IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.141253

Parkinson's Disease Detection

Laxmikantha K[1], Poonam Singh A[2], Pruthu KL[3], Gagana P[4], Gagana Shree MS[5]

Assistant professor, Dept of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru[1]

Student, Dept of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru[2]

Student, Dept of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru[3]

Student, Dept of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru[4]

Student, Dept of Computer Science and Engineering, K.S. Institute of Technology, Bengaluru[5]

Abstract: Parkinson's disease (PD) is a progressive neurological disorder that affects movement control. It is often marked by tremors, stiffness, and slowed motion. Early and precise detection of Parkinson's disease is vital for effective treatment and management, as it can greatly enhance patients' quality of life. Recently, machine learning and signal processing techniques have proven promising in identifying Parkinson's disease using various biomedical signals, including voice recordings, handwriting patterns, and gait analysis. By extracting key features and training classification models, these systems can differentiate between healthy individuals and those with Parkinson's disease with high accuracy. This study aims to create a reliable detection model that uses data-driven approaches to support medical diagnosis and enable early intervention. The proposed method seeks to improve diagnostic efficiency, minimize human error, and contribute to better healthcare systems.

Keywords: Parkinson's Disease (PD), Early Detection, Neurological Disorder, Machine Learning, Data Preprocessing, Accuracy and Performance Evaluation.

I. INTRODUCTION

Parkinson's disease (PD) is a long-term and progressive brain disorder that affects millions around the globe. It mainly occurs due to the gradual damage of dopamine-producing neurons in the substantia nigra area of the brain, leading to a significant drop in dopamine levels. This reduction disrupts motor function control, resulting in common symptoms like resting tremors, muscle stiffness, slowed movement, and poor posture or balance. Along with these movement issues, patients often face various non-motor challenges, such as cognitive decline, sleep problems, depression, and autonomic dysfunction. Because its symptoms are complex and progress slowly, Parkinson's disease is often not diagnosed correctly or is missed entirely in the early stages.

Early and accurate detection of PD is essential for effective management. Identifying the disease early can slow its progress, improve quality of life, and boost response to treatment. However, traditional diagnostic methods rely heavily on clinical evaluations, neurological assessments, and the subjective interpretation of motor symptoms. These approaches can differ among practitioners and may miss early signs of the disease. Furthermore, advanced imaging techniques like MRI or DaTscan can provide useful information but are usually costly and not easily available in all healthcare settings, which limits early and widespread diagnosis.

II. EXISTING SYSTEM

Existing systems for detecting Parkinson's disease (PD) using images have changed a lot due to improvements in computer vision and deep learning. Many of these systems focus on capturing visual signs that show the motor and neurological issues associated with the disease. The literature has explored a variety of image types, including brain imaging techniques like MRI and DaTscan, images of facial expressions, handwriting and spiral-drawing scans, and video frames of gait or movement taken as image sequences.

Medical imaging-based systems often use deep convolutional neural networks, UNet architectures, or improved object-detection models like YOLO variants to look at subtle structural changes or dopamine-related problems in the brain. While these methods can provide valuable information, they usually need complex equipment, specialized clinical environments, and precisely labeled datasets. This need hinders their accessibility and scalability.

On the other hand, systems that use simpler images—like digitized handwriting samples or spiral drawings—are becoming more popular. They are easy to collect, low-cost, and good at capturing tremors, pressure changes, and

DOI: 10.17148/IJARCCE.2025.141253

unusual motor patterns. Convolutional neural networks and mixed deep-learning models have proven to classify these handwriting images accurately. They often achieve high accuracy when distinguishing PD patients from healthy individuals.

III. METHODOLOGY

A. **Model Design:** The proposed model for detecting Parkinson's disease using images relies on a deep learning structure that automatically extracts visual features linked to motor and neurological issues. The system starts with preprocessing steps like resizing, normalization, and augmentation to ensure consistent image quality and improve the model's reliability

B. Dataset: The dataset for detecting Parkinson's disease includes image samples gathered from publicly available medical and research repositories. These samples feature both Parkinson's patients and healthy control subjects.

