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A Literature Review of a Method of Classifying Normal and Parkinson's Disease Using Machine Learning

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Abstract—*This study's goal is to investigate the variables that, when combined with normal walking and voice recordings, could be utilised to spot atypical gait patterns in Parkinson's disease patients. The cause of this disease, a neurological condition, remains uncertain. Hypokinetic dysarthria,that affects all surfaces of speech signal production, breathing, phonation, nasality, and prosody, are some of symptom of this disease. We created a vocal problem assessment for identifying unhealthy persons's Whose dopamine level is lesser then actual using data from a required collection of data. In order to get the required data from the speech sample ,we flatten the signal through figuring out it's mean value.To differentiate, we employed Support Vector Machines with several kinds of kernels and the Leave-One-Subject-Out validation strategy.*

Keywords— *Neural Network , Classification ,Parkinson Disease, SVM ,Voice And Image Dataset and Gait pattern.*

I. INTRODUCTION

Parkinson's disease (PD) is the most frequent kind of the primary neuro degenerative illness. Parkinsonism is one of most prevalent dynamic disorder .A neurodegenerative disease. It influence roughly 1% of the population and around 2.5% of the people over the age of 50, The lifetime risk of this disease in the society above the age of 70. Men develop at a rate of 2.0%, whereas women develop at a rate of 1.3%. The most frequent type of Parkinson's disease is idiopathic, often known as sporadic PD. This is a kind of Parkinson's disease that typically affects older people. PD, in general, is linked to motion symptoms such as resting tremor. Dopamine-induced akinesia and stiffness deficit in the basal ganglia as a result of neuro degeneration dopaminergic neurons in the pars compacta of the substantia nigra(SN) region.

Aside from motor symptoms, nonmotor symptoms and neuro psychiatric or neuro behavioral complications issues, autonomic abnormalities, and sensory issues is considered a key component of this disease. Neurobehavioral issues that are anxiety, depression, sleep behaviour disorder with increase in eye movement, and all of these symptoms are frequent in this disease and acquires because of neuro degenerative processes in several neurotransmitter systems in various regions of brain. Delirium, psychosis, and other complications such as spectrum disorders of compulsive/impulsive behaviour, such as impulse control disorder, control disorders Dopamine dysregulation syndrome and Punding are also rather frequent. A set of mental illnesses of 4-10 impulse control disorders connected with the desire or inclination to act impulsively be engaged in excessively joyful activities the person's (and his or her family's) health. The four main ICD behaviours are pathogenic in PD patients. excessive shopping, compulsive gambling, and obsessive sexual behaviour binge eating disorder, and hypersexuality. Important and information compared between ICDs and DDS in PD is listed in the Table. Due of ageing and population expansion in the US 65 and older adults will make up of the population continue during the ensuing years, practitioners must behaving knowledge of PD's difficulties beyond only identifying and treating motor symptoms.

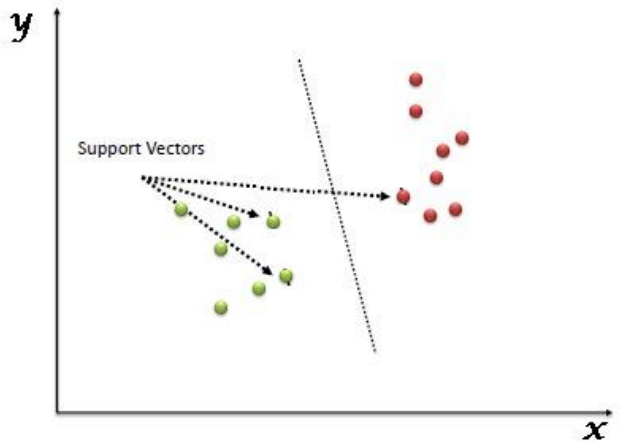

Fig 1 [1]

A supervised machine learning approach called "Support Vector Machine" (SVM) can be used to classify or can be used to solve regression problems.This approach is majorly used for

classification.In this classifier a hyperplane is selected which differentiate the data points more accurately by using some data points as support vectors.Each data point is dimensional representation of the input data of a certain co-ordinates.

II. LITERATURE SURVEY

S. Aich et.al.in [1] Over the past few years, numerous scientists have been trying to make progress for early detection of this disease. The exorbitant cost of treating chronic diseases in developed nations has made it a major source of concern.This disease is a form of brain state that directly affects neurons, leading to impairments in speech, movement, and other cognitive functions. In order to identify the diagnosis for Parkinson's disease, researchers are still focusing on a number of different areas, including speech and gait analyses. Many Parkinson's disease cases have been treated with a machine learning-based strategy that takes into account both voice and gait analysis. The random forest method is one of the machine learning techniques here, and it compares the voice data gathered.

