

Architectural Innovation Meets Clinical Application: Validating Alzevita, a 3DAttResUNet++ Model for Hippocampal MRI Segmentation



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Alzevita shows accurate, automated hippocampal segmentation and Alzheimer’s classification with strong clinical performance. It enables earlier, scalable diagnosis, supporting real world application and adoption to improve dementia care.

INTRODUCTION	METHODS	RESULTS	CONCLUSIONS																				
Dementia affects over 6 million Americans, with annual costs exceeding \$300 billion [1]. Yet, diagnosis remains delayed by several factors, one of them of which is by manual and specialist-dependent MRI analysis of the hippocampus, highlighting the need for faster, scalable solutions to enable timely and accurate care. Leveraging AI-trained software to automate volumetric calculations can accelerate MRI brain scan interpretation across multi-site clinical teams, supporting accurate and timely diagnostic decisions, and streamlining the dementia care pathway. Building on the success of our feasibility study, we developed and evaluated our AI-trained software tool, Alzevita, for precise hippocampal segmentation in brain MRI. References 1. Alzheimer's Association. (2024). 2024 Alzheimer's Disease Facts and Figures. [online] Available at: https://www.alz.org/alzheimers-dementia/facts-figures [Accessed 15 Oct. 2025].	We validated Alzevita using MRI scans from the publicly available ADNI database, ensuring no overlap with training data. The dataset was selected to reflect diverse anatomical features and imaging conditions. Preprocessing Workflow All scans were converted from DICOM to NIfTI and preprocessed. Preprocessing included: resampling all MRIs to 1×1×1 mm³ using trilinear interpolation, spatial registration to the MNI152 atlas with affine and deformable (ElasticSyN) transformations in Advanced Normalisation Tools, Z-score intensity normalization within the brain mask, and extraction of a hippocampal region of interest to reduce computational load and focus on the target region. Ground Truth Generation Manual hippocampal segmentations were performed by three certified radiologists following the EADC-ADNI Harmonised Protocol. To address inter-observer variability, consensus ground truth masks were generated using the STAPLE algorithm.	Population characteristics We validated Alzevita using 298 independent 3D T1-weighted MRI scans from ADNI database. The dataset was curated to ensure diversity in age (55–90 years, mean 76 ± 7 years), clinical subgroups (ADNI-Control, ADNI-MCI, ADNI-AD), gender, magnetic field strength (1.5T and 3T), slice thickness (1 mm and 1.2 mm), and geographic regions (East, West, Central USA, and Canada). Table 1: Performance metrics comparing predicted versus ground truth segmentations <table><tr><th>Metric</th><th>Alzevita Results (95% CI)</th><th>Alzevita Results (95% CI)</th></tr><tr><td>Dice Score</td><td>0.86 (0.85, 0.86)</td><td rowspan="2">Indicates precise hippocampal segmentation with minimal boundary error</td></tr><tr><td>Hausdorff distance (mm)</td><td>1.51 (1.43,1.59)</td></tr><tr><td>Sensitivity</td><td>0.89 (0.88, 0.90)</td><td rowspan="2">Reliably distinguishes Alzheimer's cases from healthy individuals, reducing misclassification risk</td></tr><tr><td>Specificity</td><td>0.99 (1.00,1.00)</td></tr><tr><td>Area Under the Curve</td><td>0.95 (0.94, 0.95)</td><td rowspan="3">Confirms diagnostic strength and consistency</td></tr><tr><td>Precision</td><td>0.83 (0.82, 0.83)</td></tr><tr><td>F1 Score</td><td>0.86 (0.85, 0.86)</td></tr></table> Alzevita achieved a Dice Score of 0.86 (threshold ≥ 0.75) and a Hausdorff distance of 1.51 mm (threshold ≤ 6.1 mm) indicating precise hippocampal segmentation with minimal boundary error. Hippocampal volume estimates showed a high correlation with expert manual annotations (r = 0.93), and the relative volume difference was 10.64%, below the 24.6% threshold for longitudinal monitoring. Bland–Altman analysis revealed a mean volume difference of 0.485 cm³, indicating minimal systematic bias. Performance was stable and robust across clinical, demographic, and imaging subgroups, meeting all predefined criteria.	Metric	Alzevita Results (95% CI)	Alzevita Results (95% CI)	Dice Score	0.86 (0.85, 0.86)	Indicates precise hippocampal segmentation with minimal boundary error	Hausdorff distance (mm)	1.51 (1.43,1.59)	Sensitivity	0.89 (0.88, 0.90)	Reliably distinguishes Alzheimer's cases from healthy individuals, reducing misclassification risk	Specificity	0.99 (1.00,1.00)	Area Under the Curve	0.95 (0.94, 0.95)	Confirms diagnostic strength and consistency	Precision	0.83 (0.82, 0.83)	F1 Score	0.86 (0.85, 0.86)	Alzevita demonstrates robust, clinically validated performance across key diagnostic metrics, supporting its integration into the dementia care pathway. For clinicians, this means dependable decision support; for patients, earlier and more accurate diagnosis; and for the dementia care pathway, a scalable tool to enhance efficiency and continuity of care. To fully realise its clinical impact, future studies must expand validation across broader populations and neurological conditions. We invite collaboration to advance Alzevita's deployment and unlock its utility across neuroimaging practice. CONTACT  Mail us at: info@topiamedtech.com Visit our website: www.alzevita.com 
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