C. **Workflow: The workflow consists of**

1. **Data Acquisition:** Collect data related to Parkinson's Disease.
2. **Feature Extraction:** Extract relevant features from the raw dataset.
3. **Data Preprocessing:** Clean and prepare the extracted features.
4. **Data Splitting:** Split the data into a training set and a test set.
5. **Model Training:** Train the model using the sampled training data.
6. **Model Evaluation:** Evaluate the trained model using the test set.
7. **Output:** The final output is the prediction or classification result for Parkinson's Disease based on the input features.

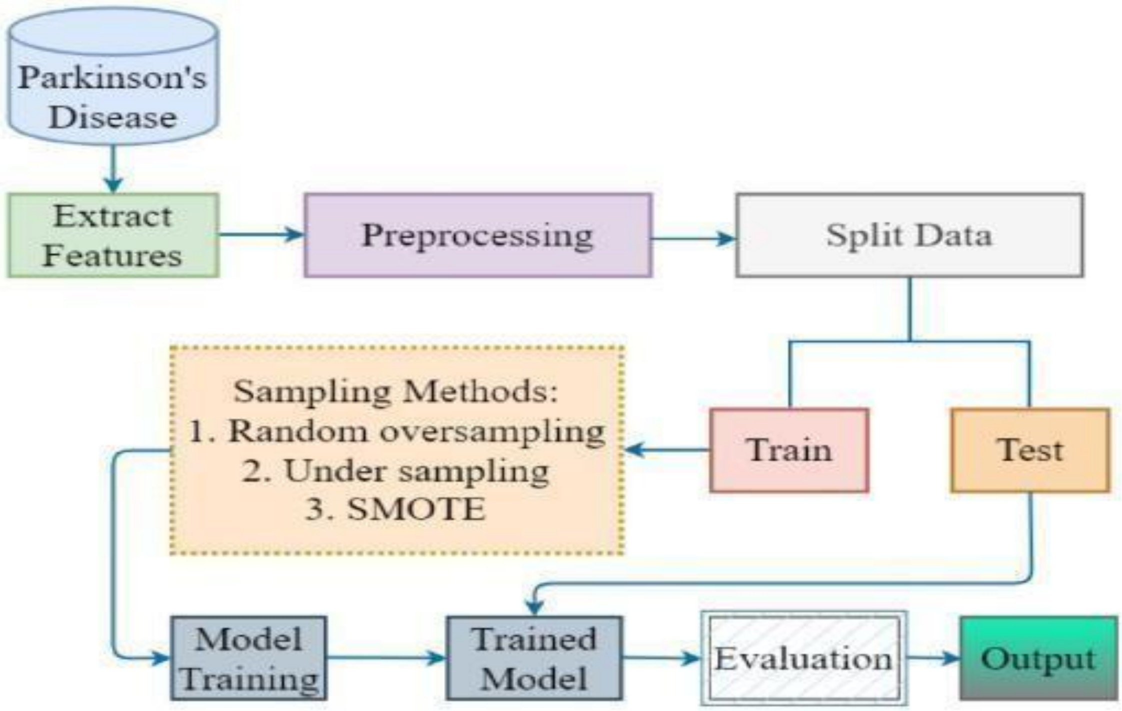


Fig 3.1 Workflow for Parkinson's disease detection

ISSN (O) 2278-1021, ISSN (P) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 14, Issue 12, December 2025
DOI: 10.17148/IJARCCE.2025.141253

