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A DEEP LEARNING BASED METHOD FOR PARKINSON'S DISEASE DETECTION USING SVM

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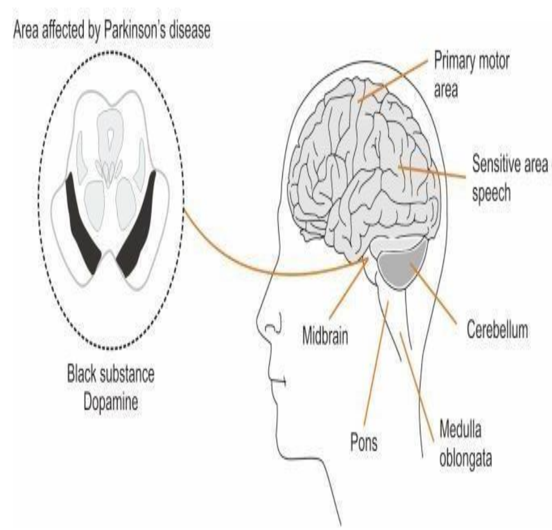
ABSTRACT

Parkinson's disease (PD) is a critical neurological disorder that requires accurate and early diagnosis to improve patient quality of life. A machine learning-based prediction system was proposed, using a support vector machine (SVM) and L1-Norm feature selection for accurate target classification. The system was validated using K-fold cross-validation and metrics such as accuracy, sensitivity, specificity, precision, F1 score, and execution time. The experimental findings suggest that the proposed method can accurately predict PD and be easily integrated into healthcare for diagnosis purposes. This approach fills a gap in feature selection and classification using voice recordings data.

INTRODUCTION:

Recently, the World Health Organization (WHO) described neurological disorders as one of the most significant threats to public health. Among the most common disorders are Parkinson's disease (PD), stroke, multiple sclerosis, headache disorders, dementia, epilepsy and other diseases. At this time it is estimated that 16 out of 60 people are suffering due to some neurological disease. Parkinson's disease (PD), initially called shaking palsy, first was described by James Parkinson. This disease is neurological and degenerative, characterized by deficiency



dopamine production in the midbrain region called black substance. Figure 1 brings an Illustrative diagram showing a region of the brain affected by Parkinson's disease.

The deficiency of dopamine is caused by the degeneration of neurons in black substance and may be related to age, family history, skull trauma and even contact with some pesticides. Dopamine is an essential neurotransmitter, because it assists 2 involuntary movements and its reduction below normal levels causes symptoms, which can be divided into two groups: motor and non- motor. The motor group manifests by involuntary tremulous motions, lessened muscular power that makes it difficult for performing simple activities like buttoning a shirt, or putting on a shoe. In addition to muscle rigidity due to the lack of dopamine in the body, the muscles fail to receive the signals to relax. Other symptoms are the loss of facial expression, changes in speech and handwriting. The non-motor group may also be present with dementia, depression, anxiety, altered sleep, and slow thinking.

In all, three steps are required to diagnose the disease. The first one contemplates the clinical consultation. After the symptoms are confirmed, the next step is performing drug therapy, in which the patient with suspected PD undergoes dopamine supplementation. If there are improvements, there is a high probability of the individual having the disease. However, a third step is required to confirm the condition, in case of doubts. In this stage, laboratory tests are performed, which may not be accessible to all people, especially in the developing world.

Problem Statement:

Six causes of PD where three of them were examined by him. Diagnosed that people with Parkinsonism has vocal disorders problems that affect their speech volume level and face complexity in the pronunciation of syllables and so forth. Thus to use vocal measurements as an effective diagnostic tool for PD recognition.

Parkinson disease is the critical disorder sickness second to Alzheimer's disease and the complete PD treatment has not discovered till now. The existing technique of therapies is good for tackle PD symptoms.

However, researchers have made attempts to find out the effective treatment strategy that ensures recovery and treatment.

In the PD diagnosis is being typically based on conducted few invasive techniques and empirical tests and examinations. The invasive based techniques in order to diagnose the PD are very expensive, less efficient, as well as very complex equipment's needed to conducts and the accuracy is also not satisfactory.

