JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

PARKINSON'S DISEASE DETECTION USING MACHINE LEARNING

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Abstract: **Parkinson's disease is a neurodegenerative disorder that affects millions ofpeople around the world. Parkinson's disease can affect a person's voice, causing them to speak softly or have difficulty in forming sound clearly. Speech or voice data is assumed to be 90% helpfulto diagnose the result. The proposed system used adata set parkinson.csv. A speech data set includes the number of voice features such as jitter, shimmer, pitch, and frequency. Different data preprocessing methods, such as datastandardization technique to improve the quality of data. In the present work relevant features were then extracted using Mel FrequencyCepstral Coefficient (MFCC) algorithm. Classification is performed using an Support Vector Machine (SVM) algorithm to differentiate between healthy and people with Parkinson's disease. The outcome of the proposed system is early detection of Parkinson's disease, which may help to better diagnose the disease.**

Keywords: Parkinson's Disease, Speech Dataset, Machine Learning, MFCC, Support Vector Machine

I. INTRODUCTION

Recently machine learning, deep learning techniques became an inevitable part. they're widely utilized in the life science & healthcare domain with the goal of early diagnosis. brain disease is one amongst the second commonest neurodegenerative disorder within which there's a decrease within the dopamine level within the neural cell [5]. Dopamine could be a chemical which carries the message in neuron. When 80% of dopamine is lost the patient will suffer resulting in shaking stiffness(tremor), slowness of movement or difficulty with walking(gait) or difficulty in speaking(voice) & so on. one amongst the secondary motor symptoms that individuals with Parkinson's disease is that the change in their speech quality or difficulty in speaking. For those that are affected, the voice may get hevieror hoarse over the time. As a results of this, the patient gradually finds verbal communication very difficult or they need difficulty forming sound clearly. People with age above 50 are the one's who has the upper possibility of getting Parkinson's disease but still an estimated 4 percentage of individuals who are under the age 50 are diagnosed with Parkinson's disease. Treatmentand prevention for PD isn't available. However, the disease is controlled in early stage. Patients laid low with the disease have a shaky, breathless voice when speaking and that they usually speak slowly and loosely. Their voice tone is reduced and words might not be pronounced correctly. All of those things impact clarity of voice. These disorders happen whenthe muscles that control speech don't function correctly.

II. RELATED WORK

Max A. little et al. [1] suggested a unique technique for the classification of subjects into Parkinsondisease and control subjects by detecting dysphonia.In their work, Pitch Period Entropy (EPI) a new robust measure of dysphony was introduced. The datawas collected from 31 people (23 were PD patients and 8 were healthy subjects) which include 195 sustained vowel phonation. Their methodology consisted of three stages; feature calculation,preprocessing and selection of features and finallyclassification. For the classification purpose, they used a linear kernel support vector machine (SVM).

Jaichandran R1et al. [2] in their paper proposed the system invokes Parkinson's disease detection using voice and spiral drawing dataset. The patient voice data set is analyzed through RStudio-based machine learning techniques with kmeans clustering and decision tree. The patients' spiral drawing is analyzedusing python. Based on these drawings, the principle component analysis algorithm (PCA) is used to extract the features of spiral drawings.From the spiral drawings:X; Y; Z; Pressure; Grip Angle; Timestamp;Test ID values have been extracted.

Abhishek M. S et al. [3] in their paper determined the optimum UPDRS threshold value, which can be distinguished by the vocal

function with the lowest possible error rate. Such functions are provided for Support of Vector Machine (SVM), ExtremeLearning Machines (ELM) and k-classifiers (K-NN)is used for the binary classification problems solved by various UPDRS values. They also take into consideration the metric of the Matthew Correlation Coefficient (MCC) to determine the maximum predictable threshold value of UPDRS. Finally, the major components are simulated and clustered to find the desired threshold values.

C K Gomathy et al.[5] in their model, a huge amount of data is collected from the normal person and also previously affected person by Parkinson's disease. these data is trained using machine learning algorithms. For the classification XGBoost, Naïve Bayes, Decision Tree classifier used with an accuracy of Decision Tree is 87% achieved. From the whole data 60% is used for training and 40% is used for testing.

Mohammad Shahbakhiet et al.[6] proposed a new algorithm for diagnosing of Parkinson's disease based on voice analysis. The subjects were asked to pronounce letter "A" for 3 seconds. In the first step, genetic algorithm (GA) is undertaken for selecting optimized features from all extracted features. Afterwards a network based on support vector machine (SVM) is used for classification between healthy and people with Parkinson.

