

A Survey on Prediction Of Parkinson's Disease Using Machine Learning

1st Kirti Wanjale
Computer Engineering Department
VIIT (SPPU University)
Pune, India
kirti.wanjale@viit.ac.in

2nd Madhavi Nagapurkar
Computer Engineering Department
VIIT (SPPU University)
Pune, India
madhavi.nagapurkar@viit.ac.in

3rd Parag Kaldate
Computer Engineering Department
VIIT (SPPU University)
Pune, India
parag.kaldate@viit.ac.in

4th Onkar Kumbhar
Computer Engineering Department
VIIT (SPPU University)
Pune, India
onkar.kumbhar@viit.ac.in

5th Subhranil Bala
Computer Engineering Department
VIIT (SPPU University)
Pune, India
subhranil.bala@viit.ac.in

Abstract—Machine Learning is one of the many applications of Artificial Intelligence that enables the system to learn automatically by itself, it also allows the system to improve from its experiences without being programmed to do so explicitly. Machine learning includes designing algorithms that will access the data and avail the results to improve its performance. This paper includes a survey of the Machine Learning techniques implemented to predict Parkinson's Disease.

Index Terms—Parkinson, Deep Learning, Unified Parkinson's Disease Rating Scale, Machine Learning

I. INTRODUCTION

Machine Learning is the study of algorithms and mathematical models, it performs tasks based on inferences and patterns. Machine Learning is used to make predictions using data. There wasn't any prevailing diagnosis procedure of Parkinson's Disease which leads the researchers to use ML as a tool to achieve the above task. Parkinson's disease is a progressive neurological disorder in which dopamine generating cells die in a part of our brain known as Substantia Nigra. Dopamine is a chemical generated in our body which acts as both neurotransmitter and a hormone. It has various functions like motor control and controlling the release of various other hormones. Due to the death of dopamine generating cells, the level of dopamine decreases in our body which causes various motor and non-motor symptoms. Motor symptoms like tremor, rigidity and postural instability, are observed and non-motor symptoms like dementia, depression and sleep disturbances are observed. Also, one of the major symptoms observed is the change in voice and speech. The person tends to talk slowly in a low volume and slurs or stutters and mumbles while talking. The cause of this disease is still unknown. Research shows that there is a role of genetics, environmental factors and aging in causing this disease. Studies have shown that a huge number of patients show the the symptom of a change in the vocal speech which can be observed five years before the actual diagnosis of the disease. So, using this symptom along with

other symptoms like tremor, machine learning algorithms are applied to detect PD and also to predict its severity.

II. RELATED WORK

A. Patric Schwab et al [1]

For distinguishing patients with and without PD, an approach consists of two stages. In the first stage, specialized training models are designed to predict the pinpointing from the signal data are given for all types of tests. Second stage comprises the use of EAM that aggregates specialized model outcomes and metadata to devise single diagnostic prediction. Sensor data includes walking, memory, voice and tapping test outcomes, the size of which is down-sampled to certain fixed lengths. In case of voice test, instead of passing raw voice signals, Mel-frequency ceptral is extracted from audio and passed. The accelerometer data of walking and tapping tests are standardized considering mean as 0 and variance as 1. RNN is used for memory tests whereas CNN is used during walking, tapping and voice tests as shown in Fig. 3.

B. Monica Giuliano et al [2]

Principle Component Analysis(PCA) is done to reduce 66 components to 33 components. K-means clustering and ANOVA is implemented on 9-factor PCA. Taking 5 voice parameters into consideration, an MLP model was generated, trained and tested, Fig. 2 represents the above data.

C. Siddharth Arora et al [3]

After fishing the data, feature extraction issued to extract more than enough features from the data. Some of the features include Mean. Standard deviation, Pitch, Vocal tract, etc. A random classifier is selected and bidden which provides good sensitivity and specificity in the range of 95% - 98%. 10-fold cross-validation is unremitted to forge prediction more accurate. The above figures are represented in Fig. 1.

D. Zoltan Galaz et al [4]

Feature extraction phase comes into the picture after data collection is done which makes use of multiple tools like NDAT(Neurological Disease Analysis Tools) and PRAAT acoustic s/w analysis tools using which about 715 features can be extracted. After this phase embedded methods are used by the feature selection phase. Fig. 2 shows relevant data. Among classifications, Guided Regularized Random Forest(GRRF) is used. After this, 100 times cross-validation is done with 10 folds and comparison is done between true UPDRS and predicted UPDRS.

E. Vaiciukynas E et al [5]

Phonation and text-dependent speech discourse modalities braces the information is taken to perpetuate the objectives. Phonation marks stamp for articulating short sentences or vowels. An Acoustic Cardoid(AC) and Smartphone Microphones(SM) are used to record voice. The MLP loom used here is RF(Random Forest). For identification of execution and expense of probability proportion, EER(Equal Error Rate) is utilized. The above text is tantamount with Fig. 3.

F. Dr. Gudapati Syam Prasad and Vidya S. Gaikwad [6]

This paper describes the entire Cloud Technology starting from its characteristics, type of models that are currently used, steps needed for deployment, Requirements required for cloud security and analysis on attacks and its counter measures.