SYSTEM ANALYSIS:

To classify PD and healthy people the usage of speech signals is an effective technique for diagnosing PD from speech impairments. In Literature, different machines learning based classification techniques have been proposed to classify PD and healthy people from speech signals, and are reported in the study. Diagnosed 23 PD and 8 healthy people and their dataset recorded vowels and used a Support Vector Machine (SVM) for classification and achieved classification accuracy 91.4 %. In 132 extracted features from speech signals applied dysphonia methods.

DRAWBACKS:

Parkinson disease is a progressive and long-term disorder the central nervous system that badly affects people whose age is usually above 60 years. The cells suffering from PD do not have a consistent flow of dopamine with the motor system. The vocal impairment is hypothesized initial signs of the disease. Diagnosed that people with Parkinsonism has vocal disorders problems that affect their speech volume level and face complexity in the pronunciation of syllables and so forth. Thus to use vocal measurements as an effective diagnostic tool for PD recognition.

PROPOSED SYSTEM:

They used Haar-like feature section technique and RBF-SVM for Parkinson detection. The proposed method achieved better performance. The L1-Norm SVM was used for appropriate features selection that improves the classification performance of the classifier.

We adopted the L1-Norm SVM for appropriate feature selection in this study because the classification performance of L1-Norm SVM FS based method is good as compare to other methods of classification for PD and healthy people.

The main contribution of this study is to propose a machine-learning based system to successfully diagnose people with PD and improve the patient's life. Machine learning predictive model SVM was used for PD and healthy people classification. The L1-Norm SVM was used for appropriate features selection that improves the classification performance of the classifier. We adopted the L1-Norm SVM for appropriate feature selection in this study because the classification performance of L1-Norm SVM FS based method is good as compare to other methods of classification for PD and healthy people.

ADVANTAGE:

- The performance of classifier checked on selected features subsets which are selected by L1-Norm SVM algorithm along with K–folds cross validation technique.
- The performance also checked on full features set and compared with performance on selected features sets.

- The system has been tested on PD dataset and achieved very high classification performance.
- We suggest that the proposed system can be effectively diagnosis PD and easily incorporated in the healthcare system.

SYSTEM DESIGN:

Input design is a part of overall system design, which requires careful attention. Input of data as designed as user-friendly and easier. Input design is a process of converting the user- oriented description of the input to the computer based information system into programmer- oriented specification. The objective of the input design is to create an input layout that is easy to follow and prevent operator errors.

Visual tracking using active contours is usually set in a static framework. The active contour tracks the object of interest in a given frame of an image sequence. A subsequent prediction step ensures good initial placement for the next frame. This approach is unnatural; the curve evolution gets decoupled from the actual dynamics of the objects to be tracked. True dynamical approaches exist, all being marker particle based and thus prone to the shortcomings of such particle-based implementations. In particular, topological changes are not handled naturally in this framework. The now classical level set approach is tailored for evolutions of manifolds of co dimension one. However, dynamic curve evolution is at least a co dimension two problem. We propose an efficient, level set based approach for dynamic curve evolution, which addresses the artificial separation of segmentation and prediction while retaining all the desirable properties of the level set formulation. It is based on a new energy minimization functional which, for the first time, puts dynamics into the geodesic active contour framework.

OUTPUT DESIGN:

The output design refers to the results and information that are generated by the system for many end users. Efficient and intelligent output design improves the system relationships with the user and help in decision making. The output of the system is in the form of report. Object tracking can be accomplished in many ways including by mechanical, acoustical, magnetic, inertial, or optical sensing, and by radio and microwaves, to mention a few. The ideal tracker should be "tiny, self-contained, complete, accurate, fast, immune to occlusions, robust, tenacious, wireless, and cheap" [1], [2]. As of now such a tracker does not exist; tradeoffs are necessary, and a method