III. EXISTING METHODOLOGY

In the existing system, PD is only detected in thesecondary phase (dopamine deficiency), which leads to medical problems. The doctor must also manually examine and suggest a medical diagnosis in which thesymptoms may differ from one person to other, suggesting that medicine is also a challenge. Consequently, mental disorders are poorly characterized and present numerous health, complications [11]. PM is generally diagnosed through the following clinical methods:

MRI or CT scan - Conventional MRI is not able to detect the early signs of Parkinson's disease.

PET - is used to assess the activity and function of areas of the brain involved in motion.

SPECT scan - may reveal changes in brain chemistry, like a decrease in dopamine.

The result is a high rate of misdiagnoses (up to 25%of non-specialists) and many years before diagnosis, people may have the disease. Thus the existing system is not effective in early prediction andaccurate medical diagnosis of the affected people.

IV. PROBLEM STATEMENT

People with parkinsonism generally have problem of balance, difficulty in speaking or tremors in one hand.These are the common issue faced by so many peoplein the world, especially geriatric aged. The problem that how will they know this is happening because of aging or they have Parkinson's disease is difficulty to identify. Here when the patient decides to speak and cannot produce the correct vocal sounds.

V. EXPERIMENTAL WORK

The methodology is designed for building a model to detect the Parkinson's disease at its early stages using machine learning algorithm. It consists of the following steps:

1. In the present work, the dataset was taken from kaggle.com. The data includes 195 sustained vowel phonation. It consists of147 people with Parkinson's and 48 is dataof healthy people [7].
2. Once we have this data some processing is done. The data standardization technique is used to pre-process the data [10]. It is usedto standardize the range of features of input data set.
3. Features are extracted from the voice sampleand optimal features are selected from them. MFCC algorithm is used for extracting the features from the voice sample [9]. In this step, using A/D conversion we will convert audio signal from analog to digital format. The For analysis, the most common feature considered are Jitter, Shimmer, frequency.
4. After that we used SVM method for the classify between healthy people and people with Parkinson's disease [8].

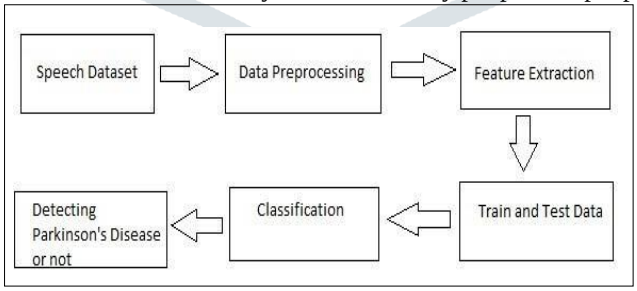

fig.1: block diagram of system

VI. RESULTS AND DISCUSSION

The results show that there are individual acousticmeasurements that show significant differences between normal speech and Parkinsonian speech Features are the input of our data and labels are like the output of our data. After applying the features and labels, we get 147 people with Parkinson's and 48 people don't have Parkinson's.

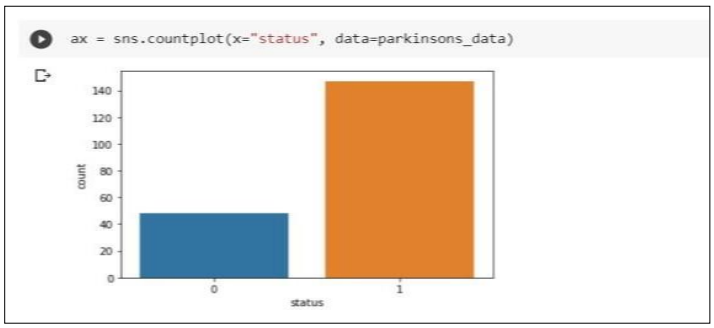

fig.2: graph showing healthy and parkinsonism

VII. CONCLUSION

From the voice data, we conclude that there are 147 people with Parkinson's disease and 48 healthy people. The current field of research on Parkinson's disease is very important and its early detection may improve the patient's life to diagnose the disease at early stage. In our work, the problem of identifying Parkinson's disease is resolved through a machine learning approach and different types of machine learning models have been used to detect it. The mainobjective of this work is to show the diagnosis of PD by analyzing speech signals. Our analysis provides very accurate performance (89%) in detecting Parkinson's disease using SVM algorithm.

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