

Geometric Modeling of Pharmacological Interventions in Alzheimer's Disease and Related Dementias

aaic2026.1bc0329

Abhishek Bansal

BVidAL SaMD shows how in-silico B-Pharma Framework target perturbations can be mapped into review-only, geometry-admissible ADRD biomarker-state trajectories without claiming real-world drug efficacy.

INTRODUCTION

Alzheimer's disease and related dementias involve interacting biological changes across amyloid, tau, neurodegeneration, metabolism, inflammation, and clinical-state domains. Pharmacological intervention modeling requires a framework that can represent how target-specific perturbations may shift a patient-like biomarker state while preserving interpretability and safety boundaries. BVidAL SaMD introduces a review-only B-Pharma framework workflow in which multimodal ADRD evidence can be organized into geometry-admissible biological-state trajectories for simulated intervention analysis.

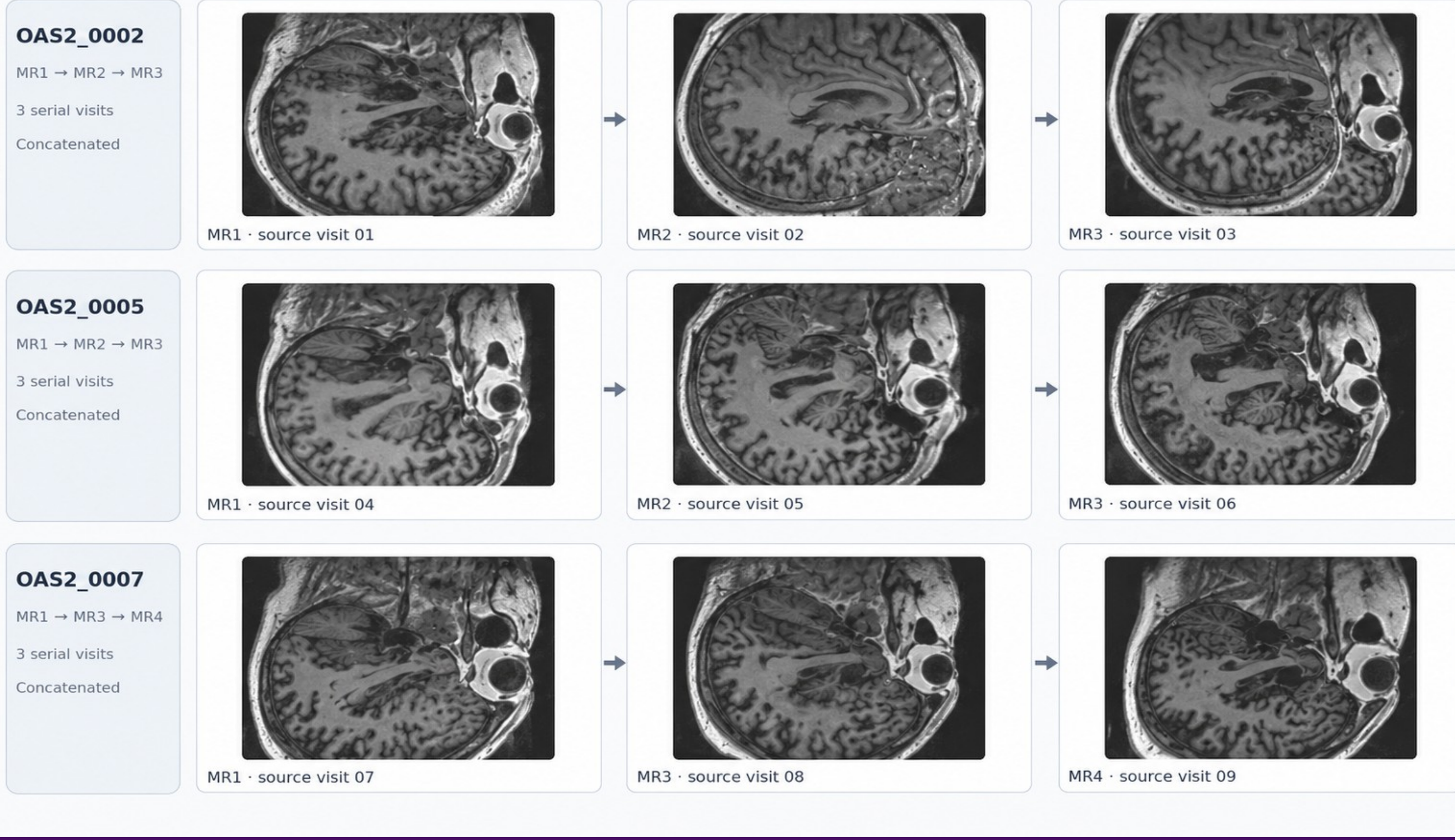
Objective : To demonstrate a BVidAL SaMD B-Pharma Framework workflow for review-only in-silico modeling of pharmacological target perturbations in ADRD using CSF, plasma, PET, MRI, cognition, diagnosis, and neuropathology-informed biomarker-state evidence.

METHODS

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

CSF and plasma biomarker data, amyloid PET, tau PET, MRI-derived neurodegeneration features, cognitive context, diagnosis variables, and neuropathology-informed disease-state evidence were organized into a BVidAL SaMD multimodal biological-state representation. A B-Pharma target operator was applied as an in-silico perturbation across amyloid-beta, tau, inflammatory, synaptic/neuroprotective, metabolic, and structural-stability axes. Simulated responses were represented as geometry-state shifts and evaluated using trajectory deviation, target-axis response, stability change, and safety/admissibility flags. The workflow generated a review-only report without claiming patient-level drug response or treatment recommendation.

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



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

Conclusion

BVidAL SaMD demonstrates a review-only B-Pharma framework simulation workflow for modeling how pharmacological target perturbations may shift ADRD biomarker geometry states across CSF, plasma, PET, MRI, and clinical-context layers. The strongest value is the target-response geometry program: BVidAL SaMD organizes multimodal biological evidence into interpretable simulated response trajectories and applies admissibility gates to distinguish stable, unstable, or non-admissible state shifts. This poster does not claim real drug efficacy, standalone diagnosis, treatment recommendation, regulatory approval, or clinical validation.

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. The original data were provided by OASIS[2] and NACC. For NACC[3], 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. 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_MR1-MR3, OAS2_0005_MR1-MR3, OAS2_0007_MR1/MR3/MR4, and OAS2_0020_MR1-MR3.
3. Selected NAAC : commercial_fcsf_nacc73.csv, NACC_CS_ADSP_PHC_CSF_2026.02.18.csv, NACC_CS_ADSP_PHC_Plasma_2026.02.18.csv, NACC_CS_ADSP_PHC_Amyloid_Detailed_2026.02.18.csv, NACC_CS_ADSP_PHC_Tau_Detailed_2026.02.18.csv, NACC_CS_ADSP_PHC_T1_FS_2026.02.18.csv, NACC_CS_ADSP_PHC_T1_MUSE_2026.02.18.csv, NACC_CS_ADSP_PHC_Cognition_2026.02.18.csv + Demographics_Diagnosis NACC_CS_ADSP_PHC_Neuropath_2026.02.18.csv

CONTACT Email :

abhishekbansal006@gmail.com

