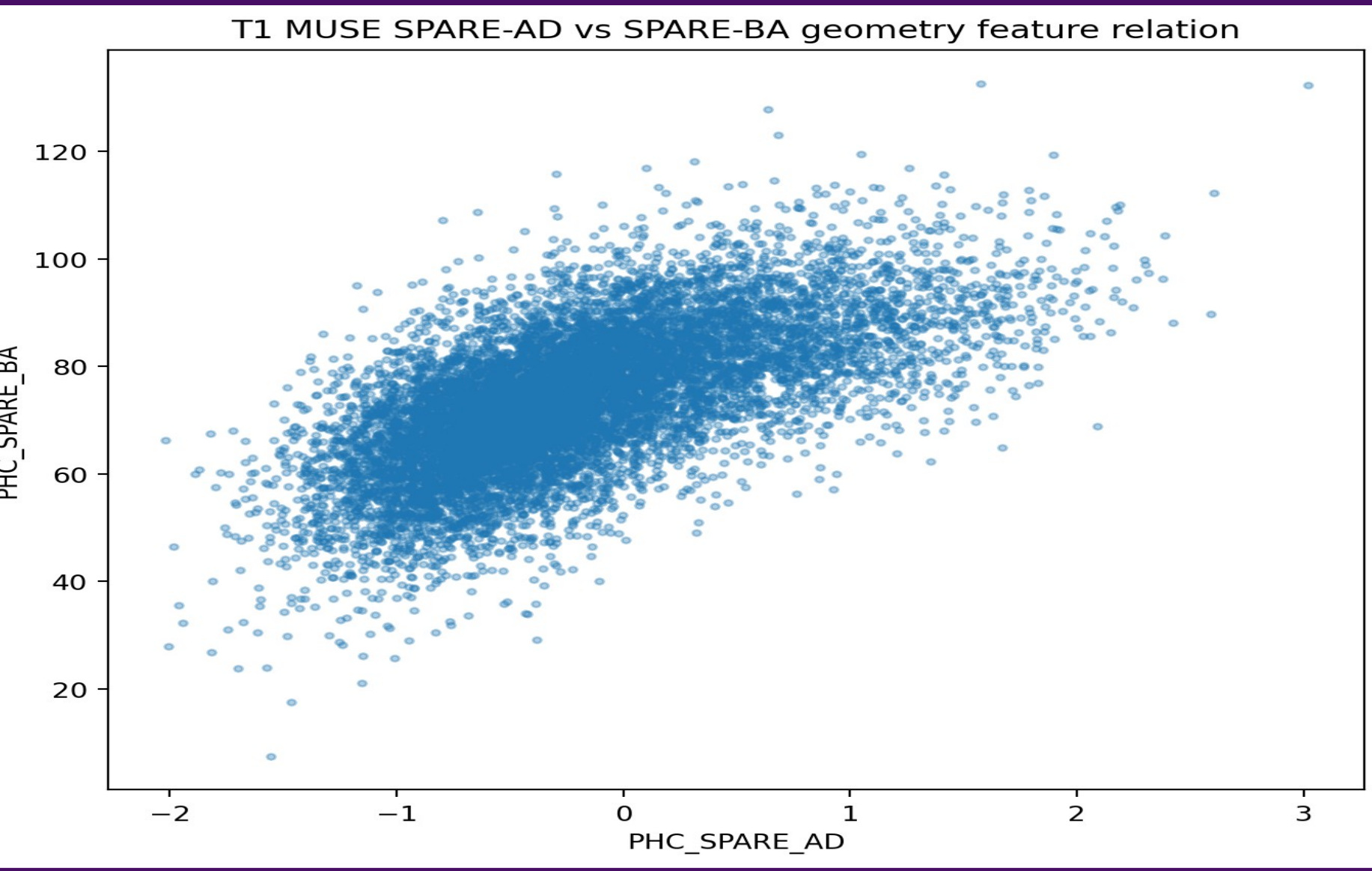
Alzheimer's disease and related dementias require interpretable review of MRI, segmentation, and structured clinical-imaging evidence, because isolated AI scores or image measurements can be difficult to interpret biologically.

