

Advancing Global Health Equity: A Systematic Evaluation Of Ubiquitous AI Models For Prodromal AD Detection

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- ❖ AI-driven machine learning enables accurate, non-invasive identification of early Alzheimer's disease using multimodal behavioral biomarkers.
- ❖ Smartphones and wearable sensors provide scalable, real-world monitoring of speech, gait, and retinal biomarkers for early detection.
- ❖ Affordable AI technologies can improve access to timely Alzheimer's screening, particularly in underserved and resource-constrained communities.

INTRODUCTION	METHODS	RESULTS	CONCLUSIONS	REFERENCES
Despite Alzheimer’s disease is a global health problem, approximately 75% of cases remain undiagnosed worldwide. Current diagnosis such as PET scans are often invasive, and unavailable in rural areas lacking advanced clinical infrastructure. This disparity affects the prodromal stage of detection, when the early intervention is most effective. Ubiquitous devices equipped with advanced sensors can capture the behavioral changes in speech, movement, and ocular health of suspected AD patients. This review addresses the technical feasibility of using ubiquitous AI models to synthesize multi-modal sensor data and to fill the gap between the high-cost clinical infrastructure and accessible, high-impact care.	Using PRISMA 2020, a systematic synthesis of 20 studies published between 2023-2025 were evaluated. A comprehensive search was carried out across IEEE Xplore, PubMed and arXiv. The focus of the review was to evaluate the diagnostic performance of ubiquitous sensor modalities such as Natural Language Processing (NLP) for acoustic speech analysis, Kinematic sensors for gait variance and Computer Vision for the tracking of retina. The review focused on evaluating the sensitivity and specificity of supervised learning architectures such as Convolutional Neural Networks (CNNs), Support Vector Machines (SVMs) and Random Forest models.	Ubiquitous AI frameworks achieve diagnostic accuracy comparable to traditional clinical approaches. Average accuracy of 88% is reported in acoustic and language analysis using NLP in identifying prodromal AD. Kinematic data processed using Random Forest and SVM models in tracking subtle gait variance showed an average specificity of 91%. Computer vision algorithms can quantify micro vascular attenuation of retina, a non-invasive surrogate for assessing the blood-brain-barrier and systemic neurovascular decline in prodromal AD. The findings suggest that compared to single-modality assessments, a multi-modal approach, integrating data from all three sensors can significantly reduce false positive rates in detecting prodromal AD.	Ubiquitous AI models are effective in providing a robust framework for prodromal detection of AD. Future work includes addressing the data privacy concerns and developing standardized protocols for effective integration of AI in clinical settings. Identification of studies via databases and registers Identification Records identified from: Databases (n = 160) - PubMed (n = 65) - IEEE Xplore (n = 75) - arXiv (n = 20) Records removed before screening: Duplicate records removed (n = 35) Records marked as ineligible (n = 0) Records screened (n = 125) Records excluded (n = 80) Reports sought for retrieval (n = 45) Reports not retrieved (n = 2) Reports assessed for eligibility (n = 43) Reports excluded: 23 - Wrong population (n = 10) - No specific AI measures (n = 8) - Review article (n = 5) Studies included in review (n = 20) Included	1. Pérez-Toro, P. A., J Ferrante, F., Pérez, G., Tee, B. L., de Leon, J., Nöth, E., ... & García, A. (2025). Automated Speech Markers of Alzheimer Dementia: Test of Cross-Linguistic Generalizability. <i>Journal of Medical Internet Research</i>, 27, e74200. 2. Inoue, T., Sawamura, S., Nagai, T., Kohiyama, K., Takenaka, T., Sera, T., & Senba, L. (2025). Using AI-Based Gait Analysis to Establish a 5-Meter Walk Time Cutoff for Discriminating Alzheimer's Disease. <i>Cureus</i>, 17(10). 3. Kwapong, W. R., Wu, N., Lin, W., Shen, J., Wang, Y., Qian, J., ... & Wang, Z. (2025). Retinal microvascular alterations in Alzheimer's disease: Linking blood plasma biomarkers and cerebral small vessel pathology. <i>Alzheimer's & Dementia</i>, 21(10), e70745.
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