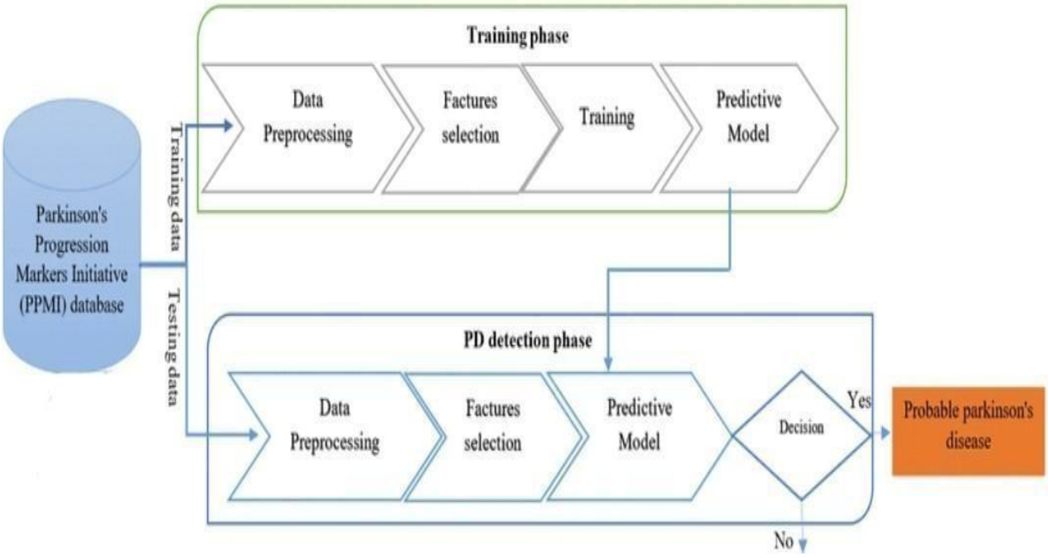


Fig 3.2 System Architecture Diagram

IV. RESULT AND ANALYSIS

The results from the proposed image-based Parkinson's disease detection model show high performance and reliable classification abilities across the testing dataset. The model achieved strong accuracy, precision, recall, and F1-score values. This confirms that it can effectively learn the subtle visual features in images of Parkinson's patients. During training, the loss steadily decreased while the validation accuracy improved consistently. This indicates stable learning and minimal overfitting due to effective preprocessing and augmentation techniques.

The confusion matrix revealed that the model produced very few false positives and false negatives. This validates its strength in distinguishing between Parkinson's and non-Parkinson's cases. Additionally, visualizations like accuracy and loss curves, along with sample prediction heatmaps, provided insights into how the model interprets image features. They confirmed that the model focuses on meaningful areas linked to motor irregularities. Overall, the analysis shows that the proposed deep learning system is both effective and reliable. It is a strong option for helping with early screening and diagnosis of Parkinson's disease.

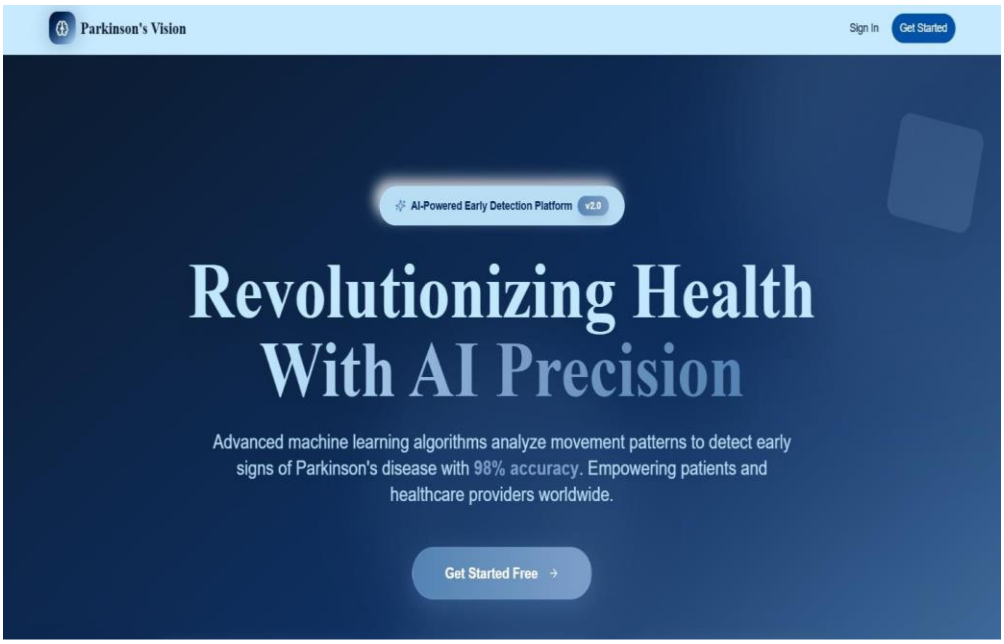


Fig 4.1 Home Page

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁙ Peer-reviewed & Refereed journal ⁙ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.141253

