



A SURVEY ON EARLY DETECTION OF PARKINSON DISEASE USING DEEP LEARNING TECHNIQUE

¹Sakshi Jadhav, ²Seema Thorat, ³Sakshi Fokane, ⁴Rahul Chakre

^{1,2,3}Student, ⁴Assistant Professor

^{1,2,3,4}Computer Engineering,

^{1,2,3,4}Gokhale Education Society's R. H. Sapat College of Engineering, Management Studies and Research, Nashik

^{1,2,3,4}Savitribai Phule Pune University, Pune, MH, India

Abstract: Parkinson's disease (PD) is a chronic, disorder which results in a variety of motor and cognitive issues. PD diagnosis may be a challenging task since its symptoms are very almost like other diseases like normal ageing and tremor. Much research has been applied to diagnosing this disease. Parkinson's disease (PD) is a neurological movement disorder characterized by a modest tremor in one hand and a feeling of stiffness throughout the body that slowly worsens over time. It has an impact on over 6 million people all over the world. Vocal fold abnormalities affect the majority of Parkinson's disease (PD) sufferers. Speech impairment is a warning sign of Parkinson's disease. This research focuses on the development of Deep Learning-based Early Stage Parkinson's Disease Prediction. Various deep learning approaches are used to model the extracted features. In this paper, an Artificial Neural Network (ANN)-based classification algorithm is employed to discriminate PD patient samples from healthy ones. Besides that, since different datasets may capture different aspects of this disease, this project aims to explore which PD test is easier within the discrimination process by analyzing different imaging and movement datasets contains Patno, Cohort, Subgroup, Enrlpd Enrlprod, Enrlrrk2, Enrlgba, Enrlsnca, Conpd, Conprod, Conlrrk2, Congba, Consnca, Comments, Condate. As a result, the aforementioned approaches may be able to provide a primary good solution for detecting PD during the preliminary stages of the disease's prognosis and may be able to increase the life span of the afflicted patient with suitable treatments and drugs, resulting in a peaceful existence.

Index Terms - Deep Learning, Artificial Neural Network (ANN), Disease Prediction, Parkinson's disease, Parkinson's dataset.

I. INTRODUCTION

Parkinson's disease is a neurodegenerative illness that arises when dopamine, a neurotransmitter, is lost. The aged are more likely to develop Parkinson's disease, which causes changes in step and stance, enhancing the chance of collapse and causing mobility impairments, is more common among the elderly. As a consequence, it has an impact on patients' and their families' everyday activities, as well as their quality of life. Parkinson's disease mostly affects the motor system. The lack of movement freely, delayed movement, enhanced muscular tonus, and trembling motion in the resting position are all symptoms of this movement disorder. Other characteristics include a loss of countenance, problems with coordination, and major alterations in speech and voice. People with Parkinson's disease may lose their sense of smell and experience sleep disruptions during the rapid eye movement sleep period. It is estimated that 1% of the population over the age of 60 suffers with paralysis against. . Parkinson's disease symptoms vary from person to person. Early warning indicators are subtle and go overlooked. Symptoms normally start on one side of your body and progress to the opposite side before affecting both edges. Symptoms of Parkinson's disease can include, trembling, slowed movement, and stiff muscles Stability and stance have been harmed as a result of the injury. Automatic motion is taken away from you. In both speech and writing, there has been a change.

The loss of neurons that create dopamine, a chemical messenger in the brain, causes agitation. Parkinson's disease is caused by a decrease in the level of the amino alkanolic acid dopamine, which leads in aberrant brain activity. The cause of paralysis agitans is unknown, however various factors appear to have a role, including genes, environmental factors, and triggers. As a result, people suffer for years before being diagnosed with this disease. According to the estimates, there are seven to ten million persons worldwide who suffer with Parkinson's disease. Although persons over the age of fifty have a higher risk of developing Parkinson's disease, an estimated 4% of people under the age of fifty are diagnosed with the disease. There is no prevention for Parkinson's disease. The disease, on the other hand, is frequently controlled in its early stages. In the vast majority of instances,

the cause of Parkinson's disease is unknown. Pathological alterations in dopaminergic neurons, as well as neurochemical dysfunction, have been revealed to be the most significant features of this condition. The bulk of dopamine-producing neurons in the brainstem comprise the substantia nigra, a black material. This anatomical region is involved in the development of regular physical movement and is related to other inner brain structures. Lack of dopamine production in the dopaminergic neurons of the substantia nigra limits mobility and impacts voluntary movements. There is currently no cure for paralysis agitans.

