



M.KUMARASAMY
COLLEGE OF ENGINEERING

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Thalavapalayam, Karur – 639 113.



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

NALAYATHIRAN PROJECT

TITLE : DETECTING PARKINSON'S DISEASE

DOMAIN : DATA SCIENCE

FACULTY MENTOR : Dr. S. SUJANTHI M.E., PH.D.,

INDUSTRY MENTOR : SOWJANYA, SANDEEP DOODIGANI

PROJECT MEMBERS :

REGISTER NO	NAME	ROLE
19BCS4066	R.LALITHAA SHREE	LEADER
19BCS4072	K. MEGHA	MEMBER
19BCS4059	S. KESAVAN	MEMBER
19BCS4038	S. HARIHARAN	MEMBER

DETECTING PARKINSON'S DISEASE USING MACHINE LEARNING

ABSTRACT:

Accurately detecting Parkinson's disease (PD) at an early stage is certainly indispensable for slowing down its progress and providing patients the possibility of accessing to disease-modifying therapy. Towards this end, the premotor stage in PD should be carefully monitored. An innovative deep-learning technique is introduced to early uncover whether an individual is affected with PD or not based on premotor features. Specifically, to uncover PD at an early stage, several indicators have been considered in this study, including Rapid Eye Movement and olfactory loss, Cerebrospinal fluid data, and dopaminergic imaging markers. A comparison between the proposed deep learning model and twelve machine learning and ensemble learning methods based on relatively small data including 183 healthy individuals and 401 early PD patients shows the superior detection performance of the designed model, which achieves the highest accuracy, 96.45% on average. Besides detecting the PD, we also provide the feature importance on the PD detection process based on the Boosting method.

LITERATURE SURVEY:

Timothy J. Wroge [1]. The Parkinson's disease (PD) manifests as the death of dopaminergic neurons in the substantia nigra pars compacta within the midbrain. This neurodegeneration leads to a range of symptoms including coordination issues, bradykinesia, vocal changes, and rigidity. Dysarthria is also observed in PD patients; it is characterized by weakness, paralysis, and lack of coordination in the motor-speech system: affecting respiration, phonation, articulation, and prosody. Since symptoms and the disease course vary, PD is often not diagnosed for many years. Therefore, there is a need for more sensitive diagnostic tools for PD detection because, as the disease progresses, more symptoms arise that make PD harder to treat. The main deficits of PD speech are loss of intensity, monotony of pitch and loudness, reduced stress, inappropriate silences, short rushes of speech, variable rate, imprecise consonant articulation, and harsh and breathy voice (dysphonia). The range of voice related symptoms is promising for a potential detection tool because recording voice data is non-invasive and can be done easily with mobile devices.

Problem Identified:

In this paper, it is difficult to detect early due to the subtle initial symptoms. There is a significant burden to patients and the health care system due to delays in diagnosis. The difficulty in early PD diagnosis has inspired researchers to develop screening tools relying on automated algorithms to differentiate healthy controls from people with PD. This binary diagnosis focuses on the first step of validating digital biomarkers in distinguishing disease from control; it does not offer a form of differential diagnosis where the model may distinguish PD among a variety of disorders that present PD-like symptoms (e.g., Lewy-Body Dementia, Essential Tremor). The current research is a promising first step toward a long-term goal of providing a decision support algorithm for physicians in screening patients for

PD. In this paper, we apply several different machine learning models to classify PD from controls using the mPower Voice dataset.

Johannes Frasnelli [2] Diagnosis of Parkinson's disease (PD) is commonly based on medical observations and assessment of clinical signs, including the characterization of a variety of motor symptoms. However, traditional diagnostic approaches may suffer from subjectivity as they rely on the evaluation of movements that are sometimes subtle to human eyes and therefore difficult to classify, leading to possible misclassification. In the meantime, early non-motor symptoms of PD may be mild and can be caused by many other conditions. Therefore, these symptoms are often overlooked, making diagnosis of PD at an early stage challenging.

Problem Identified:

To address these difficulties and to refine the diagnosis and assessment procedures of PD, machine learning methods have been implemented for the classification of PD and healthy controls or patients with similar clinical presentations. To provide a comprehensive overview of data modalities and machine learning methods that have been used in the diagnosis and differential diagnosis of PD, in this study, we conducted a literature review of studies published until February 14, 2020, using the PubMed and IEEE Xplore databases. A total of 209 studies were included, extracted for relevant information and presented in this review, with an investigation of their aims, sources of data, types of data, machine learning methods and associated outcomes. These studies demonstrate a high potential for adaptation of machine learning methods and novel biomarkers in clinical decision making, leading to increasingly systematic, informed diagnosis of PD.

Chirag Mittal [3] Parkinson's disease is a nervous system disease that affects your ability to control movement. The disease usually starts out slowly and worsens over time. If you have Parkinson's disease, you may shake, have muscle stiffness, and have trouble walking and maintaining your balance and coordination. As the disease worsens, you may have trouble talking, sleeping, have mental and memory problems, experience behavioral changes and have other symptoms. About 50% more men than women get Parkinson's disease. It is most commonly seen in persons 60 years of age and older. However, up to 10% of patients are diagnosed before age 50. About 60,000 new cases of Parkinson's disease are diagnosed in the United States each year.

Problem Identified:

Parkinson's disease affects the CNS of the brain and has yet no treatment unless it's detected early. Late detection leads to no treatment and loss of life. Thus, its early detection is significant. For early detection of the disease, we utilized various machine learning algorithms to detect Parkinson's disease. We checked our Parkinson disease data and found out that K Nearest Neighbors is the best Algorithm with accuracy of 97.43% to predict the onset of the disease which will enable early treatment and save a life.

SUMMARY OF LITERATURE SURVEY:

S.No	Author Name	Title	Methods	Limitations
1.	Timothy J, Wroge	Parkinson's Disease Diagnosis Using Machine Learning and Voice.	Decision support algorithm	It is difficult to detect early due to the subtle initial symptoms.
2.	Johannes Frasnelli	Machine Learning for the Diagnosis of Parkinson's Disease.	Machine learning algorithm	Difficulties and to refine the diagnosis and assessment procedures of machine learning methods have been implemented for the classification.
3.	Chirag Mittal	Parkinson's Disease Detection Using Different Machine Learning Algorithms.	K Nearest Neighbors algorithm	Late detection leads to no treatment and loss of life by using this algorithm.

REFERENCE:

1. Chirag Mittal, Parkinson's Disease Detection Using Different Machine Learning Algorithms, International Journal of Scientific and Research Publications, Volume 12, Issue 2, February 2022 23 ISSN 2250-3153.
2. Johannes Frasnelli, Machine Learning for the Diagnosis of Parkinson's Disease, Front. Aging Neurosci, 06 May 2021Sec. Parkinson's Disease and Aging related Movement Disorders.
3. Timothy J, Wroge, Parkinson's Disease Diagnosis Using Machine Learning and Voice. 2018 IEEE Signal Processing in medicine and Biology symposium (SPMB).