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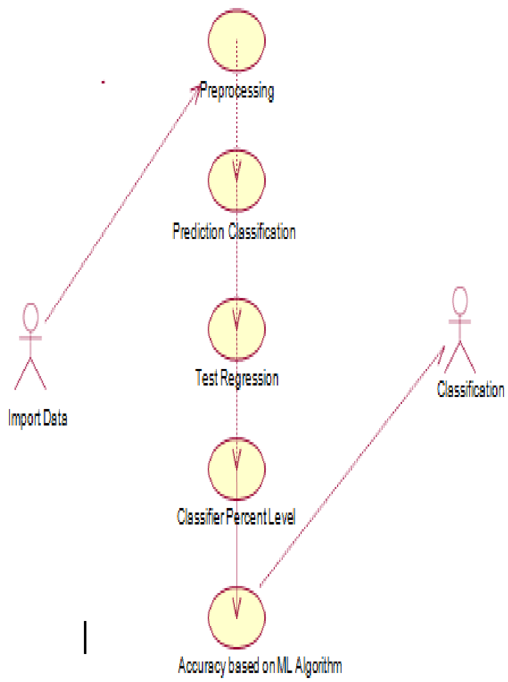
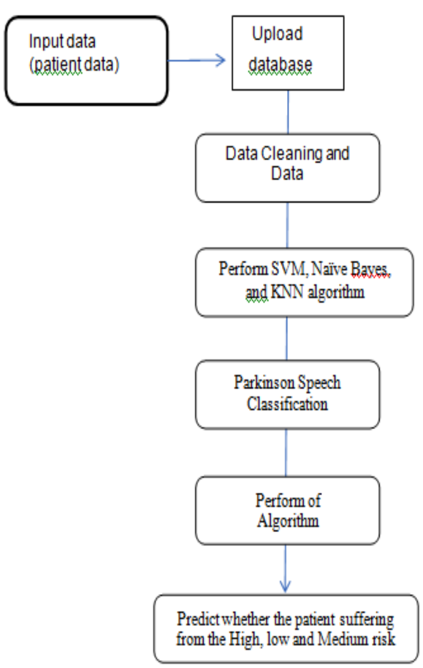
SYSTEM ARHITECHTURE:



***DATA FLOW DIAGRAM*:**



SYSTEM MODULE :

MODULE DESCRIPTION

- Classification capability of hybrid features:
- Parkinson's disease:
- Synthetic Minority over Sampling Technique:
- Tunable Q-factor wavelets transform**:**

CLASSIFICATION CAPABILITY OF HYBRID FEATURES:

Seen from the, over 80% of classification accuracy (ACC) can be obtained regardless of different evaluation criteria. Compared with the ACC from the provider of the dataset, the improvement is apparent. With the number of the selected feature increasing from zero to tens of features, the ACC rapidly reach 70% or so. After that, the improvement of the ACC becomes slow. When the number of selected features reaches 200 or so, the ACC is close to the optimal ACC. the curves of ACC based on different evaluation criteria. For corrcoef, the curve is fastest to reach close to the best ACC. For p_value and recorr2, the curves are similar and can obtain best ACC.

***PARKINSON'S DISEASE*:**

Parkinson's disease (PD) is a common neurological degeneration disease; its clinical manifestations include static tremor, slow movement, muscle rigidity and postural gait disorder. According to statistics, the current total number of patients with Parkinson's disease in China more than 2 million, accounting for about half of the global number of such patients.

Recent studies showed that speech signal (data) is helpful for recognizing PWP (people with Parkinson's) from healthy people, because most of the PWP has vocal disorder in daily communication to some Extent.

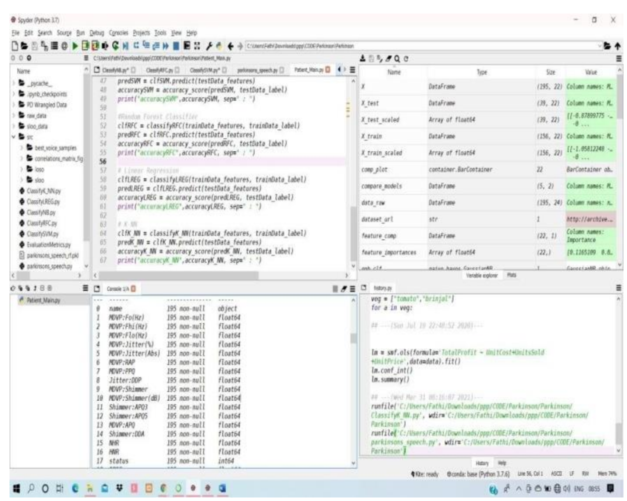
SYNTHETIC MINORITY OVER SAMPLING TECHNIQUE:

Over-sampling is carried out by simply replacing existing elements of the minority class in the educational setting. This method leads to over fitting. To prevent this over fitting, new samples can be artificially produced by the distribution of the minority class. This approach is the Synthetic Minority Over- sampling Technique (SMOTE). There are many studies in the literature regarding the classification of Parkinson's disease dataset. Some of these studies are given below. Sakar et al. used several signal processing algorithms for Parkinson's disease from speech signals and formed the PD data set.