Deep learning algorithms are being utilized to help in early disease identification and diagnosis. Deep learning methods in medicine might be a study topic that combines advanced representational and computing approaches with professional physician insights to provide tools for bettering healthcare. Deep learning is a quantitative method for discovering hidden patterns in datasets by building predictive or identification systems that learned from previous experiences and adapted in future cases. As a result, there is a need for a more precise, objective means of early identification, preferably one that can be used by individuals in their own homes.

Table 1 Dataset Description

Dataset Attribute/Factors	Type
Patno	Binary
Cohort	Binary
Subgroup	Binary
Enrlpd	Binary
Enrlprod	Binary
Enrlrrk2	Binary
Enrlgba	Binary
Enrlsna	Binary
Conpd	Binary
Conprod	Binary
Conlrrk2	Binary
Congba	Binary
Consna	Binary
Comments	Binary
Condate	Binary

II. LITERATURE SURVEY

This section of the describes the theoretical background of this project, starting with an explanation of Parkinson's disease, followed by overviews of machine learning, deep learning, related work and finally PD diagnosis problems. The detection of PD is extremely important at the first stage. The detection can be performed using data mining technique.

Jie Mei *et al.* [1] used all basic algorithms of deep learning techniques for the detection of PD. Like SVM, RF, Decision Tree, ANN, KNN, Radial Basis Function Networks (RBF) and Deep Belief Networks (DBN) etc. The early identification of Parkinson's disease is critical. The identification can be performed with the use of a data mining technique. The techniques for detecting PD, such as Naive Bayes, support vector machine, multilayer perceptron neural network, and decision tree, are theoretically explained in this study. This study uses speech input from acoustic devices to predict Parkinson's disease. People from various areas and speech factors are investigated in this article in order to predict Parkinson's disease among patients. The speech dataset was used to recognize Parkinson's illness using Multi - layer Perceptron and Logistic Regression (LR) frameworks.

Gabriel Solana-Lavalle *et al.* [2] uses the algorithms such as Multilayer Perceptron (MLP), Random Forest (RF), K-Nearest Neighbor (KNN). For the prediction of Parkinson disease, three set of experiences were conducted to obtain the features with highest contribution to PD. This three sets are 1.a population with male and female subjects (balanced), 2.male subjects (balanced and unbalanced), and 3. Female subjects (balanced and unbalanced). In this study, the researchers used acoustic devices to collect speech parameters from 50 persons with Parkinson's disease and fifty healthy people. They employed the k-fold cross validation method for testing and claim that it can deliver 85 percent accuracy.

Yi Xia *et al.* [3] they have considered approaches, they include four DL-based models (DCNN, DALSTM, DCLSTM, and CNN-LSTM) and also used two traditional classifications for extraction. In the DL-based model DCNN gives less accuracy than other DL models. Parkinson's disease affects people all around the world. People and people with Parkinson's disease could be classified using machine learning approach. This paper provides a comprehensive overview of machine learning-based approaches for Parkinson disease prediction. A comprehensive overview of various computational system-based techniques for

Parkinson disease prediction is presented. This report also includes an overview of the results obtained by several scientists from publicly available data in order to forecast Parkinson's disease.

Kazi Amit Hasan *et al.* [4] used different classification methods RF, KNN, Decision Tree, Logistic Regression (LR), SVM, and Naïve Bayes for detection of PD. The best result achieved by Decision Tree and Random Forest (RF) classification methods. The data mining techniques may be a more popular in many field of medical, business, railway, education etc. They are most commonly used for medical diagnosis and disease prediction at the early stage. The data mining is employed for healthcare sector in industrial societies.