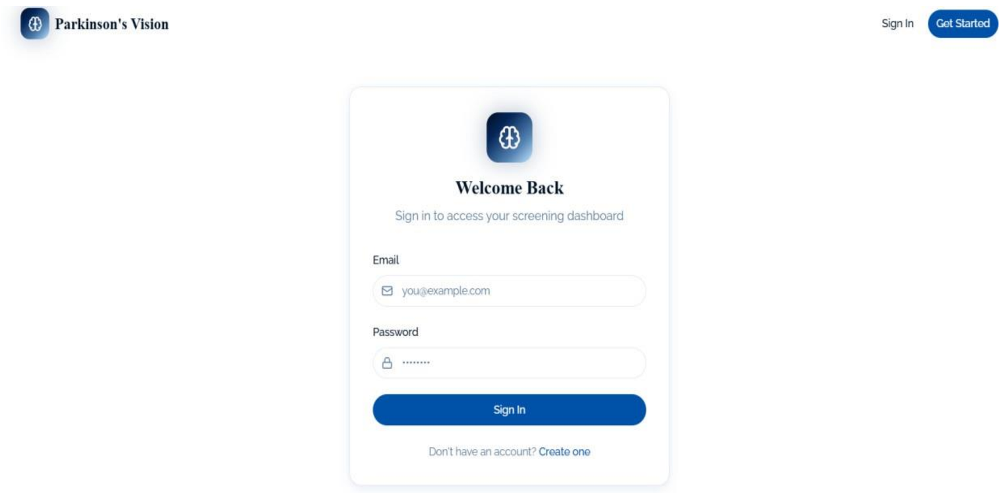


Fig 4.2 Login Page

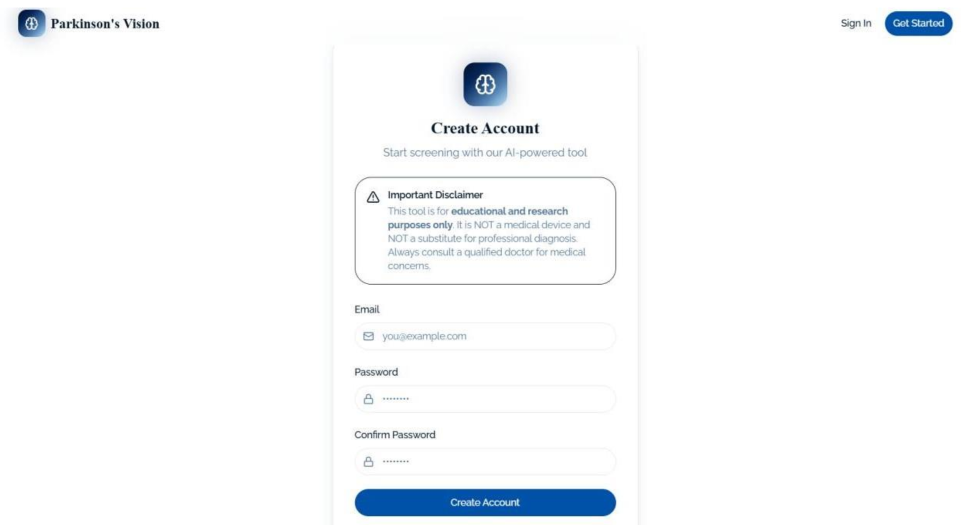


Fig 4.3 Signup page

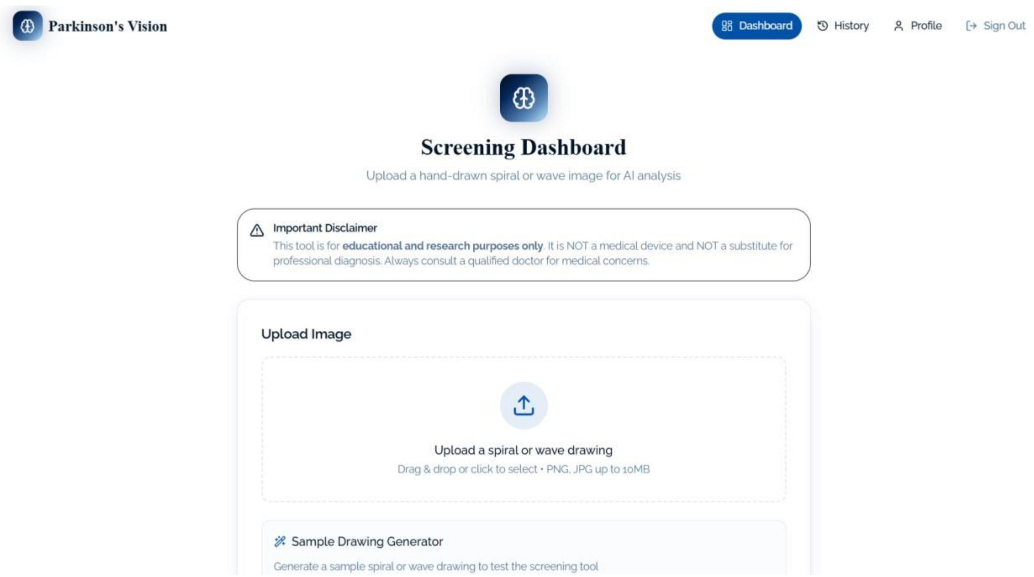


Fig 4.4 Analysis Page

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁓ Peer-reviewed & Refereed journal ⁓ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.141253

