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MACHINE LEARNING TECHNIQUE BASED PARKINSON'S DISEASE DETECTION FROM SPIRAL AND VOICE INPUTS

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ABSTRACT

Parkinson's disease is a dynamic neurodegenerative disorder influencing over 6 million people worldwide. However there is no recognized test for PD for patients, particularly in the early stages. This results in increased mortality rate. Thus detection system of Parkinson's disease with easy steps and feasible one to detect parkinson's disease at the early stage is essential. The proposed system invokes parkinson's disease detection using voice and spiral drawing dataset. The patients voice dataset is analyzed using RStudio with kmeans clustering and decision tree based machine learning techniques. The patients spiral drawing is analyzed using python. From these drawings principal component analysis (PCA) algorithm for feature extraction from the spiral drawings. From the spiral drawings : X ; Y; Z; Pressure; Grip Angle; Timestamp; Test ID values are been extracted. The extracted values are been matched with the trained database using machine learning technique (Support vector machine) and results are produced. Thus our experimental results will show early detection of disease which facilitates clinical monitoring of elderly people and increase their life span by improving their lifestyle which leads to a peaceful life.

Keywords: RStudio, kmeans, decision tree, principal component analysis, Support vector machine

1. INTRODUCTION

Parkinson's disease is a physical disorder. If Parkinson disease is not detected at the early stage then it affects the sensory system and cerebral paralysis. Research states that 50,000 individuals are affected with Parkinson's disease every year in US and large portion of people across globe are affected by Parkinson's disease. The symptoms of Parkinson's disease gets developed gradually. Few people will end in getting dementia. A large portion of the side effects results from a fall in dopamine levels in the cerebrum [1].People aged over 60 years are majorly affected by Parkinson disease. Parkinson's disease sufferers get worse over time as the normal bodily functions, including breathing, balance, movement, and heart function worsen [2]. As there is no medication for PD, in existing approach PD is been manually inspected and there is no accuracy and feasible solution through which people can get inspected in an easy manner. Also MRI, CT scan based PD detection cannot be a feasible solution for people in which radiation problem would be there. Thus MRI, CT scan process is time consuming and can be performed in respective time interval only. It causes the cerebral cells to harm the entire brain, in some serious cases rendering an individual unfit to perform day to day activities. It is also considered as neuro-degenerative type of dementia. There are many ways to diagnose and detect consisting of MRI scans, MMSE (mini-mental state exams) both expressed in terms of CDR standards. However, recognizing differentiations between Alzheimer's brain and a healthy one in older people beyond 75 years old is hard as they are alike in cerebral patterns and image concentration. PD causes shrinkage in hippocampus and cerebral cortex and it enlarges the ventricles in the brain [3]

2. RELATED WORKS:

[4] The detection of PD is very important at the early stage. The detection can be performed using data mining technique. This paper theoretically explains the algorithms to detect PD such as Naive Bayes, support vector machine (SVM), multilayer perceptron neural network (MLP) and decision tree. This paper has taken 8 patients voice input dataset and checked their performance with four types of classifiers such as Naïve Bayes, SVM, MLP neural network, and decision tree.

[5] This paper predicts parkinson's disease from voice input with acoustic devices. In this paper, people from different locations and voice parameters are analyzed to predict PD among the patients. Multilayer Perceptron (MLP) and Logistic Regression (LR) frameworks were used to recognize parkinson's disease from the voice dataset.

[6] In this paper, the researcher have considered 50 people with PD and 50 people who are healthy and collected their voice parameters from acoustic devices. For evaluation they have used k-fold cross validation technique and state it can provide 85% accuracy. This paper failed to explain the outcome experimentally. The outcomes cannot be promising as in this many PD patients were under treatments and infected.

[7] The data mining techniques is a more popular in many field of medical, business, railway, education etc. They are most commonly used for medical diagnosis and disease prediction at the early stage. The data mining is utilized for healthcare sector in industrial societies. This paper to provide a survey of data mining techniques of using Parkinson's disease.

[8] Parkinson disease is a global public health issue. Machine learning technique would be a best solution to classify individuals and individuals with Parkinson's sickness (PD). This paper gives a complete review for the forecast of Parkinson disease by utilizing the machine learning based methodologies. A concise presentation of different computational system based methodologies utilized for the forecast of Parkinson disease are introduced. This paper likewise displays the outline of results acquired by different scientists from accessible information to predict the Parkinson disease.