Objective : To demonstrate PyTorch and Bansal Frameworks (B-AI)-based workflow that extracts MRI/segmentation features and projects them into geometry-aware, review-only evidence states for interpretable Alzheimer's and related dementias modeling.

METHODS

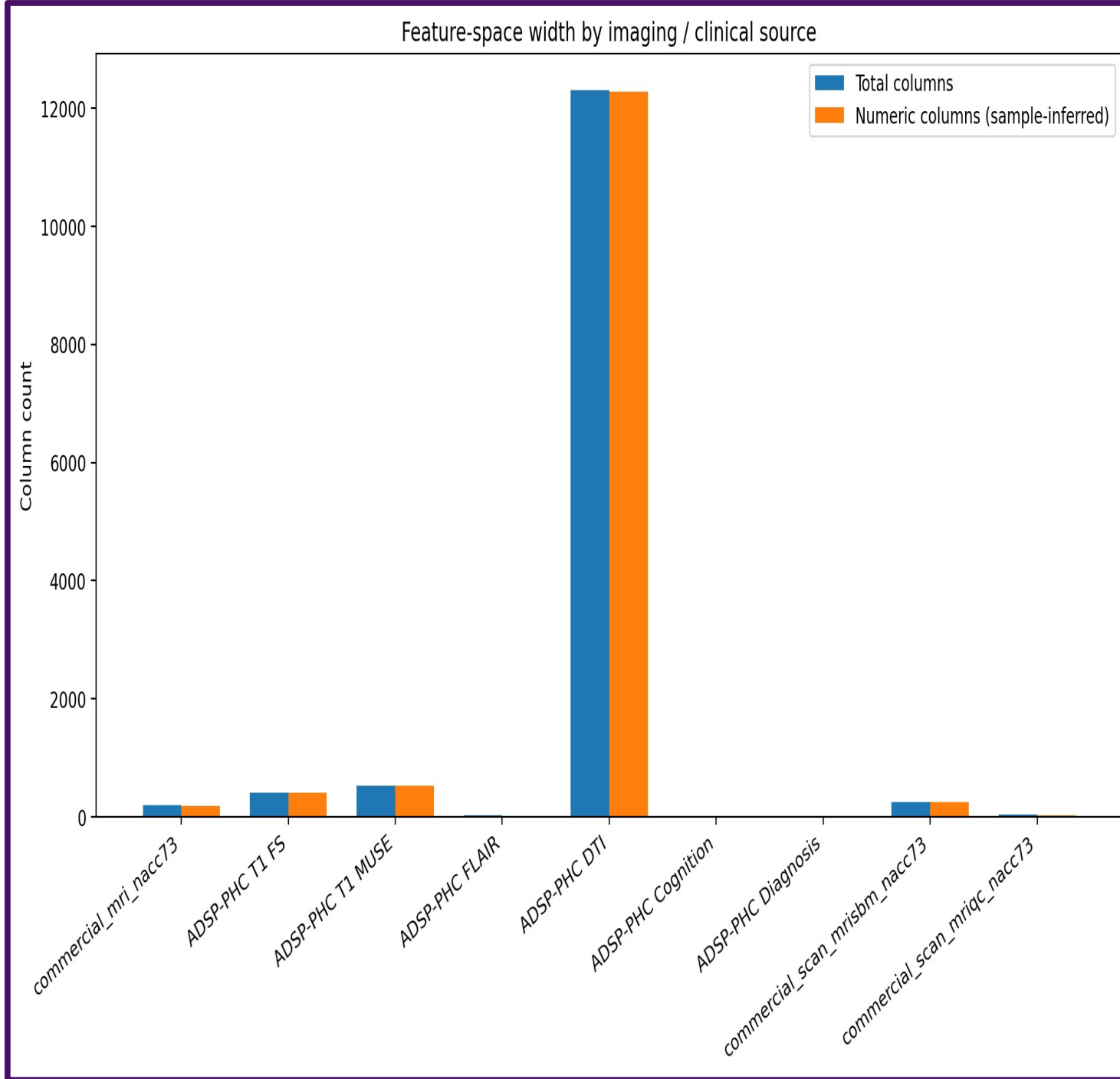
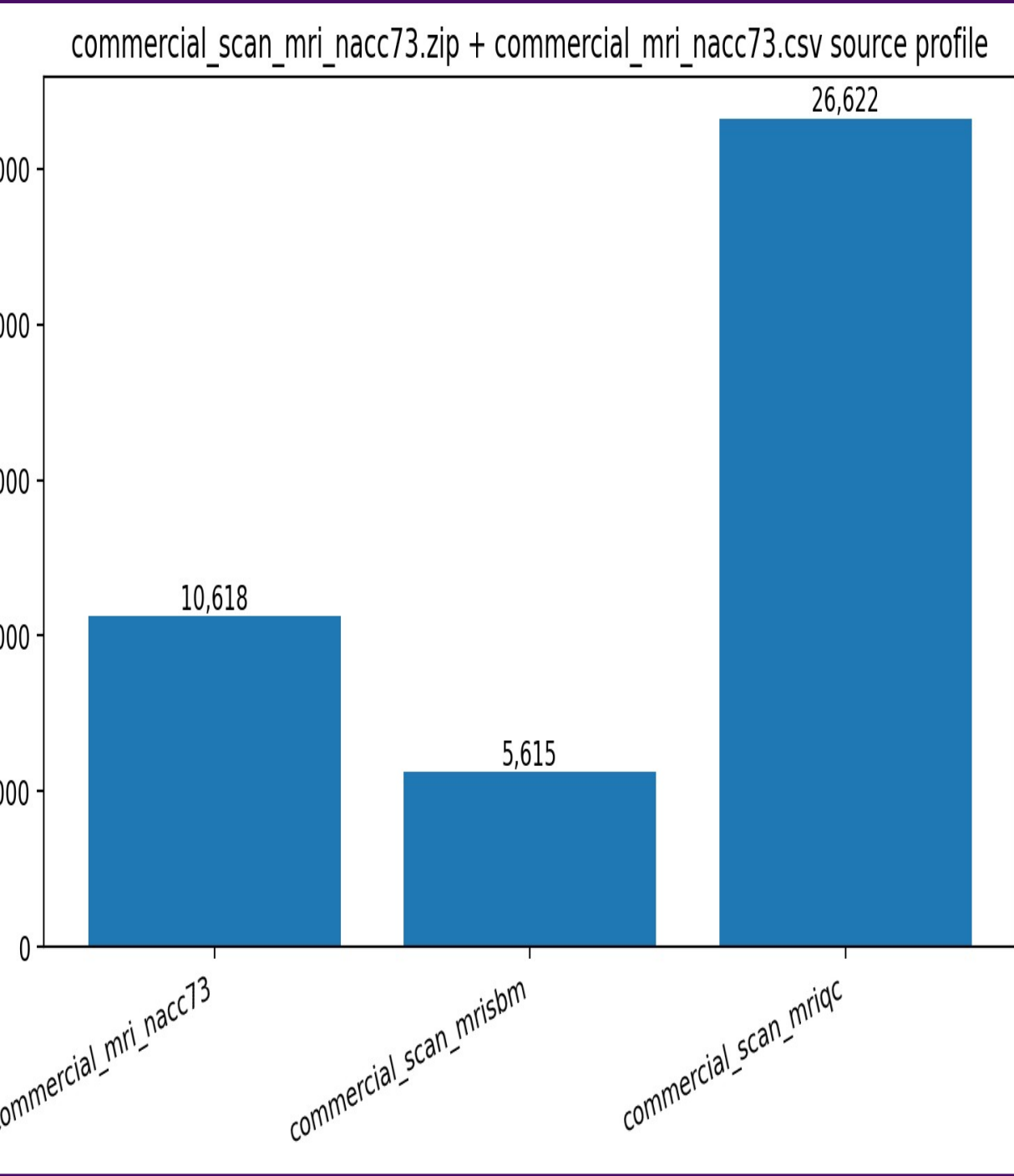
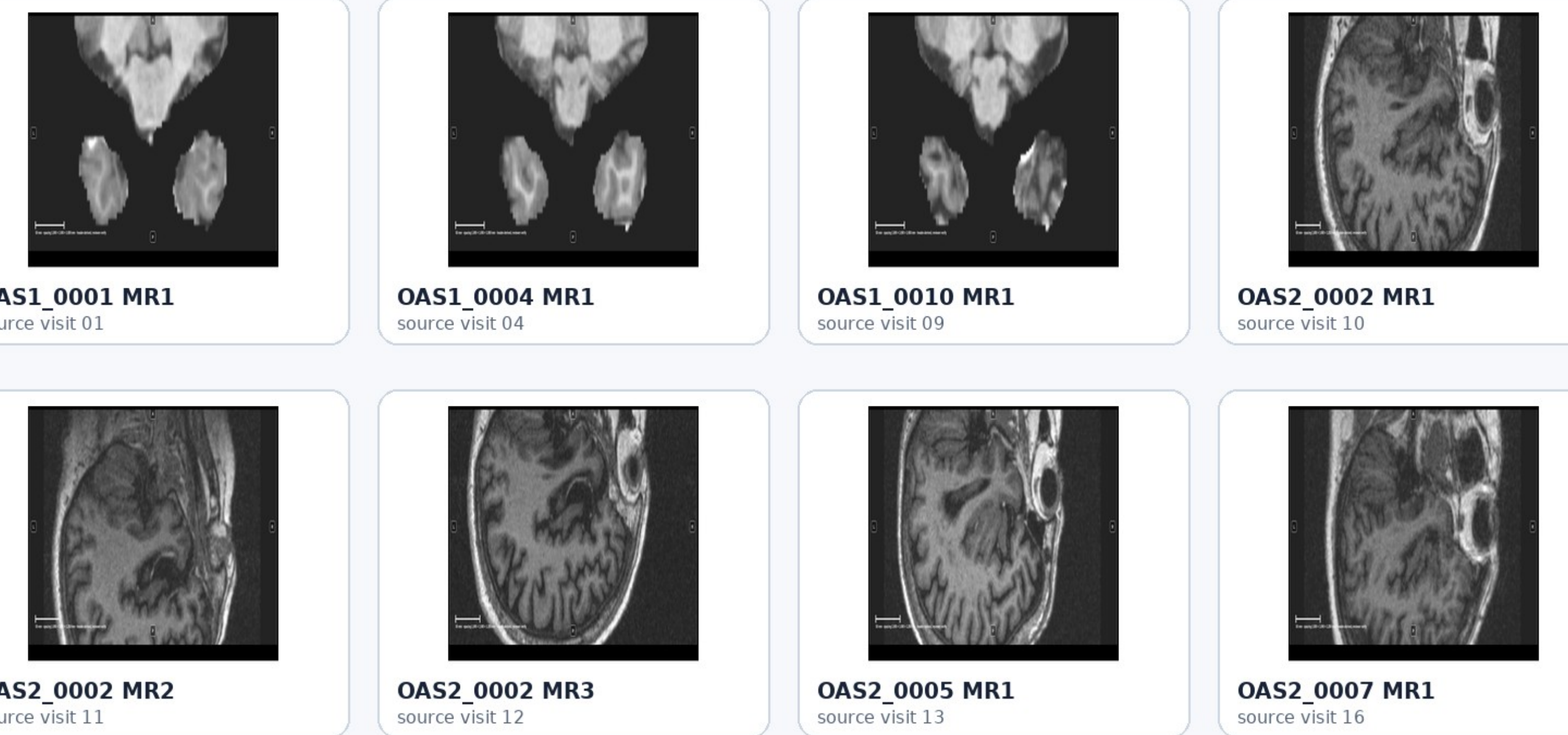