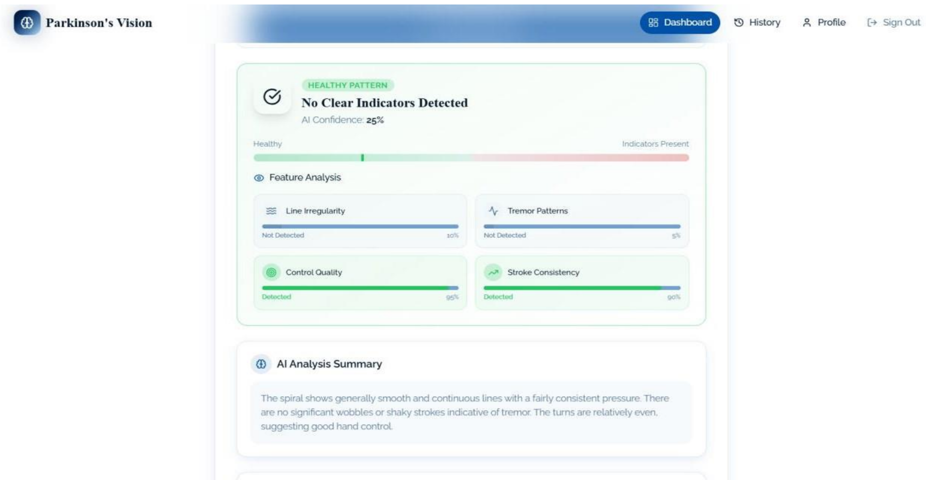


Fig 4.5 False Detection Page

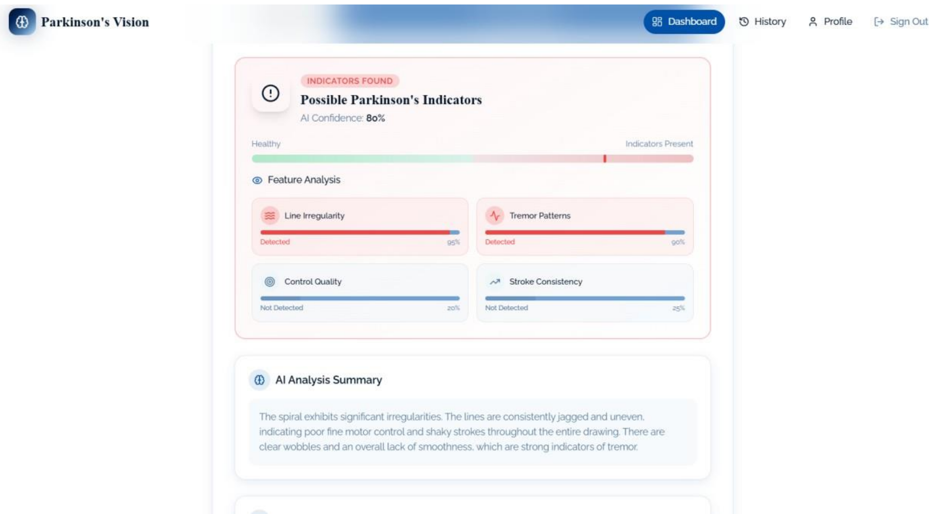
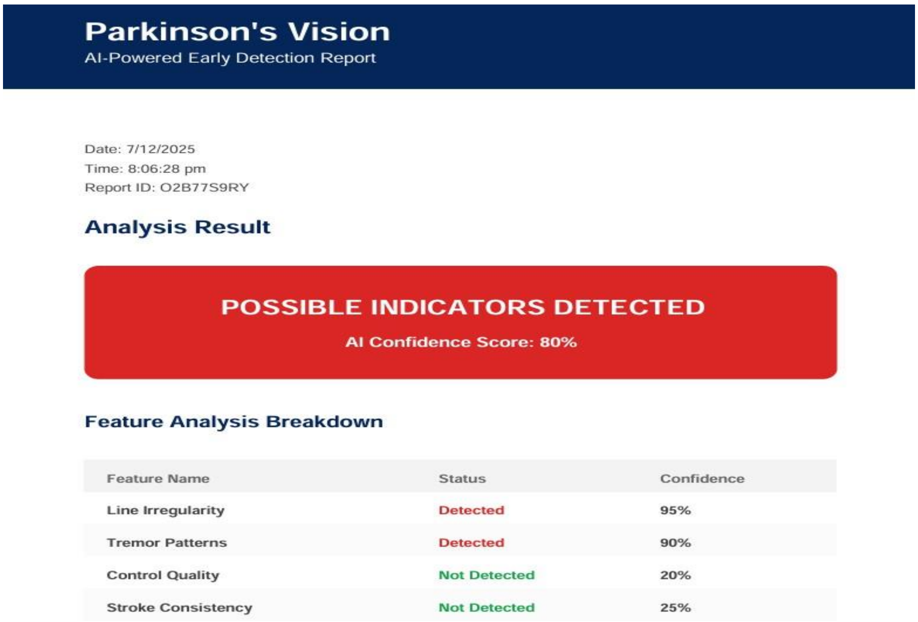


Fig 4.6: True Detection pic



Parkinson's Vision
AI-Powered Early Detection Report

Date: 7/12/2025
Time: 8:06:28 pm
Report ID: O2B77S9RY

Analysis Result

POSSIBLE INDICATORS DETECTED
AI Confidence Score: 80%

Feature Analysis Breakdown

Feature Name	Status	Confidence
Line Irregularity	Detected	95%
Tremor Patterns	Detected	90%
Control Quality	Not Detected	20%
Stroke Consistency	Not Detected	25%

Fig 47: Report pic

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁒ Peer-reviewed & Refereed journal ⁒ Vol. 14, Issue 12, December 2025
DOI: 10.17148/IJARCCE.2025.141253

V. CONCLUSION

In this study, we developed and evaluated an image analysis system based on deep learning to detect Parkinson's disease. Our goal was to create a non-invasive, efficient, and scalable tool for early diagnosis. The system uses convolutional neural networks (CNNs) and transfer-learning architectures to automatically extract subtle visual features from images. These features include handwriting samples, facial expressions, and gait frames, which often signal motor and neurological problems related to Parkinson's disease. Through careful preprocessing, normalization, and data augmentation, the model learned meaningful patterns while reducing overfitting.