3. METHODOLOGY

Fig 1 explains the proposed methodology used to predict parkinson's disease using patients voice and spiral drawings. For experimental results, we used RStudio and Jupiter based python script for analysis. In the proposed methodology, we proposed a hybrid architecture with voice and spiral drawing dataset information analysis to predict Parkinson disease in an easy manner and feasible one.

The voice dataset is been downloaded from the UCI website. We used RStudio for data analysis. The proposed predictive analytics framework is a combination of K-means clustering and Decision Tree classification algorithm to predict PD from the patients. By using machine learning techniques, the problem can be solved with minimal error rate. Parkinson's disease voice dataset from UCI Machine learning repository is used as input. Thus our experimental results will show early detection of disease will facilitate clinical monitoring of elderly people and increase the chances of their life span and improved lifestyle to lead peaceful life [9].

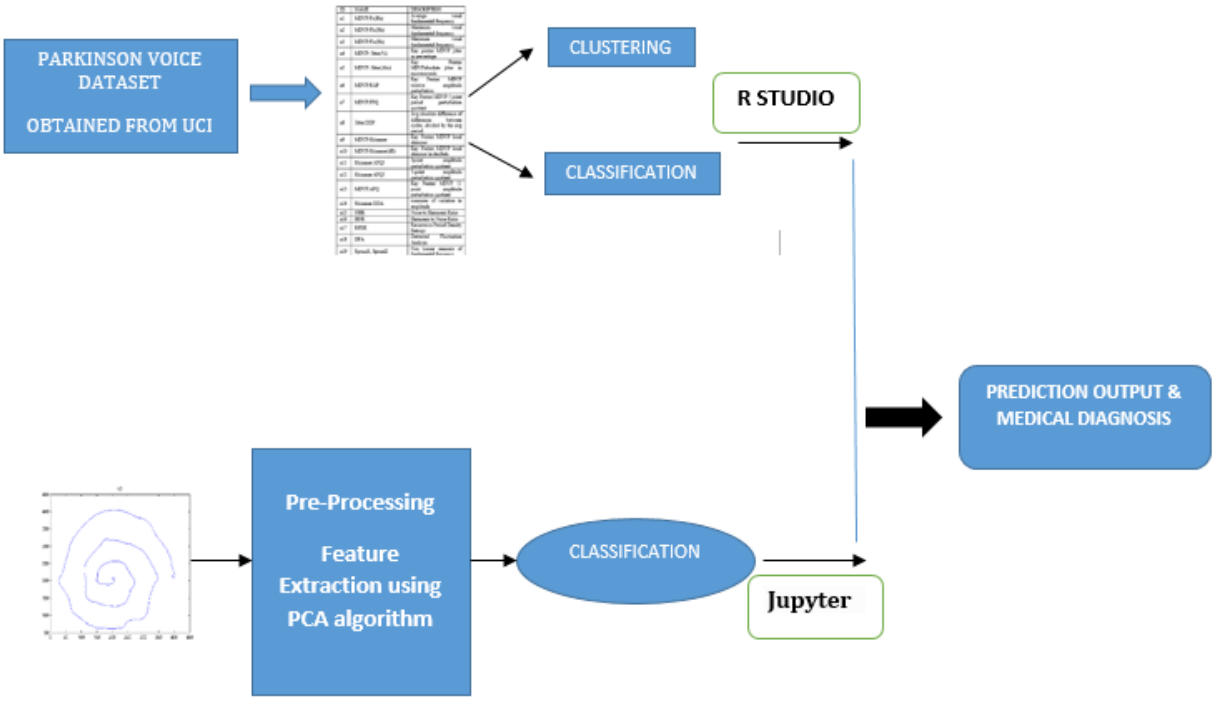

Fig 1. Proposed Methodology

For processing the spiral images, we used Jupyter based python language for data analysis. Our proposed system provides accurate results by integrating spiral drawing inputs of normal and parkinson's affected patients. From these drawings principal component analysis (PCA) algorithm for feature extraction from the spiral drawings. From the spiral drawings : X ; Y; Z; Pressure; GripAngle; Timestamp; Test ID values are been extracted [10]. The extracted values are been matched with the trained database using machine learning technique and results are produced. Finally we used linear regression machine learning algorithm for identifying Parkinson disease or not. Linear regression is probably one of the most important and widely used regression techniques. It's among the simplest regression methods. One of its main advantages is the ease of interpreting results.