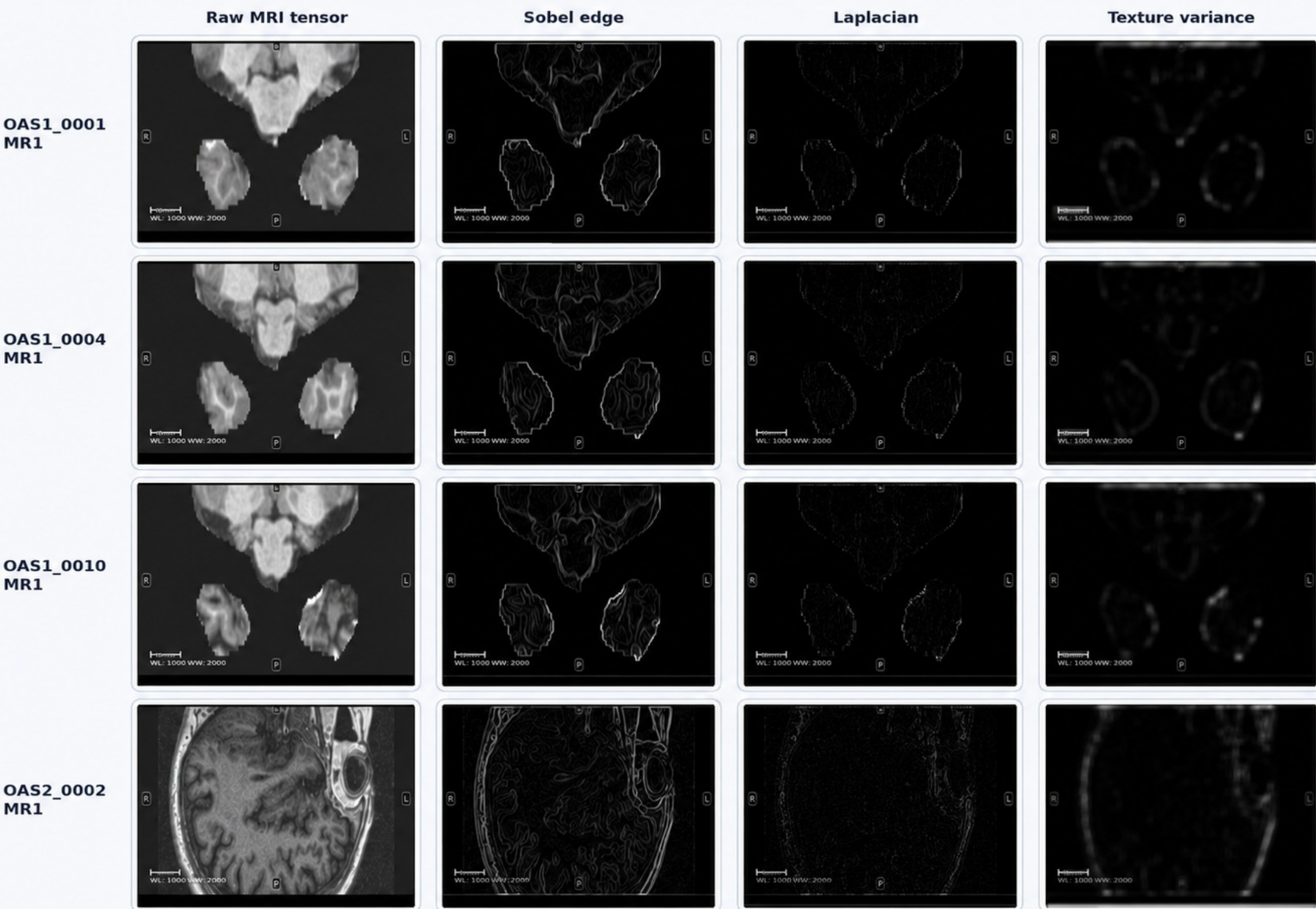
Proposed Novel B-Bio Theory, Frameworks and Pillars on SaMD- BVIDAL Clinical Software Suite

