LITERATURE SURVEY:

Detecting Parkinson's Disease using Machine Learning

Batch:

19L207 – Poojitha B

19L227 – Nesan M

19L263 – Venkateshan R

19L264 – Viveka P

S.No	Title	Author	Paper	Summary
1.	Early Detection of Parkinson's Disease Using Deep Learning and Machine Learning	Wu Wang, JUNHO LEE, FOUZI HARROU1 (Member, IEEE), AND YING SUN	IEEE Access	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 disease-modifying therapy. Towards this end, the premotor stage in PD should be carefully monitored. An innovative deep learning technique is introduced to quickly 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.
2.	The Role of Neural Network for the Detection of Parkinson's Disease	Mahmood Saleh Alzubaidi , Uzair Shah, Haider Dhia Zubaydi , Khalid Dolaat , Alaa A. Abd-Alrazaq , Arfan Ahmed and Mowafa Househ.	MDPI Healthcare	The scope of this paper is limited to the detection of Parkinson's disease (PD) in the early stage using neural networks. The patient dataset such as electronic health record (EHR) and medical image can be analyzed using neural network (NN) features; in particular, patient's data can undergo many processes; analysis, segmentation, augmentation, scaling, normalization, sampling, aggregation, and sifting, in order to obtain accurate prediction that assists healthcare ecosystem and stakeholders in the healthcare domain. Many studies have been recently conducted to address and propose a solution to mitigate and prevent neurodegenerative disorders such as PD. However, most of these studies and research are dispersed. Therefore, summarizing NN technologies' involvement in resolving challenges related to PD is needed; an appropriate summarization allows new researchers to understand the current role of neural networks against PD. It will open new opportunities for researchers to have the necessary base that allows them to build on instead of starting from ground zero.

3.	Machine Learning Approaches for Detecting Parkinson's Disease from EEG Analysis: A Systematic Review	Ana María Maitín, Alvaro José García-Tejedor and Juan Pablo Romero Muñoz.	MDPI Applied sciences	Diagnosis of Parkinson's disease (PD) is mainly based on motor symptoms and can be supported by imaging techniques such as the single photon emission computed tomography (SPECT) or M-iodobenzyl-guanidine cardiac scintiscan (MIBG), which are expensive and not always available. In this review, authors have analyzed studies that used machine learning (ML) techniques to diagnose PD through resting state or motor activation electroencephalography (EEG) tests. Methods: The review process was performed following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.
4.	Use of Laughter for the Detection of Parkinson's Disease: Feasibility Study for Clinical Decision Support Systems, Based on Speech Recognition and Automatic Classification Techniques	Miguel Terriza,Jorge Navarro,Irene Retuerta,Nuria Alfageme,Ruben San-Segundo,George Kontaxakis, Elena Garcia-Martin,Pedro C. Marijuan and Fivos Panetsos	MDPI Applied sciences	Parkinson's disease (PD) is an incurable neurodegenerative disorder which affects over 10 million people worldwide. Early detection and correct evaluation of the disease is critical for appropriate medication and to slow the advance of the symptoms. In this scenario, it is critical to develop clinical decision support systems contributing to an early, efficient, and reliable diagnosis of this illness. In this paper we present a feasibility study for a clinical decision support system for the diagnosis of PD based on the acoustic characteristics of laughter. Our decision support system is based on laugh analysis with speech recognition methods and automatic classification techniques. We evaluated different cepstral coefficients to identify laugh characteristics of healthy and ill subjects combined with machine learning classification models. The decision support system reached 83% accuracy rate with an AUC value of 0.86 for PD–healthy laughs classification in a database of 20,000 samples randomly generated from a pool of 120 laughs from healthy and PD subjects. Laughter could be employed for the efficient and reliable detection of PD; such a detection system can be achieved using speech recognition and automatic classification techniques; a clinical decision support system can be built using the above techniques. Significance: PD clinical decision support systems for the early detection of the disease will help to improve the efficiency of available and upcoming therapeutic treatments which, in turn, would improve life conditions of the affected people and would decrease costs and efforts in public and private healthcare systems.

5.	A Robust Machine Learning Approach Towards Detection of Parkinson's Disease	A. R. Susmitha & Saneev Kumar Das	Springer Conference Paper	Parkinson's disease is nowadays a very common brain ailment found in many individuals across the globe. The task of predicting or detecting Parkinson's disease requires expensive mechanisms to be adopted. But with the advent in technologies like machine learning, artificial intelligence, and many such, the detection and prediction based on specific parameters have become easier. This paper proposes a novel architecture to predict Parkinson's disease in individuals using specific attributes. We have used four significant classifiers viz., logistic regression, k-nearest neighbor, decision tree, and random forest. The performance obtained with the aid of each of the considered classifiers are presented diagrammatically. The proposed framework entails five layers basically including dataset collection, data wrangling, data validation, data analysis, model training and validation. The layers of the proposed framework are practically realized through proper implementation presented for the prediction of Parkinson's disease. A thorough visualization of principal component analysis is presented initially followed by visualization of freeviz chart, and decision tree. Further heatmap, and decision surface is provided. Finally, ending up with a performance comparison of the four considered classifiers using a three-dimensional surface plot. The highest accuracy is achieved with the use of random forest classifier i.e., 94.3% and the lowest accuracy achieved is with the use of decision tree classifier i.e., 78.2%.