A. Benba et. al. in [2] The cause of this disease, a neurological condition, remains uncertain. Hypokinetic dysarthria, ,that affects all surfaces of speech signal production, including breathing, phonation, is experienced by Parkinson's disease patients. In order to assess these illnesses, therapist have employed emotive techniques contingent on audio signals that differentiate between these various states of disease. The estimation of speech abnormalities to recognizing unhealthy persons with this disorder was developed by the authors using different set of data of 34 participants, among them 17 were unhealthy, who had Parkinson's disease (PD). In order to obtain different patterns of voice from each instance of speech signala , they flatten the signals through figuring out its mean value. SVM was utilised to categorise the patients.

A. Bhan et. al. in [3] There are several ways to identify this disease in the birth stages. The MRI, CNN, and other deep learning methods have been employed by authors. The use of magnetic resonance imaging (MRI), a cheap, non-invasive equipment that produces sharp images, makes it an effective and efficient technique. Here, early Parkinson's disease diagnosis was achieved using various CNN models. Magnetic resonance (MR) image augmentation was done to the dataset.Then, in order to more precisely to differentiate between healthy and unhealthy persons, we performed binary classification using the deep learning techniques that use input from the next layers to increase their efficiency .

H. H. Manap et. al. in [4] The gait pattern was employed by the authors to categorise Parkinson's disease. As a result, the fundamental, kinematic, and kinetic gait parameters are all analysed. According to preliminary research, the average stalk period is longer for the patients who are affected by this disease than for normal participants, the most common cadence,the distance swing of each step, and each step speed are all of low values when compare to the healhty persons. Additionally, compared to the control group, Parkinson's disease patients have lower mean hip, knee, and ankle joint angles. Additionally, for the kinetic parameter, walking speed is the main factor that causes common worth of force which comes in opposite direction, this specification are higher for healthy person. The results of the statistical study show that the classification of PD depends on several factors, including distance swing of each step, walking speed, elevation of knee with respect to ground, and the vertical ground response force parameter.

Z. A. Moharkan et. al. in [5] Millions of people throughout the world suffer with Parkinson's disease, a neurological condition. Because of lack of established detection methods, most cases go unreported. The objective of this work is to create a machine learning and data mining-based system for diagnosing this condition. An easy-to-use interface is provided by this system for uploading data, modelling it, and producing reports using the models. The method can also be used to determine if a human has this disease. To determine whether a individual has this disease or not, the authors employed the SVM classifier with voice samples as the data.

A. Naik et al. in [6] In this article, A. Naik et al have looked into the different possible solutions to identify the primary disorders of PD that affect the locomotion, such as slowed locomotive moments, slow down shakiness and problem while talking. The literature on the self -acting recognization of each of the preceding symptoms was thoroughly reviewed by the authors. Each symptom is detailed in its own section, which also considers the pros and cons of each data mining and classification methodology for that particular ailment. The most advantageous, practical, and straightforward procedure that might be quickly implemented in a typical medical examination is then determined by evaluating these tactics. These techniques' accuracies, precisions, and other crucial parameters have been compared. The authors have classified Parkinson disease from normal using a Bayesian Network Classifier.

I. Nissar et al.in [7] Studies shows that complete 90% of people with this disease have trouble with speaking. As the severeness of the ailment grows, the voice of patient gets progressively worse. The use of speech analysis in the development of predictive telemonitoring and telediagnosis models has significantly increased. Accurate speech signal interpretation is very much challenging classification difficulties in these disease diagnosis. Effective PD categorization was discovered using techniques like deep learning and machine learning. There are some of the techniques like Support vector machines, deep neural networks, random forests and etc are just a few of the effective categorization models utilised today.

B. E. Sakar et al. in [8] Parkinsonism speech pattern analysis applications for creating prognostic teledisease and keep an eye on models through tele are gaining popularity. The indicated, authors obtained a different kinds of voice and speech samples, including endured vowels, letters of words, and phrases that come from a group of talking drills for patients having this

disorder. When learning from a dataset with numerous speech recordings for each individual, there are two main difficulties: 1) How accurate is the recognition of this disease depending on various speech samples, such as sustained vowels as opposed to words? 2) How better did the measures for central inclination along with scaterring describe each sample recording for a subject? The authors used a machine learning technique like SVM for this aim in order to predict the outcomes.

M. Shahbakhti et.al.in [9] Paralysis agitans is a neuro degenerative brain state that develops when 60-80 percent of the brain's dopamine-producing cells are lost. This disease is very most familiar neuro logical condition following Alzheimer brain damage. EEG, gait, and speech are just a few of the labels that shall be implemented to identify this disease. Since speech problems affect over 90% of people with these disorder, it might be thought of as the most straightforward way to accomplish this. This study suggests a unique method for diagnosing Parkinson's disease from speech signals, in which an SVM network performs classification while PCA combines obtained features from the data. For three optimised characteristics, the classification accuracy percentage is 91.5.