From the extracted values the respective patient has Parkinson disease or not is identified. If both voice and spiral drawing states parkinson's disease then Parkinson disease is confirmed. If both voice and spiral drawing states no parkinson's disease then the patient is find healthy.

4. EXPERIMENTS AND RESULTS

Fig 2 and fig 3 explains the patient voice input dataset analysis using RStudio. The patients input is provided to RStudio as a .csv format and grouping of data is performed using kmeans clustering. After grouping of data i.e., clustering classification technique is performed to train the condition and define the solutions based on the input values. For condition definition and prediction of parkinson's disease we used decision tree algorithm.

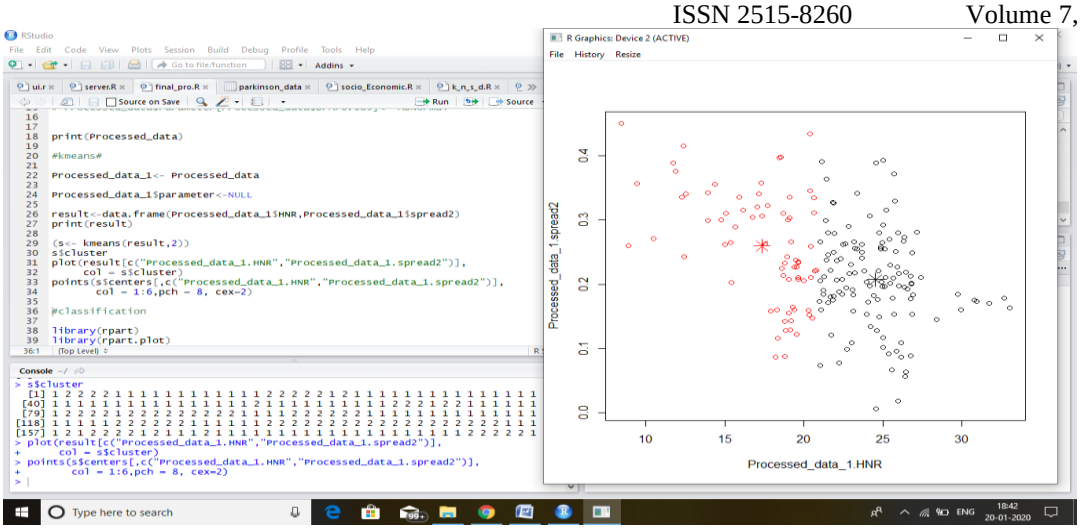

Fig 2. Voice input analysis: Kmeans clustering

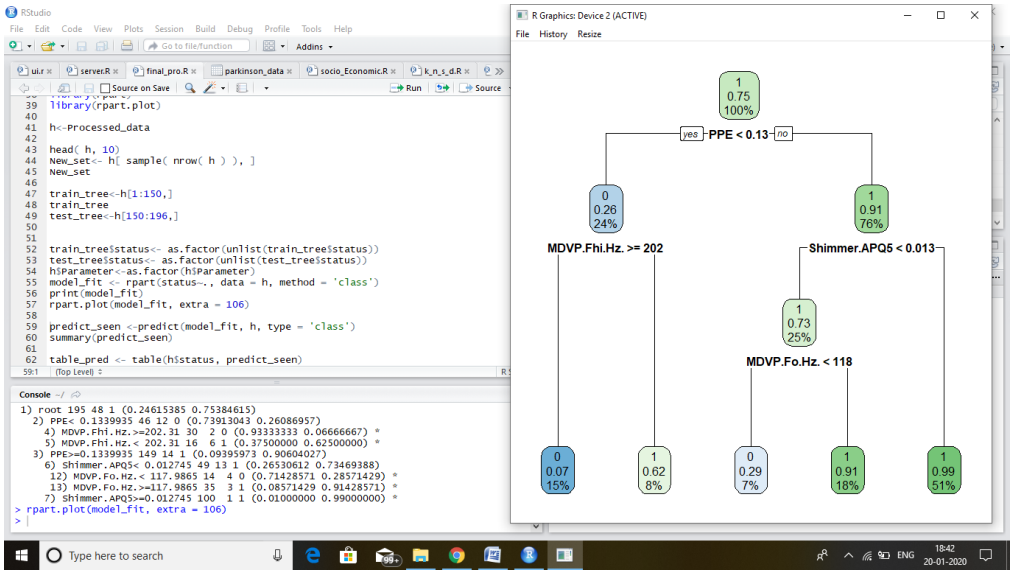

Fig 3. Voice input analysis: Decision Tree

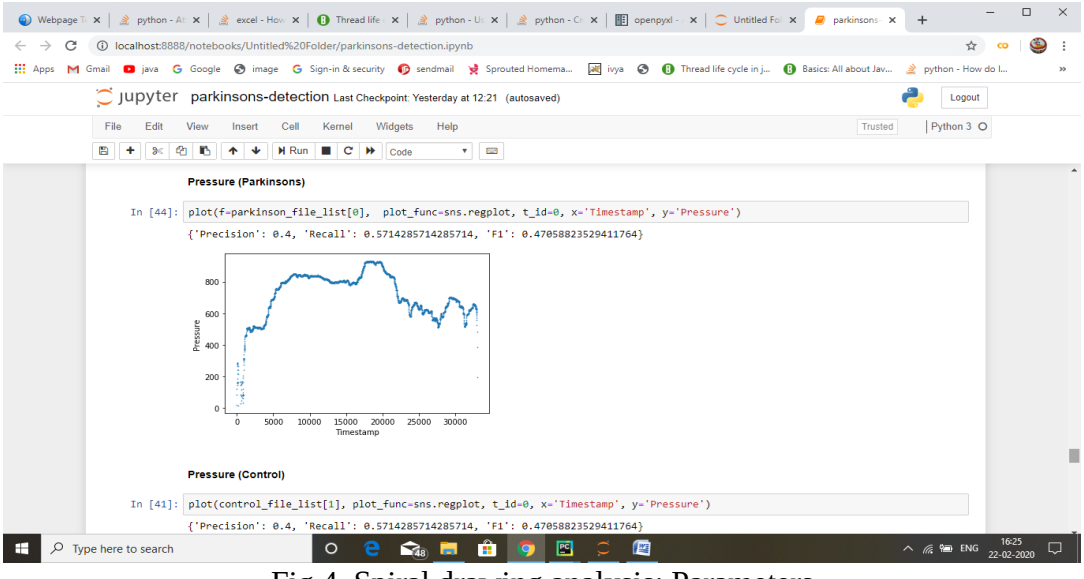

Fig 4. Spiral drawing analysis: Parameters

Fig 4 explains same set of patient's spiral drawing inputs. For spiral drawing analysis we used Jupiter tool for analysis. The input spiral drawing dataset is provided to Jupiter tool for analysis.