6.	Biomarkers for Detection of Parkinson's Disease Using Machine Learning—A Short Review	Moumita Pramanik, Ratika Pradhan & Parvati Nandy	Springer Conference Paper	Detection of Parkinson's disease (PD) from the symptom of motor oriented and non-motor oriented anomalies is a very crucial task. One of the reasons behind this disease is the deficiency of dopaminergic neurons in the brain that leads to various neurodegenerative disorders in the human being mostly in an aged person. Vocal impairments to tremors, difficulty in walking are the prominent symptoms found in Parkinson's disease. Medical scientists and practitioners introduced many biomarkers for ease of diagnosis of PD. This article provides a detailed analysis of various biomarkers such as acoustic, handwriting, Electroencephalography (EEG), and gait signals along with the associated machine learning approaches of PD subjects. This paper also enlightens the symptoms of PD in its various stages and delivers the information about the popular rating scales mostly referred by the medical practitioners during the diagnosis process.
7.	Early Detection of Parkinson's Disease Through Speech Features and Machine Learning: A Review	Ajay Sankar Gullapalli & Vinay Kumar Mittal	Springer Conference Paper	Parkinson's Disease (PD) is a kind of neurodegenerative disorder. The disease causes communication impairment based on its progression. In general, identification of PD carried out based on medical images of brain. But it was recently identified that voice is acting as biomarkers for several neurological disorders. A review of speech features and machine learning algorithms is presented. This might be helpful for development of a non-invasive signal processing techniques for early detection of PD. Several models developed for disease detection is discussed, which are developed based on features like acoustic, phonation, articulation, dysphonia, etc. Machine learning algorithms like Logistic Regression (LG), Support Vector Machine (SVM), Boosting Regression Tree, bagging Regression, etc., and their performance accuracies in classification of Patient with PD (PWP) and Healthy Controls (HC) are reviewed. All these classification algorithms are trained and tested on several repository corpuses and customized datasets. The Spontaneous Speech (SS) is an efficient tool for the early detection of diseases like Parkinson's, Alzheimer's, Autism and several other dementia types in elderly people.

8.	An Analysis of Vocal Features for Parkinson's Disease Classification Using Evolutionary Algorithms	Son V. T. Dao,Zhiqiu Yu,Ly V. Tran ,Phuc N. K. Phan,Tri T. M. Huynh andTuan M. Le	MDPI Applied Sciences	Parkinson's Disease (PD) is a brain disorder that causes uncontrollable movements. According to estimation, roughly ten million individuals worldwide have had or are developing PD. This disorder can have severe consequences that affect the patient's daily life. Therefore, several previous works have worked on PD detection. Automatic Parkinson's Disease detection in voice recordings can be an innovation compared to other costly methods of ruling out examinations since the nature of this disease is unpredictable and non-curable. Analyzing the collected vocal records will detect essential patterns, and timely recommendations on appropriate treatments will be extremely helpful. This research proposed a machine learning-based approach for classifying healthy people from people with the disease utilizing Grey Wolf Optimization (GWO) for feature selection, along with Light Gradient Boosted Machine (LGBM) to optimize the model performance. The proposed method shows highly competitive results and has the ability to be developed further and implemented in a real-world setting.
9.	Machine Learning Techniques for Voice-based Early Detection of Parkinson's Disease	Audil Hussain; Amit Sharma	IEEE Xplore	Neurodegenerative, progressive diseases having multiple motor and non-motor characteristics are mainly associated with Parkinson's disease (PD). A person suffering from PD usually faces problems with his/her speech or vocal impairment in the early stage of this disease. Presently, one of the significant research fields is biomedical signal processing. Henceforth, considering vocal impairment as early signs for PD patients, diagnosis systems using vocal analysis is the need of the hour. Early detection of Parkinson's disease may aid in better diagnosis and treatment of the disease, as well as better equipping caregivers to care for the patient. Further, this may also help the hospital management centers better use their resources. This paper aims to discuss and analyze the various machine learning methods for predicting the early onset of PD. The UCI Machine Learning repository has the dataset we used in our research. Various machine learning methods are applied to this dataset, and the performance of each method is further explored. For the proposed model, we observe that stacking different learning models together works best for the given task with an accuracy of 93%.

10.	An Intelligent Computing Based Approach for Parkinson Disease Detection	Ashis Ranjan; Aleena Swetapadma	IEEE Xplore	In this work various machine learning techniques such as support vector machine (SVM), nearest neighbor (k-NN), artificial neural network (ANN) has been used for detection of Parkinson disease. Input features are collected from the handwriting of various normal and Parkinson persons. The inputs and their corresponding targets are given to machine learning based methods. A comparative study of SVM, k-NN and ANN has been carried out. Accuracy of the proposed method is found to be 100% for all the tested data. Hence machine learning based methods can be put to use in real time scenario.