S. Shetty and Y. S. Rao et. al. in [10] Movement is hampered by paralysis agitans a neuro logical condition. Tremors, rigidity in muscles, and erroneous walking patterns are the hallmarks of this illness. This work focused on specific gait traits that would help distinguish this disorder from other neuro logical symptoms and well authorised, in contrast to previous attempts to distinguish this disease from normal subjects. The best classified vectors are removed from each classifying vector by individual analysis, and they are then classified using a SVM classifier including a kernel of Gaussian function of radial basis.

L. Vavrek, et al. in [11] This research paper tells the details of the usage of deep neural network techiniques (DNN) for dectecting the improper speech.Numerous approaches were evaluated in this study, which was on the basis of the cutting edge VGG16 convolutional-neural-network(CNN)-based transfer learning. We evaluated the various designs using the Voice database of Saarbrucken (SVD). In order to overcome language and educational constraints the vowel subsets /a/, /i/, and /u/ with natural sustained pitch was limited in SVD. The machine or model which was implemented achieved an 82% of accuracy in identifying aberrant speech. Therefore the results suggest that previously-trained CNN networks is being used for the transfering learning when the input is a spectrogramic representation of a voice stream.

M. Wodzinski et al. in [12] The method for identifying Parkinson's disease described in this article uses verbal including prolonged vocalism and a Res Net architecture that was initially created for picture classification. Using the Image Net and SVD dataset, the range of the voice recordings was calculated and used for image input to the previously-trained Res Net architecture. To prevent overfitting, dataset's temporal domain was greatly improved. There are 100 people in the Parkinson dataset,50 of whom are healthy and 50 of whom have the condition. Data from every patient was gathered three times. More than 90% accuracy was achieved on the verification set, which is compared to present latest methods.

A. M. S. Muniz et al.in [13] This study's objective is to employ a probabilistic neural network to differentiate amid persons without paralysis agitans and those who have it by feeding it principal components (PCs) obtained from the ground response force's vertical component (vGRF). The effects of subthalamic nucleus brain stimulation both including and not including medication, on this disease were then evaluated from the trained PNN. Six PC scores are chosen for this study's probabilistic neural PC analysis of the vGRF utilising the broken stick test. Using a bootstrap methodology and the portion under the curve ROC as a showcasing indicator, 1^{st},2^{nd} ,3^{rd} and 5^{th} PCs were choosed as primary variables for the PNN model.

L. Moro-Velazquez et al. in [14] This work proposes and tests a novel method for speaker identification using allophonic distillation on four allophones while examining parkinsonian speech databases. Depending on the database, this novel methodology offers values between 72% and With increases of up to 9% above standard approaches, automated PD detection now has a 94% accuracy rate.

D. Bazazeh et al. in [15] Section II illustrated the various motor and non-motor symptom kinds while underlining the primary cardinal symptom of PD. C. Schenck, S. highlighted the key components of the ideal biomarker in Section III [18], and parkinsonian disease explains its properties. The most recent biomarkers in genetics, neuroimaging, clinical, and [19] R. Kaddurah, J. biochemistry were showed in part IV. In Section IV, a summary of the biomarker discovery procedure is presented, demonstrating pre-data processing and feature selection methods. In Section V, performance evaluation methodologies and ML approaches were finally covered.The identification and finding of biomarkers is a crucial step in the early diagnosis and treatment of neurological conditions.

F. Amaru et al.in [16] Locomotion disorders like PD or essential tremor can be surgically treated with deep brain stimulation (DBS). Although this is one of great therapy, the exact mechanism of action is still unclear. The ability to access deep brain areas using DBS implanted electrodes may provide for the possibility of monitoring the common tasks that a nuclei performs that were previously only accessible during incision procedures. In this paper, a first device is of wearable prototype for this recordings is suggested. Local field potentials (LFP), which are extremely low voltage signals, have been shown to be suitable for conditioning with the proposed device's portable and modular design.

M. Novotny et al.in [17] The assessment of dysphonia is the main focus of the most popular techniques for automated

evaluation of speaking performance. The major focus of the paper was to create a trustworthy automatic solution for precisely estimating articulatory impairments in PD. They carried out diadochokinetic exercises based on iterative sounds /pa/-/ta/-/ka/. Vowel quality, laryngeal and tongue movement, consonant articulation accuracy, blocking, enfeeble, along with timing of speech were among the six main articulatory elements of speech that were examined. To difference between patients who has PD and the persons who don't , categorization of SVM experiment based on articulatory features was suggested. The classification result achieved an 88% success rate in differentiating PD from controls utilising the six criteria that represent various articulation-related elements.

