■ Parkinson’s Disease Detection Using CNN

1. Project Overview
This project uses a Convolutional Neural Network (CNN) to detect Parkinson’s Disease from brain scan images. The model classifies input images into two categories:
• **YES** – Parkinson’s Disease Present
• **NO** – Parkinson’s Disease Absent

Dataset Summary:
• Training Images: 413
• Validation Images: 103
• Testing Images: 129

2. Model Architecture Summary

Layer Type	Output Shape	Parameters
Conv2D + BN + Pool + Dropout	(64, 64, 32)	~19K
Conv2D + BN + Pool + Dropout	(32, 32, 64)	73K
Conv2D + BN + Pool + Dropout	(16, 16, 128)	74K
Dense(128) + Dropout	(128)	4.19M
Dense(1)	(1)	129

3. Training Results

The model was trained for up to 25 epochs with early stopping at epoch 12.
• Optimizer: Adam
• Learning Rate: 0.001 (with decay)
• Loss: Binary Crossentropy
• Best Validation Accuracy: **84.46%**
• Final Test Accuracy: **75.19%**

4. Classification Report

Class	Precision	Recall	F1-Score	Support
NO (Healthy)	1.00	0.26	0.41	43
YES (Parkinson’s)	0.73	1.00	0.84	86
Overall Accuracy	-	-	0.75	129

5. Confusion Matrix

Predicted ↓ / Actual → | NO | YES
NO: 11 | 32
YES: 0 | 86

The model successfully detects Parkinson’s (YES) cases but often misclassifies healthy (NO) samples as positive.

6. Recommendations for Improvement

1. Balance the dataset (more healthy control images).
2. Try transfer learning (ResNet50, MobileNet, EfficientNet).
3. Enhance image augmentation for better generalization.
4. Use `.keras` model saving format instead of legacy `.h5`.
5. Add AUC-ROC and Precision-Recall metrics for deeper insight.

7. Conclusion

The CNN model achieved strong recall for Parkinson's Disease cases and overall accuracy of 75.19%. It demonstrates strong diagnostic potential with further data balancing and tuning.

■ Model File: **parkinsons_cnn_brain.h5**
■ Framework: TensorFlow / Keras
■ Purpose: Medical image classification for early Parkinson's detection.