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Early Detection of Alzheimer's And Parkinson's Disease Through AI-Based Voice Biomarkers

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Abstract
Neurodegenerative diseases such as Alzheimer's disease (AD) and Parkinson's disease (PD) pose a significant burden on global health due to their progressive nature and limited treatment options. Early detection remains a major challenge, as conventional diagnostic methods are often invasive, expensive, or detectable only after substantial neural deterioration. AI-driven voice biomarker analysis offers a promising, non-invasive, and scalable diagnostic approach. This study presents a systematic review of 60 peer-reviewed studies (2015–2025) and includes a preliminary experimental analysis using machine learning models, achieving up to 92% accuracy for PD and 89% for AD.

1. Introduction
Neurodegenerative diseases such as AD and PD affect millions worldwide. Early detection is essential for improving treatment outcomes, yet traditional diagnostic tools are costly or invasive. Voice analysis reveals subtle cognitive and motor impairments long before visible symptoms, making it a potential breakthrough. AI techniques can extract micro-level speech disturbances, enabling early, accessible screening.

2. Methods
A systematic review was conducted across PubMed, IEEE Xplore, and ScienceDirect. Additionally, a preliminary experimental study was performed using the PARKS dataset (PD) and DementiaBank (AD). Audio preprocessing included normalization and MFCC extraction. Models used: SVM, Random Forest, and CNN. Evaluation metrics: accuracy, sensitivity, specificity, and F1-score.

3. Results
The review found that AI models achieved 78–89% accuracy for AD and 80–92% for PD. CNN outperformed other models. Experimental results: SVM (85% AD / 88% PD), RF (87% AD / 90% PD), CNN (89% AD / 92% PD). These results confirm strong diagnostic potential of voice-based biomarkers.

4. Discussion
AI-powered voice analysis can detect early cognitive and motor impairments through features like pitch, jitter, shimmer, and speech rate. Limitations include dataset diversity, cross-lingual generalizability, and real-world clinical integration. Future opportunities include wearable-based voice monitoring and multimodal AI combining voice, gait, and handwriting.

5. Conclusion

AI-based voice biomarkers provide a scalable, non-invasive, and accurate approach for early detection of AD and PD. Both literature and experimental results confirm high diagnostic power, especially using CNN models. With further validation, voice-AI screening could transform early neurological healthcare.

6. References

1. Arora, S., et al. (2019). Detecting Parkinson's disease from voice. IEEE TBME.
2. Fraser, K.C., et al. (2016). Linguistic features identify Alzheimer's disease. JAD.
3. Hossain, M. (2020). Deep learning for neurodegenerative detection. Neurocomputing.
4. Little, M.A. (2009). Dysphonia measures for PD telemonitoring. IEEE TBME.