M. A. Little et al.in [18] The most extensively utilised techniques for the Speech performance may presently be evaluated automatically and are centred on the assessment of dysphonia. Articulatory impairments are an essential feature of diplopia in disease called as Parkinson's. The classification result achieved an 88% success rate in differentiating PD from controls utilising the six criteria that represent various articulation-related elements. The major focus of this work was to build an accurate automatic method for estimating articulatory impairments in PD. The proposed approach, according to the results, provides good circumstances for accurate automatic assessment, including the study of a variety of articulatory impairments related to hypokinetic dysarthria.Other Neural network approaches

A. Tsanas et al. in [19] study of the correlation between speech impediment and Parkinson's disease (PD). Dysphonia measurements and voice signal processing algorithms with the goal of predicting the seriousness of these symptoms using signals of speech that have been developed. he use sustained vowels to calculate 132 different dysphonia measures in total. They next used random forests and SVM which classify statistically , it is necessary to convert these subsets of features into a classification that gives two outputs. They first choose four sparse subsets of these dysphonia measures using an algorithm that selects one in these features. Using an 263 samples of data which was collected from 43 people that was already present , they showed how these innovative measures of dysphonia may out perform state of the art findings, attaining a very good classification accuracy with just 10 dysphonia traits.

Y. Lavner et al. in [20] Abstract A method for automatically analysing and processing GC-MS data that is relay on the VOCs found in samples of blood. The solution finds all peaks (local and global). It calculates the regions of the peaks in these signals together with their accompanying amplitudes and time of retention. The feasibility of determining whether a these signals originated from an healthy or unhealthy rat by examining the regions of the peaks was tested using a supervised learning system on a selection of characteristics.

A. Benba et al. in [21] A 34 set of data of sustained vowels from 34 participants was used, including 17 patients with (PD), to establish the of voice assessment problems to identifying patients who have this disorder. By figuring out their average value, they compressed the frames. For classification, they combined the SVM classifier with their many kernel types with the Leave-One-Subject-Out validation approach.

A. Salarian et al.in [22] By estimating the kinematics properties of the motion of trunk between siting and standing posture that were transited meach time,these transitions were identified and discriminated from other movements of body. This data was fed into a fuzzy classifier, which utilised it to identify times of standing and sitting. Both in unhealthy and healthy persons, the suggested technique demonstrated a high level of accuracy and with less error for the identification of basic position of body assignments, including periods of sitting, standing, and walking.

H. Su et al. in [23] This research describes object recognition and immediate partition in VHR remote sensing pictures using an accurate mask area CNN that uses layered filters to get the desired output. For each case of an item in the picture, using this method, segmentation masks and bounding boxes are constructed. Opposite to regions of interest (RoI) line up, whose trail sites are already defined and not bin size adaptable, the recommended precise RoI pooling may calculate the two order integral relay on the feature map that are continuously calculate to prevent accuracy loss.

A. Salarian et al.in [24] Both a proposed and approved algorithm for measuring bradykinesia and another algorithm for detecting and quantifying tremor have been developed. There have been two clinical investigations conducted. In the first research, a 45 minute solution comprising 17 common usual activities was completed by 10 patients with and 10 without PD persons. UPDRS tremor subscore and the estimated tremor amplitude had a strong connection . The evaluated brady kinesia related parameters measured for the entire measurement period and the corresponding UPDRS subscore had a strong and significant connection.

Banita et al. in [25] Study work focuses just on Parkinson Disease symptoms that have been verified; it does not fully address any other diseases. The Unified Parkinson's Disease Rating Scale (UPDRS) and associated symptoms are also a focus of the study. It comprises an evaluation of PD using computer technology and medical science.In the study, medication for PD has also been covered, along with a thorough literature review that clarifies the purpose of treating PD. In comparison to UPDRS, the study's proposed rating scale is more time-effective.

S. M. Rissanen et al.in [26] A novel method for distinguishing between unhealthy persons having Parkinson's disease and healthy individuals is provided using surface electromyography and measurements of acceleration . Irregular techniques and wavelets with the help of this we evaluate changes in EMG and readings of acceleration. The findings demonstrate that this

readings and measurements may provide useful information to evaluate neuro muscular dysfunction in this disease, and that can also aid in the objective clinical evaluation of condition.

B. R. Brewer et al.in [27] They have developed a protocol modern Sensing for examination of Parkinson's disease using readily available commercial sensors to get a computable and accurate measurement of early movement in a average disease of parkisons . These findings show that the ASAP technique can measure differences in people with diverse clinical characteristics. This suggests that this technique that track changes in a PD patient's motor symptoms over time.

III. CONCLUSION

In this survey, how we survived and how SVM can be pivotal in classifying the Parkinson's disease. Using this technology we can create classification system between Parkinson's disease patient and normal patients.
We surveyed the relevent paper of research on clssifying Parkinson's disease based on SVM And how SVM is being utilized in classification of PD. research into classifing how sum is being being PD. We mapped all the relavent research into a literation review.

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