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## **CNN-Based Parkinson's Disease Detection Using** MRI & CT Scans in MATLAB

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**ABSTRACT:** This project proposes an automated system for the early and accurate diagnosis of Parkinson's Disease (PD) using a deep learning-based approach. The system leverages Convolutional Neural Networks (CNNs) to analyze MRI and CT scan images for identifying patterns indicative of PD. Implementation is carried out in MATLAB, utilizing transfer learning by fine-tuning pre-trained CNN models such as ResNet50 and VGG16. A comprehensive preprocessing pipeline is employed—incorporating noise reduction, contrast enhancement, and image resizing—to ensure standardized input suitable for CNN training and inference. The proposed system is evaluated using key performance metrics including accuracy, sensitivity, specificity, and precision. Results demonstrate that the CNN-based approach significantly outperforms traditional diagnostic techniques, providing a fast, reliable, and non-invasive solution for Parkinson's detection. This work contributes to the advancement of AI-assisted diagnostics, supporting early detection and personalized treatment planning to enhance patient outcomes.

**KEYWORDS:** Parkinson's Disease diagnosis, Convolutional Neural Networks (CNNs), deep learning, MRI, CT scan, transfer learning, ResNet50, VGG16, MATLAB, image preprocessing, medical imaging, early detection, AI in healthcare, non-invasive diagnosis, smart diagnostic system.

#### I. INTRODUCTION

Parkinson's Disease (PD) is a progressive neurodegenerative disorder affecting motor function, causing symptoms like tremors, rigidity, and bradykinesia. Early, accurate diagnosis is vital but traditional methods are subjective and prone to variability. Leveraging advancements in artificial intelligence (AI) and deep learning, an AI-based system is developed using Convolutional Neural Networks (CNNs) in MATLAB to detect PD from MRI and CT scans. Transfer learning with architectures like ResNet50 and VGG16 enables deep feature extraction with fewer resources. A preprocessing pipeline including noise removal, contrast enhancement, and resizing enhances image quality. Models are evaluated through accuracy, sensitivity, and specificity, demonstrating superior performance over traditional methods. The CNN-based system promises faster, more consistent diagnosis, supporting clinicians in early detection and treatment planning, ultimately improving patient outcomes.



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#### **II. LITERATURE SURVEY**

Recent advancements in lung disease monitoring emphasize remote and real-time healthcare solutions. Unnikrishna Menon et al. (2014) proposed a remote diagnostic system leveraging FFT-based analysis of lung sounds with GSM/3G communication, laying the groundwork for future enhancement via machine learning techniques. Keyi Yang et al. (2024) introduced a novel energy-efficient dual-mode AI accelerator tailored for wearable lung sound monitoring, significantly improving processing performance and energy usage. Bunyuan Sun et al. (2019) explored Electrical Impedance Tomography (EIT) for lung cancer diagnosis, while Mariem Hafsa et al. (2022) expanded this approach by deploying a cloud-integrated EIT system for continuous, real-time patient monitoring. Despite promising results, further clinical validation and large-scale integration remain essential for widespread adoption.

In parallel, research in biometric and medical diagnostics demonstrates the versatility of machine learning and deep learning across domains. A multimodal biometric recognition system proposed in 2020 employed deep learning and fusion techniques integrating iris, face, and finger vein traits for improved identity verification. A 2021 study applied deep learning and transfer learning to address complications in solid organ transplantation, illustrating the growing role of AI in complex medical contexts. More recently, in 2023, machine learning—specifically the K-Nearest Neighbors (KNN) algorithm—was employed in a non-invasive framework to identify Metabolic Syndrome efficiently and cost-effectively.

These works collectively highlight the rapid evolution and cross-disciplinary application of AI technologies in healthcare, biometrics, and disease diagnosis, paving the way for intelligent, real-time, and accessible medical solutions.

#### **III. METHODOLOGY**

The intended system is an AI-based automated Parkinson's Disease (PD) detection platform that utilizes deep learning algorithms for medical image analysis. The system operates on MRI and CT scan images, which serve as primary diagnostic inputs for the early identification of PD. Developed in MATLAB, the platform uses Convolutional Neural Networks (CNNs), specifically implementing transfer learning with pre-trained architectures such as ResNet50 and VGG16. A robust image preprocessing pipeline is applied to enhance diagnostic accuracy—this includes noise reduction, contrast enhancement, and image resizing to ensure uniform input dimensions compatible with the CNN models.

The CNN is trained using labeled datasets of MRI and CT images, enabling it to learn subtle structural patterns in the brain associated with Parkinson's Disease. Once trained, the model can classify input scans into healthy or PD-affected categories with high precision. The system is evaluated based on accuracy, sensitivity, specificity, and precision to validate its performance. By providing a non-invasive, fast, and reliable diagnostic tool, the proposed system supports early-stage detection, thereby aiding timely medical intervention and improving patient outcomes. The solution is designed to be a cost-effective, AI-assisted tool for neurology departments and remote healthcare centers.

#### **IV. EXPERIMENTAL RESULTS**





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Command Window

Parkinson's disease is not detected.

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#### **V. CONCLUSION**

In summary, the Parkinson's Disease Detection System using MRI and CT scans and powered by deep learning offers an advanced, automated approach to neurological diagnostics. By leveraging Convolutional Neural Networks (CNNs)—specifically pre-trained models like ResNet50 and VGG16—within a MATLAB environment, the system accurately analyzes medical imaging data to detect early signs of Parkinson's Disease. Through a well-defined preprocessing pipeline and training on labeled datasets, the system learns to distinguish between normal and affected brain regions with high precision. This AI-driven model enables early detection, reduces reliance on invasive procedures, and provides fast and reliable diagnostic support. Its non-invasive nature, coupled with accuracy and scalability, makes it a valuable tool for neurologists, radiologists, and healthcare facilities, particularly in improving early intervention, reducing diagnostic delays, and supporting personalized treatment planning. This intelligent solution enhances the effectiveness of PD diagnosis and promotes better outcomes in managing degenerative neurological conditions.

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