***TUNABLE Q-FACTOR WAVELETS TRANSFORM*:**

The authors examined the effect of tunable Q-factor wavelet transform (TQWT) method and obtained good results. In the classification of Parkinson's disease, have proposed a new method called Multiple Feature Evaluation Approach (MFEA) and individually combined with classification algorithms. They achieved their best success with the SVMMFEA combination. Deepak Joshi et al. proposed a new hybrid method on the detection of Parkinson's disease from walking signals. In this method, wavelet analysis methods are combined with SVM. Apart from the literature, a new hybrid method based on SMOTE and Random Forests classification was proposed, and promising results were obtained by applying the Parkinson's disease dataset.

FIG. B1 Training the data



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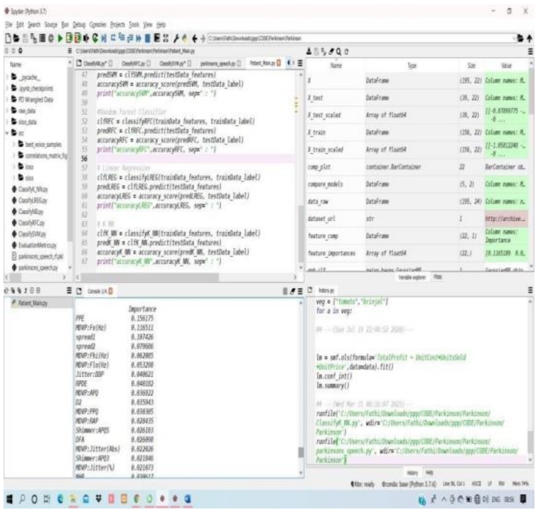

FIG.B2 Classification

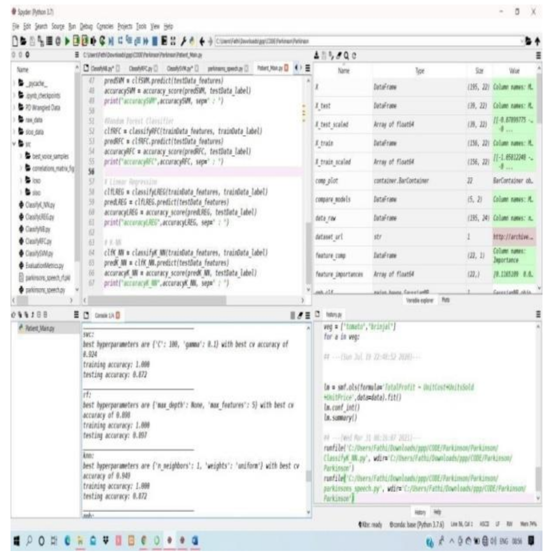

FIG.B4 Accurate results

FIG.B3 Testing the data

CONCLUSION:

The solving of the class-imbalance problem is very hard to handle in machine learning. There are some approaches to handle this problem in the literature. One of the best solutions is the SMOTE (Synthetic Minority Over-sampling Technique). In this paper, the SMOTE and Random Forests classifier have been combined to classify the Parkinson disease dataset. In the SMOTE approach, the number of samples for minority class in the PD dataset has been synthetically increased to balance the dataset. Only the random forests classification were classified as 87.037% in the classification of PD dataset, while the proposed hybrid method (the combination of SMOTE and random forests) achieved 94.89% classification success. The proposed hybrid model could be used in other medical real world class-imbalanced classification problems.

FUTURE WORK:

As a future work, we suggest using a combination of ensemble classifiers to implement the N Nge algorithm and compare it with the AdaBoostM1 classifier. Also, another suggestion is to use feature selection with clustering algorithms to achieve high accuracy in predicting PD.

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