

Parkinson's Disease Detection using Deep Learning & Speech Signal Analysis

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Abstract

A serialized Parkinson's Disease (PD) is a chronic and progressive neuro degenerative disorder that primarily impairs motor coordination, speech, and cognitive abilities. Early and precise detection is essential for effective management and intervention. This project aims to develop an intelligent diagnostic framework powered by deep learning algorithms such as Convolution Neural Networks (CNN), Support Vector Machines (SVM), and Random Forest, focused on analyzing speech-based biomarkers—specifically variations in pitch, intensity, and timing—for early identification of Parkinson's Disease. The system integrates Gemini AI, an adaptive artificial intelligence model that enhances the diagnostic pipeline through automated feature extraction, hyper parameter optimization, and anomaly detection. This integration enables the AI to learn continuously from new data and adapt its predictions for improved accuracy and robustness. Beyond detection, the Gemini AI module is further designed to provide intelligent recommendations for medication and treatment pathways, aligning with medical standards and evidence-based approaches. By correlating speech analysis results with known therapeutic responses, Gemini AI can suggest preliminary medication strategies that physicians may consider, thereby assisting in clinical decision-making. Unlike traditional diagnostic methods that rely heavily on subjective clinical observations, this AI-driven framework ensures objectivity, scalability, and real-time adaptability. Its continuous learning capability enables it to evolve with incoming data, ensuring consistent performance across diverse patient profiles. This innovation not only improves diagnostic reliability and reduces manual intervention but also holds the potential to enhance the quality of life for patients through timely detection and personalized medication recommendations.

Keywords: Parkinson's Disease, Deep Learning, Speech Analysis, Convolutional Neural Networks, Support Vector Machines, Random Forest, Gemini AI, Machine Learning, Healthcare, Early Detection, Diagnostic Accuracy, AI-based Medication Recommendation.