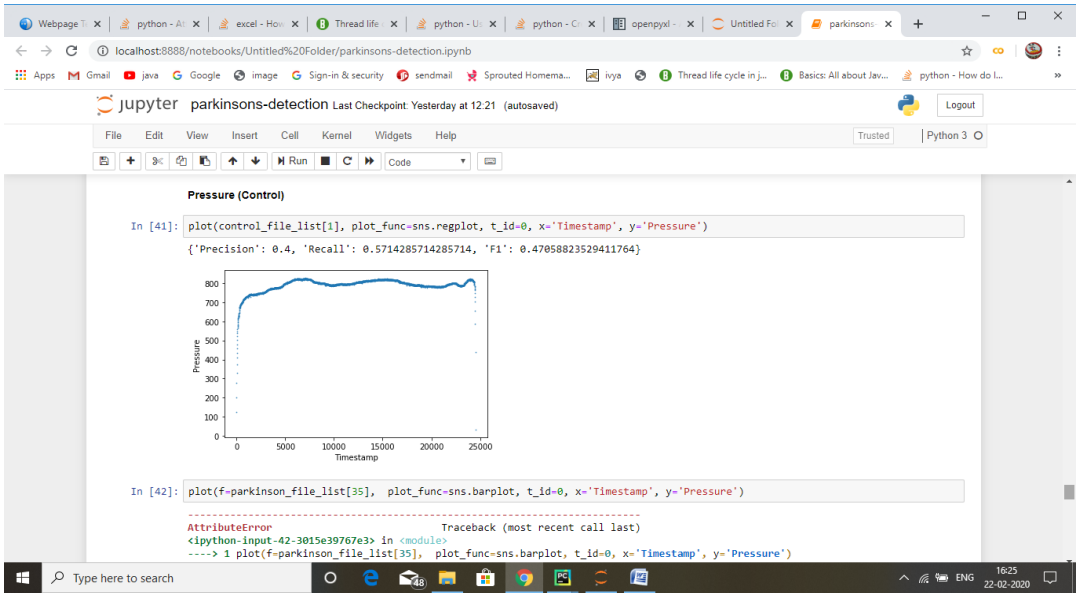

Fig 5. Spiral drawing analysis: Parameters

Fig 5 explains what all parameters has to be analyzed from the spiral drawings to predict parkinson's disease. The parameters like X,Y,Z, Timestamp, pressure, hand grip can be analyzed to predict parkinson's disease. Since it's a dataset image, we majorly focus on X,Y,Z values are taken for analysis.

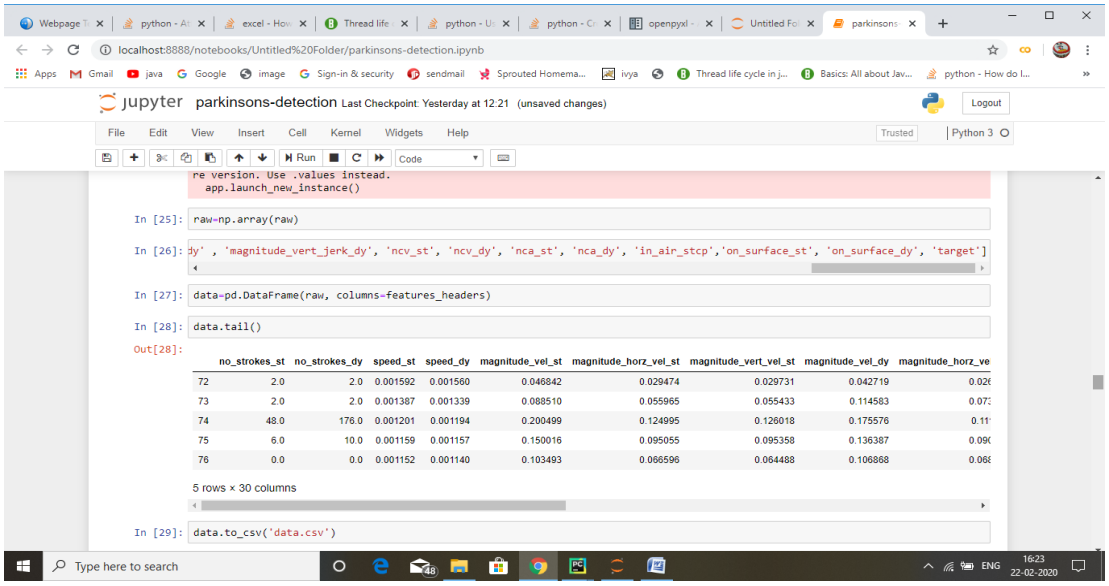

Fig 6. Spiral drawing analysis: PD detection

Fig 6 explains parkinson's disease prediction based on the comparison of the extracted values with the trained dataset.

5. CONCLUSION

This paper predicts parkinson's disease through machine learning technique. In this paper the outcome provides promising results by analyzing both voice and spiral drawing analysis. Previous review papers have focused only on a particular imaging based analysis such as MRI or PET, or on one specific type of dementia only such as AD. This proposed project aimed to provide machine learning technique to predict and provide early diagnostics for Parkinson disease. In this project the voice input is analyzed using RStudio and spiral

drawing using python. Thus this proposed system emphasize the importance of early detection and prediction of Parkinson's disease, such that treatment and support can be provided to patients as soon as possible.

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