DTSA 5511

Parkinson's Disease Detection

Using Hand-Drawn Images

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01 Introduction

Motivation

The increasing prevalence of Parkinson's Disease (PD) highlights the need for early, accurate, and automated detection using hand-drawn patterns.

Problem

PD affects motor skills, making early detection critical. Can deep learning accurately classify PD vs. non-PD based on hand-drawn images?

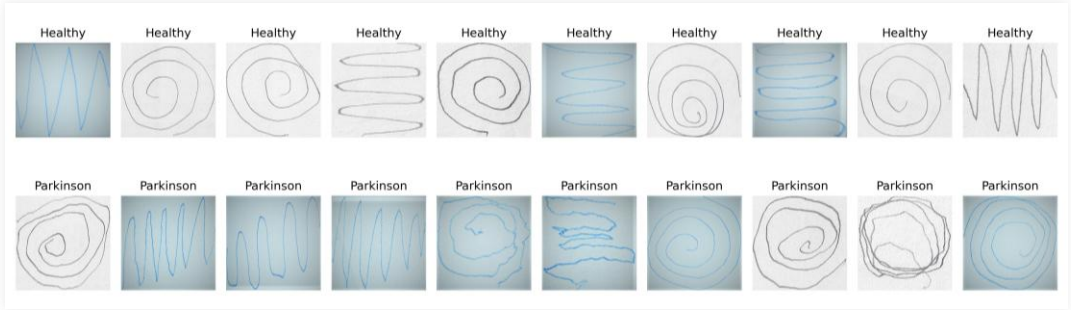
Approach

Applied CNN-based models for classification and compared their performance with some traditional machine learning models.

02 EDA

3,264 Images (1,632 Healthy 1,632 Parkinson)

This dataset consists of hand-drawn **spirals** and **waves**.



1 Data Splitting

80% for training
20% for testing

2 Data Cleaning

0 missing file
0 corrupted image
0 extreme value

3 Data Preprocessing

Resize all images to 256x256 pixels.

Load image data for deep learning.

Extract features for traditional models.

03 Models

Deep Learning

(Custom)

CNN

(Transfer Learning)

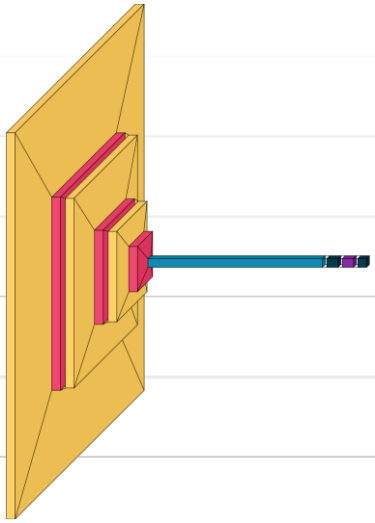
MobileNetV2

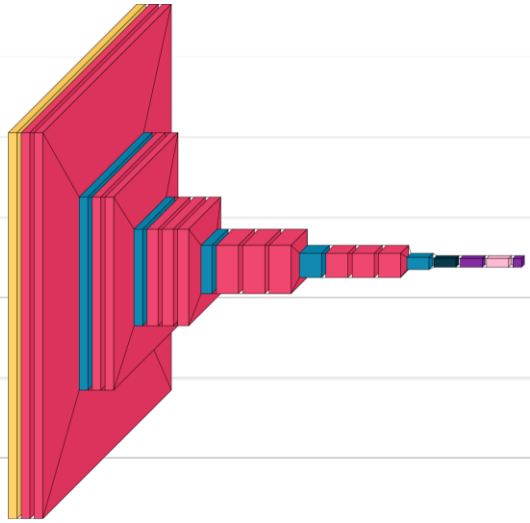
VGG16

DenseNet121

Traditional ML

Support Vector Machine
K-Nearest Neighbor
Random Forest





CNN

Mobile Net

VGG

Dense Net

04 Results

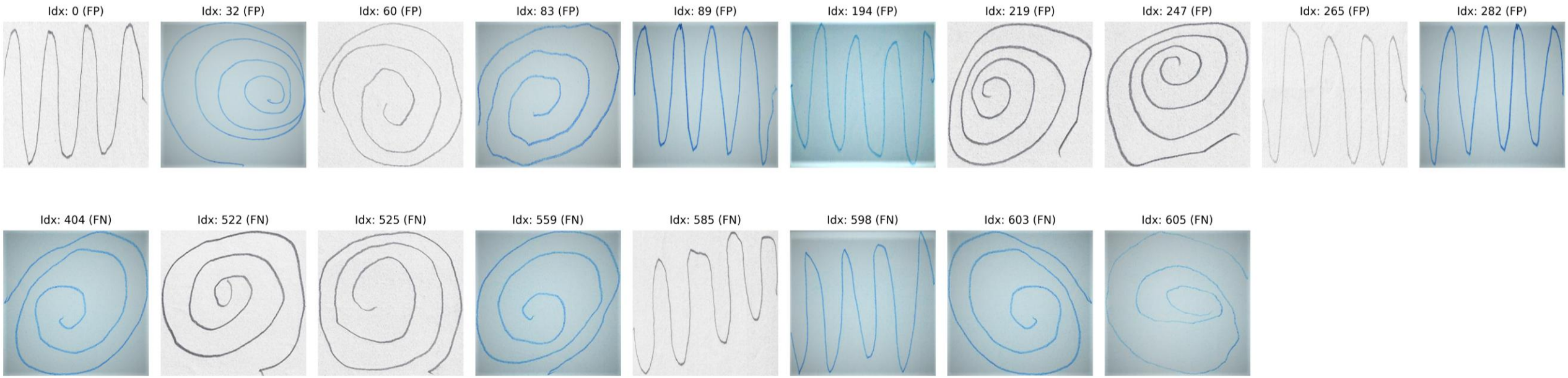
Model	Accuracy (%)	Confusion Matrix	Error Rate (%)	Total Parameters	Model Size (MB)
CNN	96%	[318 9] [15 311]	3.68%	22.2M	84.86
MobileNet	97%	[317 10] [8 318]	2.76%	2.6M	9.87
VGG	92%	[323 4] [51 275]	8.42%	15M	57.14
DenseNet	97%	[325 2] [18 308]	3.06%	7.6M	28.85
SVM	92%	[317 10] [41 285]	7.81%	-	-
KNN	86%	[321 6] [84 242]	13.78%	-	-
RF	88%	[313 14] [65 261]	12.10%	-	-

05 Discussion

Misclassified Images (use MobileNetV2 as sample)

(True: 0, Pred: 1) - False Positives (FP): 10 samples (5 spirals, 5 waves)

(True: 1, Pred: 0) - False Negatives (FN): 8 samples (6 spirals, 2 waves)



06 Conclusion

Project Summary

This project explores deep learning (CNN, MobileNetV2, VGG16, DenseNet121) for early Parkinson's detection using hand-drawn images, compared with traditional models (SVM, KNN, RF).

Key Findings

MobileNetV2 had the highest accuracy (97%) and smallest model size (9.87MB), confirming deep learning's superiority in detecting Parkinson's from hand-drawn images.

Future Work

Future work includes expanding the dataset, incorporating multimodal data, optimizing model efficiency, exploring advanced techniques, and ensuring real-world clinical applicability.

THANKS.

https://github.com/d93xup60126/Deep_Learning_PD_Detection