



Non-Invasive Prediction of Parkinson's Disease

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Abstract

Parkinson's is a disease affecting 700000 plus people in India. It primarily affects the nervous system and has many symptoms. The early diagnosis can help in the treatment of the patient. Therefore, we propose here a solution in the form of a mobile application that allows people to test themselves for symptoms of Parkinson's anywhere, anytime.

Introduction

Parkinson's disease is a nervous system disorder which starts with barely noticeable symptoms and gradually develops into major movement disorders. Identifying this disease is very difficult as there is no laboratory test to diagnose with certainty and the symptoms are common to various disorders. Early medication can help reduce the development of symptoms and disease.

Objective(s)

- To research extensively on previous work and ascertain which features are best discriminators of control group and the subjects with Parkinson's Disease
- To employ a multi-modal approach to pick on various biomarkers thus, covering more symptoms
- To provide a convenient, user friendly, portable system mechanism

Problem Definition

Our problem definition divides into two parts :

- To conduct a thorough comparative analysis of existing technologies for detecting symptoms of Parkinson's disease. Identify the gap and scope of research in this domain.
- Design a non invasive, multi modal system for prediction of Parkinson's disease in the form of a portable, user friendly mobile application.

Contribution

- Most of the existing mobile applications focus on the therapy of Parkinson's Disease rather than its detection. Our system aims to aid in early detection of the disease.
- Multiple tests consider various symptoms to provide accurate analysis.