Mosarrat Rumman *et al.* [5] based on Image Processing and Artificial Neural Network (ANN) classification algorithm According to ANN prediction, if value closer to 1 then suggests PD and value closer to 0 then suggest normal. Parkinson disease is a global public health issue. Machine learning technique would be a best solution to classify individuals and individuals with Parkinson's sickness (PD). This paper gives an entire review for the forecast of Parkinson disease by utilizing the machine learning based methodologies. A concise presentation of varied computational system based methodologies utilized for the forecast of Parkinson disease are introduced. This paper likewise displays the outline of results acquired by different scientists from accessible information to predict the Parkinson disease.

Shail Raval *et al.* [6] For the detection of PD they include all the aspects such as biological data, chemical data and genetic data. In this paper they mainly focused on the symptoms like rigidity, Tremor at rest, changing voice etc. The secure data transmission is proposed through authentication check, duplication check and faulty node detection. The proposed method is applicable to long ranges of transmission. It is also supporting a retransmission concept.

Zehra Karapinar Senturk *et al.* [7] proposed the algorithms to detect PD like support vector machine (SVM), Classification and Regression Tree (CART). It provided about 13% performance improvement for SVM, about 11% for ANN, and about 5% improvement for CART. The result shows that Naive Bayes and decision tree (j48) yield better accuracy when performed upon the discretized PD dataset with cross-validation test mode without applying any attributes selection algorithm.

Satyabrata Aich *et al.* [8] According to this Random Forest (RF) gives more accuracy. This analysis will help the clinicians to differentiate the PD group from healthy group based on the voice data. CNN's, also referred to as ConvNets, contains multiple layers and are mainly used for image processing and object detection. Yann LeCun developed the primary CNN in 1988 when it had been called LeNet. It was used for recognizing characters like ZIP codes and digits.

Timothy J. Wroge *et al.* [9] used Extra Tree and gradient boosted Decision tree classification algorithms are used to detect variations in voice. LSTMs are a kind of Recurrent Neural Network (RNN) which will learn and memorize long-term dependencies. Recalling past information for long periods is that the default behavior.

Rajalakshmi Shenbaga Moorthy *et al.* [10] used to novel analytic system for Parkinson's disease Prediction mechanism using Improved Radial Basis Function Neural Network (IRBFNN). RNNs is during a <"one amongst one in every of"> one among the deep learning models that are used for modeling the arbitrary length sequences by applying a transition function to all or any it's hidden states during a recursive manner.

Rahul R. Chakre *et al.* [11] According to the hybrid approach, which is a combination of supervised and unsupervised techniques, is also beneficial for classification and feature extraction. Support vector machine is employed as the supervised technique for classification, and ICA is used as unsupervised technique for the feature extraction in multiclass data set.

Rahul Ramesh Chakre *et al.* [12] According to the field of medical diagnosis, bio-inspired computing is also a novel technique. Swarm intelligence and immune computing algorithms, two major subsets of bio-inspired computation, are presented for a wide range of issues. For the feature selection process, swarm intelligence approaches are described, and immune computing techniques are proposed for the classification.

III. CONCLUSION FROM LITERATURE SURVEY

Prediction of Parkinson disorder is one of the most important problem that has to be detected in the early phases of the commencement of the disease so as to reduce the disease progression rate among the individuals. Various researches have been made to find the basic cause and some have reached to the heights by proposing a system which differentiates the healthy people from those with any ND'S (Neurodegenerative disorders) using various machine learning techniques. Lots of pre-processing feature selection and classification techniques have been implemented and developed in the past decades.

IV. PROPOSED METHODOLOGY

4.1 Input: The first step is Data gathering. This step is extremely important because the standard and quantity of the info you gather will directly affects the extent of your prediction model. So we've taken data of various voice recordings of the patient.

4.2 Data pre-processing: In this step the info is visualized well to identify the connection between the parameters present within the data so on take the advantage of also as to get the data imbalances. With this, we need to separate the info into two parts. The first part for training the model like in our model we've used 70 percent of knowledge for training and 30 percentage for testing.