Selected OASIS MRI visual evidence, segmentation/viewer outputs, commercial MRI/NACC scan metadata, and ADSP-PHC T1 FS/MUSE, FLAIR, DTI, cognition,demographics/diagnosis tables are curated as separate evidence layers. PyTorch is used as the computational tensor and automatic differentiation framework for imaging feature-map and feature-vector extraction within the Bansal Unified/B-AI workflow which provides geometry-aware projected evidence states and interpretation, with no standalone diagnostic or clinical decision claim.



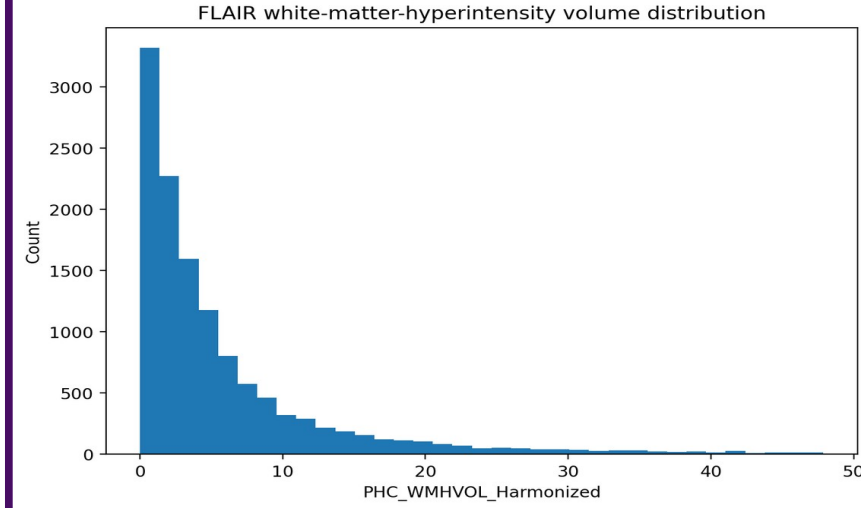
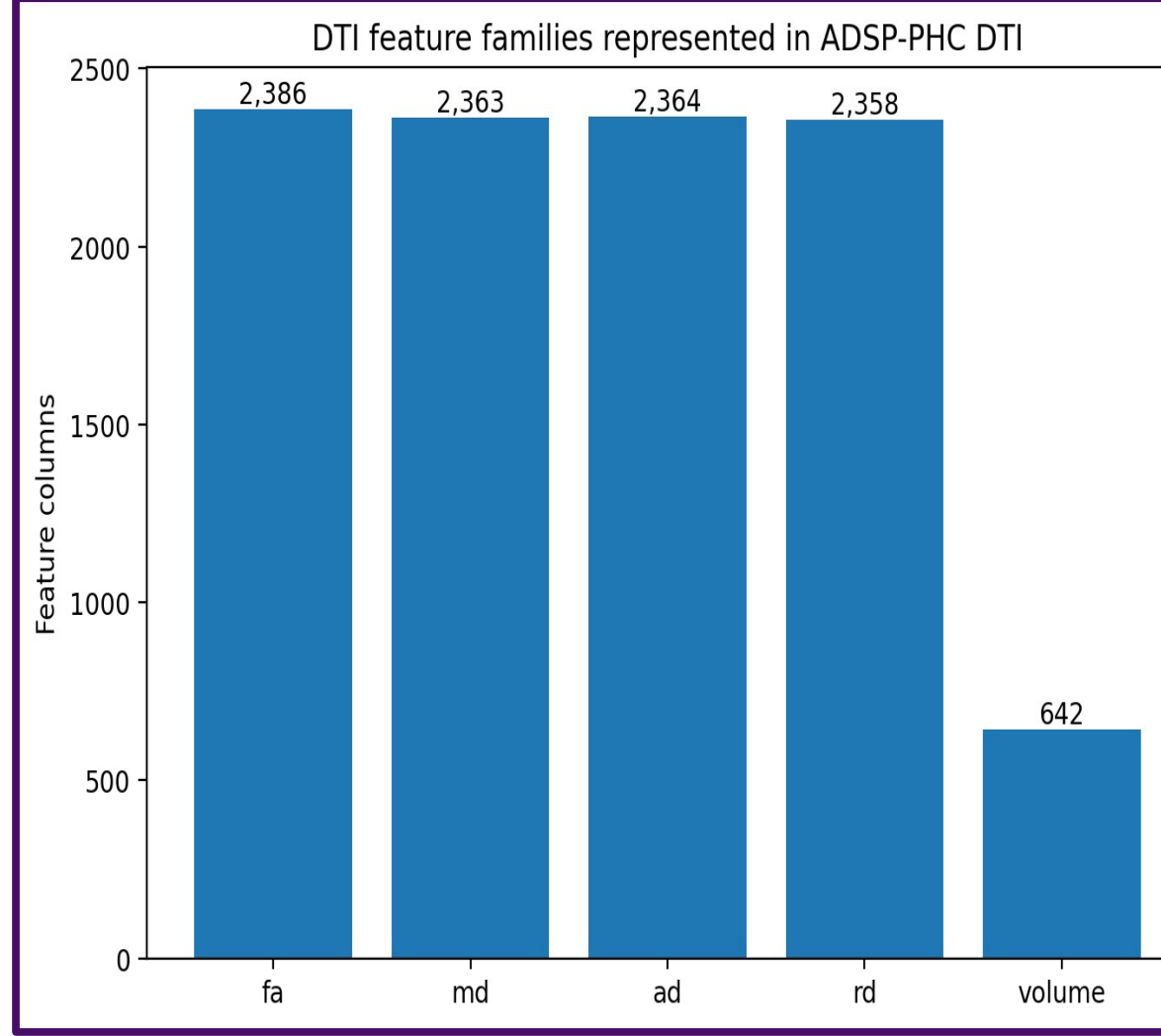
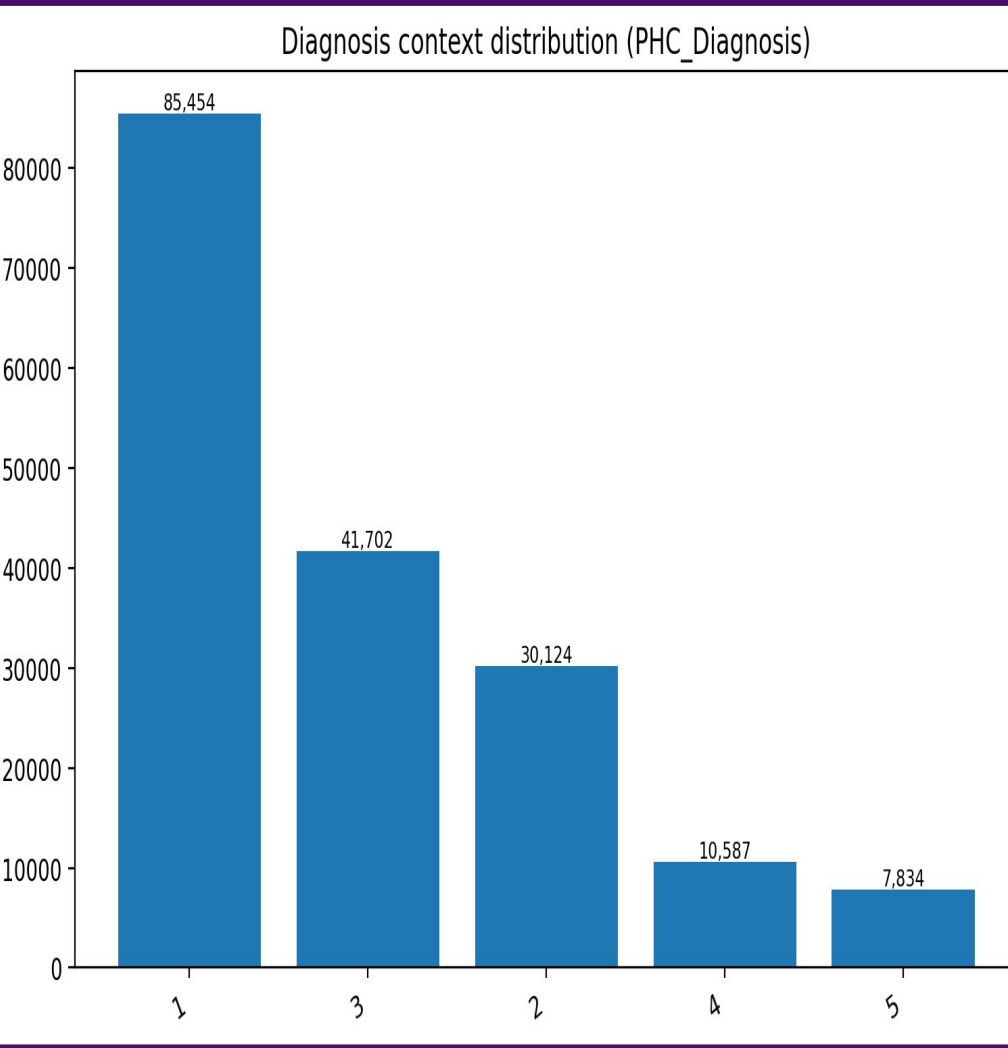
RESULTS – BVIDAL Clinical Software Suite (Software as a Medical Device)