Design

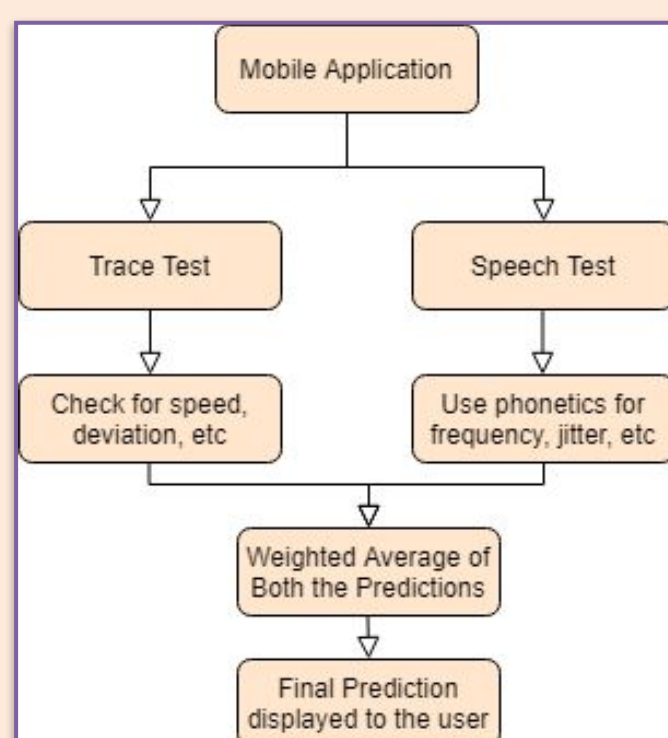


Fig 1 . Overview of the System

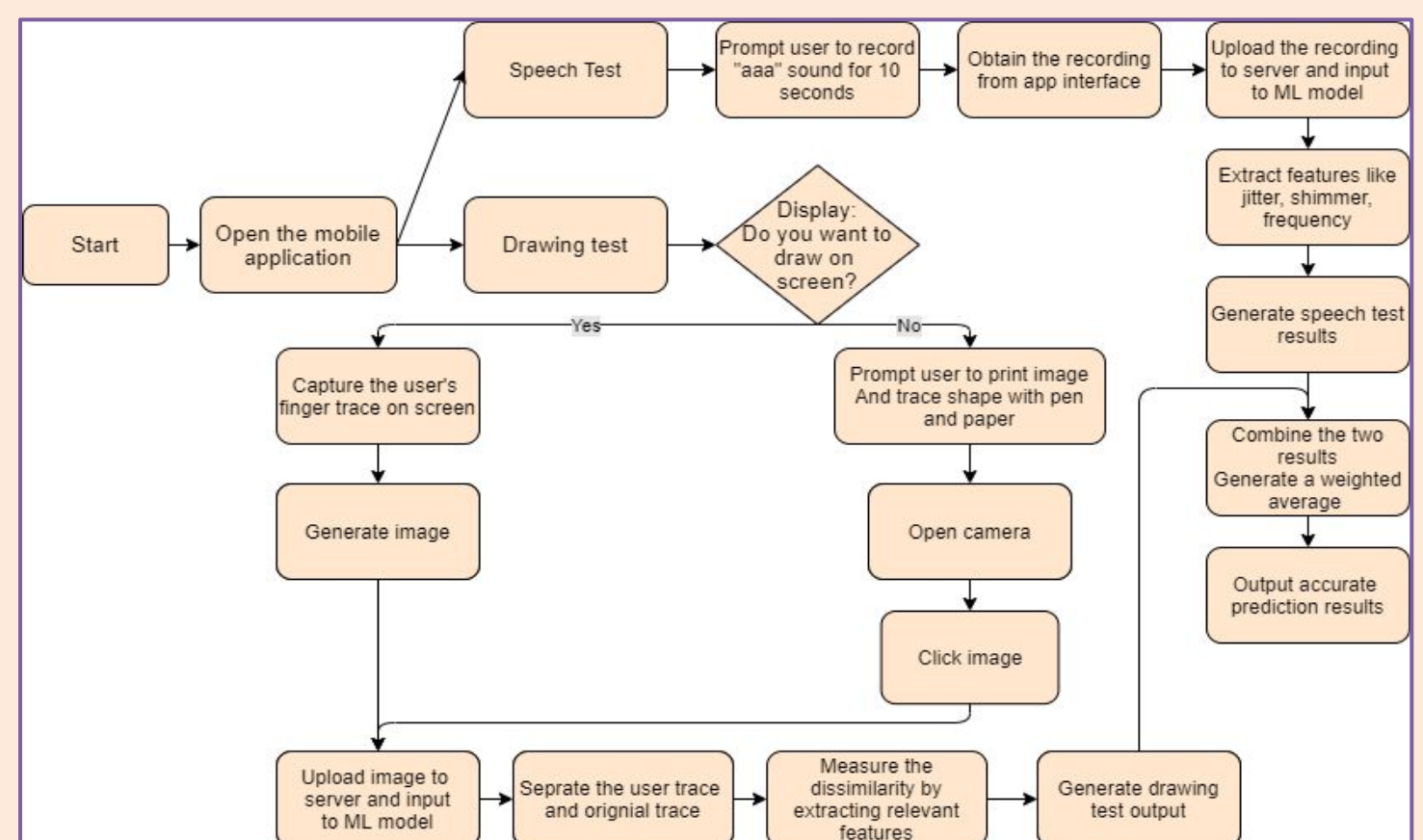


Fig 2. Workflow of the system

Methodology/Algorithms

➤ Trace Test

- Preprocessing of the dataset is carried out prior to training
- Transfer learning used on pretrained model trained on Imagenet dataset
- This CNN model is retrained on the NewHandPD dataset

➤ Speech Test

- Random forest classifier is used to train the model on features extracted from different utterances of vowels and short sentences
- Parselmouth library in python is used as a interface for Praat software, to extract 26 important features from those input audio files

Finally, a weighted average of both tests is output as a class indicating the likeliness of prevalence of Parkinson's Disease in a user.

Results

Test	Model	Train Acc.	Test Acc.	Information
Trace Test	VGG19	99.53%	98.11%	Meander Trace
Speech Test	LGBM	100.00%	91.21%	26 sound features extracted

Conclusion

Speech and Tremor tests can help in early detection of the disease. Smartphones can be used for accurate PD symptoms analysis will be more accessible hence allowing the widespread use. In the future, we can use the data acquired from the app, after verification, to train the model and increase its efficiency and accuracy.

References

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