- 4.3 Feature Selection:** The next step in our workflow is Feature selection. There are various models that have been used till date by researchers and scientist. Some are meant for image processing, some for sequences like text, numbers or patterns. In our case we have defined the PD patient's samples from various patients so we have chosen such models which will classify or differentiate the unhealthy patient with the healthy one.
- 4.4 Training:** Training the dataset is one of the main tasks of machine learning. We will apply the data to progressively improve the selected model's ability to predict better i.e. the actual result should be approx. to predict one.
- 4.5 ANN Model:** ANN BACK PROPAGATION: Artificial Neural Networks are a special sort of machine learning algorithms that are modeled after the human brain. That is, a bit like how the neurons in our system nervous are ready to learn from the past data, similarly, the ANN is in a position to find out from the info and provide responses within the sort of predictions or classifications. ANNs are nonlinear statistical models which display a push relationship between the inputs and outputs to get a replacement pattern. A variety of tasks like image recognition, speech recognition, MT also as diagnosis makes use of those artificial neural networks.
- 4.6 Feature Extraction:** The metrics we've calculated are ROC, Accuracy, Specificity, Precision *etc.* which will highlight the simplest algorithm among all.
- 4.7 Prediction:** In this phase we finally get the model ready to detect the prediction of Parkinson's disease based on the given dataset.