PyTorch MRI feature extraction for B-AI geometry-aware interpretation



B-AI / PyTorch feature-vector heatmap from OASIS MRI

	mean intensity	std intensity	edge energy	edge p95	laplacian energy	texture variance	occupancy fraction
OAS1_0001 MR1	-0.9	1.6	-1.4	-1.2	-1.3	-1.4	-1.3
OAS1_0004 MR1	-1.1	1.2	-1.3	-1.3	-1.3	-1.3	-1.2
OAS1_0010 MR1	-1.6	0.8	-1.2	-1.2	-1.2	-1.1	-1.4
OAS2_0002 MR1	1.4	-0.5	0.8	0.8	0.7	0.6	0.9
OAS2_0002 MR2	0.2	-1.4	0.7	0.6	0.8	0.9	0.9
OAS2_0002 MR3	0.4	-0.7	1.0	1.0	1.1	1.0	0.5
OAS2_0005 MR1	1.1	-0.2	0.8	1.0	0.7	0.9	0.8
OAS2_0007 MR1	0.5	-0.8	0.6	0.3	0.5	0.4	0.6



Workflow item	Evidence / value
Segmentation clinical status	Candidate overlay only, verified QClabel evidence not attached
ADSP suggested source volumetry	1667.264 mL; background signal candidate from raw MRI
ADSP suggested signal classes	low 233.717 mL; periphery-like 913.768 mL; high 414.779 mL
Mask overlay	Loaded
Segmentation measurement state	Segmentation label measurement completed for supervised clinical research review
Label 1 / Label 1	226375 voxels; 226.375 mL
Label 2 / Cerebral white matter candidate / Label 2	910301 voxels; 910.301 mL
Label 3 / Cerebral cortex candidate / Label 3	530788 voxels; 530.788 mL
Challenge metrics	referenceQT label not attached
Current slice label measurement	3 visible label classes on Axial slice 34
Label 1 current slice area	7219 pixels (7219.00 mm²) on current plane

Note : OASIS [2][3] standalone data, NACC [4] standalone data, and an evidence-level merged dashboard; the merged dashboard represents evidence-level integration only, not patient-identity linkage.

Acknowledgements

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REFERENCES

- IEEE DataPort, Abhishek Bansal, "Data:B-Bio Models-2", doi: 10.21227/pvpx-7p34
- D. S. Marcus, T. H. Wang, J. Parker, J. G. Csernansky, J. C. Morris, and R. L. Buckner, "Open Access Series of Imaging Studies (OASIS): Cross-sectional MRI Data in Young, Middle Aged, Nondemented, and Demented Older Adults," Journal of Cognitive Neuroscience, vol. 19, no. 9, pp. 1498–1507, 2007, doi: 10.1162/jocn.2007.19.9.1498. Selected OASIS-1 : OAS1_0001-0007, 0009, 0010
- Original Data provided by OASIS : OASIS-2 Longitudinal MRI Data in Nondemented and Demented Older Adults. Marcus DS, Fotenos AF, Csernansky JG, Morris JC, Buckner RL. J Cogn Neurosci. 2010;22(12):2677-2684. doi:10.1162/jocn.2009.21407. Selected OASIS-2 : OAS2_0002, 0005, 0007, 0020, 0027
- Selected NACC/ADSP-PHC:commercial_scan_mr1qc_nacc73.csv, commercial_scan_mr1sbm_nacc73.csv,commercial_mri_nacc73.csv,NACC_CS_ADSP_PHC_T1_FS_2026.02.18.csv,NACC_CS_ADSP_PHC_FLAIR_2026.02.18.csv,NACC_CS_ADSP_PHC_DT1_2026.02.18.csv,NACC_CS_ADSP_PHC_Cognition_2026.02.18.csv,NACC_CS_ADSP_PHC_Demographics_Diagnosis_2026.02.18.csv

CONTACT Email :

abhishekbansal006@gmail.com



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Conclusion

The workflow generated MRI input panels, PyTorch feature-map montages ,feature-vector heatmaps, and structured CSV evidence graphs, demonstrating how imaging geometry, segmentation context, and multimodal metadata can support interpretable review. PyTorch-based feature extraction and Bansal Frameworks (B-AI)-based interpretation converted MRI and multimodal evidence into bounded geometry-aware projected evidence states for reviewer assessment, without claiming black-box diagnosis, clinical validation, or autonomous decision-making.