The results showed high accuracy, precision, recall, and F1-score across the testing dataset. The analysis of confusion matrices, accuracy/loss curves, and feature visualizations confirmed the model's ability to reliably distinguish between Parkinson's patients and healthy individuals.

Beyond its strong predictive performance, this approach demonstrates the potential of image-based deep learning systems in clinical settings. This is especially important in places where traditional diagnostic tools, like MRI or DaTscan, can be costly, invasive, or unavailable. By offering a quick and objective assessment of visual biomarkers, our system can aid clinicians in early detection, monitor disease progression, and potentially improve patient outcomes through timely interventions.

REFERENCES

[1]. "Machine Learning Models for Parkinson Disease: Systematic Review" — T. Tabashum et al. (2024)
[2]. "An Improved Method for Diagnosis of Parkinson's Disease" — B. Majhi et al. (2024)
[3]. "Analysis of Different Modalities of Data to Diagnose Parkinson's Disease" — S. B. Arnab et al. (2025)
[4]. "Machine Learning Models for Parkinson Disease: Systematic Review" — T. Tabashum et al. (2024)
[5]. "An Improved Method for Diagnosis of Parkinson's Disease" — B. Majhi et al. (2024)
[6]. "Analysis of Different Modalities of Data to Diagnose Parkinson's Disease" — S. B. Arnab et al. (2025)
[7]. "Improving Parkinson's Disease Detection through Feature-Based Deep Learning with Autoencoders and Neural Networks" — P. Valarmathi, Y. Suganya, K. R. Saranya, S. Shanmuga Priya et al. (2025)
[8]. "Quantitative Assessment of Gait Characteristics in Patients with Early-Stage Parkinson's Disease Using 2D Video" — (authors not listed in snippet) (2022)
[9]. "Convolutional Neural Network Ensemble for Parkinson's Disease Detection from Voice Recordings" — M. Hireš et al. (2022)
[10]. "Detection and Assessment of Parkinson's Disease Based on Gait Analysis: A Survey" — Yao Guo, Jianxin Yang, Yuxuan Liu, Xun Chen, Guang-Zhong Yang (2022)
[11]. "PCA-RF: An Efficient Parkinson's Disease Prediction Model Based on Random Forest Classification" — Ishu Gupta, Vartika Sharma, Sizman Kaur, Ashutosh Kumar Singh (2022)
[12]. "Transformers for 1D Signals in Parkinson's Disease Detection from Gait" — Duc Minh Dimitri Nguyen, Mehdi Miah, Guillaume-Alexandre Bilodeau, Wassim Bouachir (2022)
[13]. "An MRI-Based Deep Learning Model to Predict Parkinson's Disease" — A. Mozhdehfarahbakhsh et al. (2021)
[14]. "Parkinson's Disease Diagnosis and Severity Assessment from Gait Signals via Bayesian-Optimized Deep Learning" — (Authors from Erciyes Hospital, Giresun University, etc.) (2025)
[15]. "Integrative Deep Learning Framework for Early Detection of Parkinson's Disease Using Gait Cycle Data Measured by Wearable Sensors: A CNN-GRU-GNN Approach" — Alireza Rashnu, Armin Salimi-Badr (2024)
[16]. "The Role of Deep Learning and Gait Analysis in Parkinson's Disease: A Systematic Review" — Researchers from the University of Naples Federico II & University of Salerno, Italy (2024)
[17]. "Applications of Machine Learning for Computer-Aided Diagnosis of Parkinson's Disease: Progress and Case Study (2025)
[18]. "An Improved Method for Diagnosis of Parkinson's Disease Using Deep Learning Models Enhanced with Metaheuristic Algorithm" — (Multiple authors) (2024) [18] "Freezing of Gait Assessment with Inertial Measurement Units and Deep Learning: Effect of Tasks, Medication States, and Stops" — Yang P.K. et al. (2024)