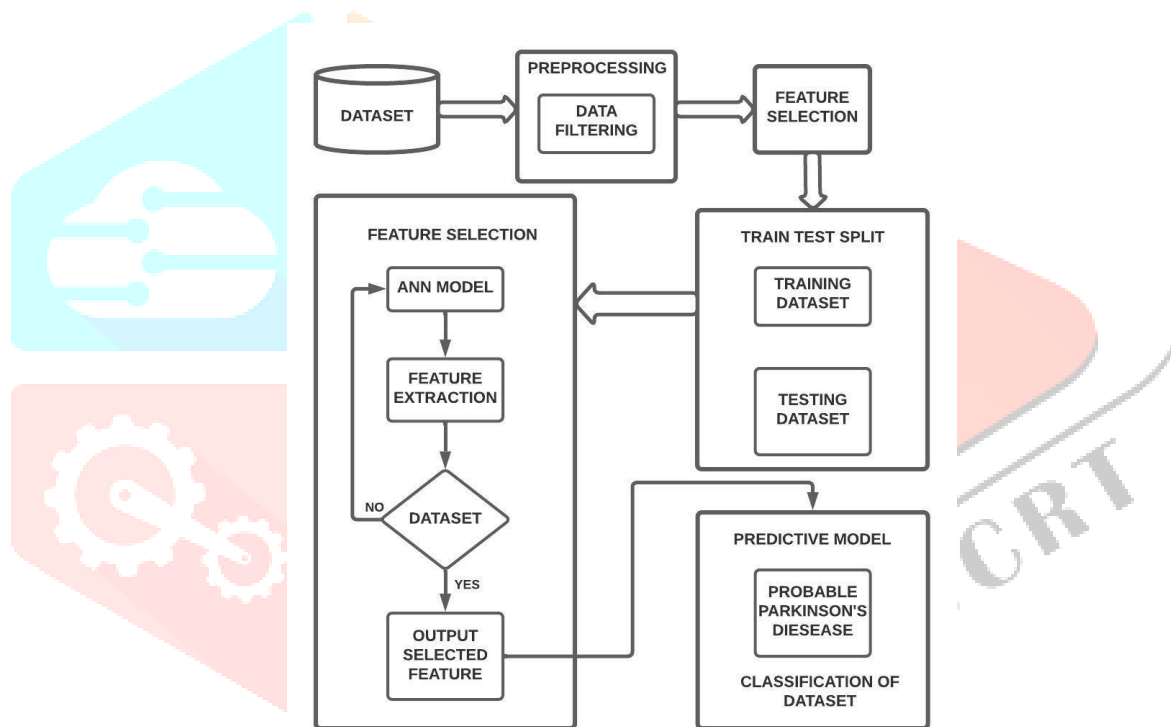


Fig 1. Block Diagram of Proposed Methodology

V. CONCLUSION

In this Paper, the concepts of Deep Learning are discussed, while the application in Parkinson prediction is focused. The literature survey has been conducted on the Parkinson's disease. To avoid the drawbacks of the conventional methods, new age deep learning techniques are proposed in this review paper. The included studies showed that Deep Learning techniques have significant impact on early detection of Parkinson with high accuracy rate. However, most of the proposed methods are still in development and not tested in a clinical setting. In this paper, the work is mainly focusing on advancement of predictive models to achieve good accuracy in predicting valid disease outcomes using deep learning methods like prediction based on Artificial Neural Network (ANN). In this paper, Deep Learning techniques are proposed for the prediction of Parkinson Disease in early stage.

VI. FUTURE WORK

In this study deep learning techniques are discussed. In future, the implementation of the proposed work is plan for the early detection of the Parkinson's disease using the deep learning techniques. In the future, different types of attributes are also plan to use for the classification of patients and also try to identify the different stages of Parkinson's disease.

REFERENCES

- [1] Jie Mei, Christian Desrosiers and Johannes Frasnelli, “Machine Learning for the Diagnosis of Parkinson’s Disease” Front Aging Neuroscience, 2021.
- [2] Gabriel Solana-Lavalle, “Analysis of voice as an assisting tool for detection of Parkinson’s disease and its subsequent clinical interpretation”, ELSEVIER, Biomedical Signal Processing and Control, 2021.
- [3] Yi Xia, “A dual- modal attention-enhanced deep learning network for quantification of Parkinson's disease characteristics”, IEEE Transactions on Neural Systems and Rehabilitation Engineering, pp.1-12, 2019.
- [4] Kazi Amit Hasan, “Classification of Parkinson’s Disease by Analyzing Multiple Vocal Features Sets”, Department of Computer Science & Engineering Rajshahi University of Engineering & Technology Rajshahi, Bangladesh, 2021, pp.758-761.
- [5] Mosarrat Rumman, “Early detection of Parkinson’s disease using image processing and artificial neural network”, Department of Computer Science & Engineering, BRAC University, Bangladesh, 2018.
- [6] ShailRaval, “A Comparative Study of Early Detection of Parkinson’s Disease using Machine Learning Techniques”, Dept. of Information Technology Vishwakarma Government Engineering College Ahmedabad, India, pp. 509-516, 2020.
- [7] Zehra Karapinar Senturk, “Early Diagnosis of Parkinson’s Disease Using Machine Learning Algorithms” Duzce University, Faculty of Engineering, Computer Engineering Department, Duzce, Turkey, ELSEVIER, pp.1-20, 2020.
- [8] Satyabrata Aich, “A Nonlinear Decision Tree based Classification Approach to Predict the Parkinson’s disease using Different Feature Sets Voice Data.” International Conference on Advanced Communications Technology (ICACT). ISBN 979-11-88428-01-4. ICACT 2018 February 11-14, 2018.
- [9] Timothy J. Wroge, “Parkinson’s Disease Diagnosis Using Machine Learning and Voice”, Department of Bioengineering, University of Pittsburgh, Pittsburgh, Pennsylvania, USA 2018.
- [10] Rajalakshmi Shenbaga Moorthy, “Prediction of Parkinson’s Disease Using Improved Radial Basis Function Neural Network”, Madras Institute of Technology, Chennai 2021.
- [11] Rahul R. Chakre, Dr. Radhakrishna Naik, “Performance Analysis of Hybrid (supervised and unsupervised) method for multiclass data set” IOSR Journal of Computer Engineering , Volume 16, Issue 4, Ver. III (Jul – Aug. 2014), PP 93-99.
- [12] Rahul Ramesh Chakre, Dipak Patil “A Survey on Bio-inspired Computing on Medical Image Analysis” in THE JOURNAL OF ORIENTAL RESEARCH MADRAS, ISSN: 0022-3301, MARCH 2021.