G. Vidula V. Meshram, Kailas Patil, Vishal A. Meshram, Felix Che Shu [7]

This paper gives a solution for visually impaired people for their autonomous navigation and orientation. this article proposes an electronic assistive gadget called the NavCane. The gadget assists individuals with discovering obstruction free ways in both indoor and outside settings. The NavCane likewise helps in the acknowledgment of items in an indoor setting. The benefit of the NavCane gadget is that it gives need data about hindrances in the way without causing data over-burden.

H. Aniket Kudale, Kirti Wanjale [8]

This paper propose an interaction based project display system which collaborates with infrared pen touch interaction on flat surface with a webcam and projector. The data of a computer is projected on the flat surface and the user interacts with the surface with the help of an infrared pen, the movement of an infrared pen is tracked by the webcam. In here, the infrared LED light act as a tracking point which helps in controlling the data projected on surface. The proposed method is performed in three stages.

III. FIGURES AND TABLES

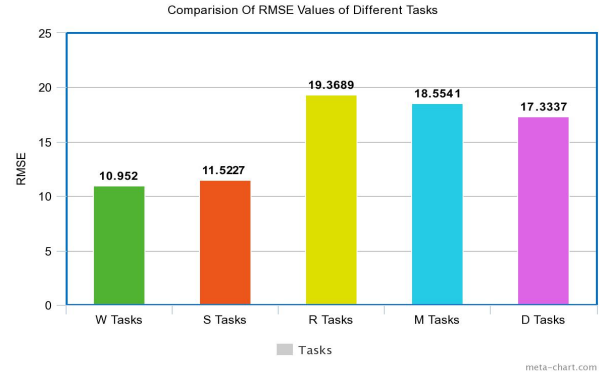


Fig. 1. RMSE Values of Various Tasks Performed

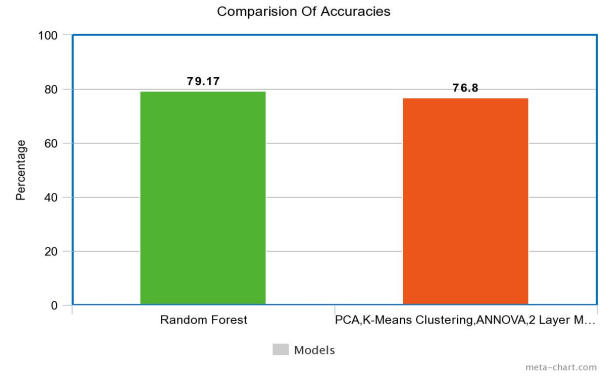


Fig. 2. Comparison Of Model Accuracies

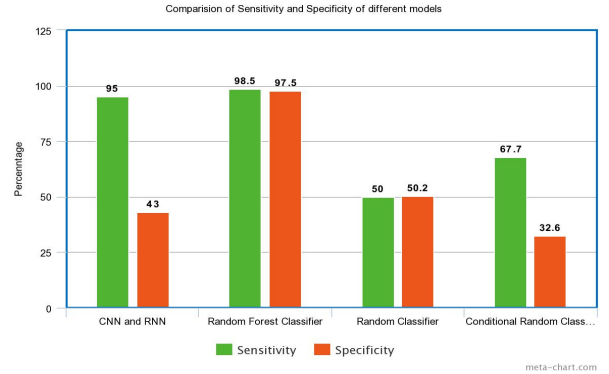


Fig. 3. Comparison Of Various Model's Sensitivity and Specificity

IV. CONCLUSION

The survey paper includes various approaches to detect Parkinson's disease using Machine Learning. In our survey, we came across many methodologies implemented by various researchers to detect PD. We have summarised the work done till now in this field. By the literature survey done by us, we conclude that the change in vocal speech symptom is best for the detection of PD. The future work of our study is to design a better approach to predicting PD using machine learning.

REFERENCES

- [1] Patrick Schwab, Walter Karlen "PhoneMD: Learning to Diagnose Parkinson's Disease from Smartphone Data" Published in AAAI 2018 DOI:10.1609/aaai.v33i01.33011118.
- [2] Monica Giuliano, Alfonso Garcia-Lopez, Silvia Perez, Francisco Diaz Perez, Osvaldo Sposito, Julio Bossero "Selection of voice parameters for Parkinson's disease prediction from collected mobile data" 2019 XXII Symposium on Image, Signal Processing and Artificial Vision (STSIVA).
- [3] Siddharth Arora, Vinayak Venkataraman, Sean Donohue, Kevin M. Biglan, Earl R. Dorsey, Max A. Little, "HIGH ACCURACY DISCRIMINATION OF PARKINSON'S DISEASE PARTICIPANTS FROM HEALTHY CONTROLS USING SMARTPHONES" 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP).
- [4] Zoltan Galaz, Zdenek Mzourek, Jiri Mekyska, Zdenek Smekal, Tomas Kiska Irena Rektorovat, Juan Rafael Orozco-Arroyave, and Khalid Daoudi "Degree of Parkinson's Disease Severity Estimation Based on Speech Signal Processing" 2016 39th International Conference on Telecommunications and Signal Processing (TSP).
- [5] Vaiciukynas E, Verikas A, Gelzinis A, Bacauskiene M (2017) "Detecting Parkinson's disease from sustained phonation and speech signals". Published on October 5, 2017 PLoS ONE 12(10): e0185613. <https://doi.org/10.1371/journal.pone.0185613>.
- [6] GUDAPATI SYAM PRASAD, Dr; S. GAIKWAD, Vidya. A Survey on User Awareness of Cloud Security. International Journal of Engineering Technology, [S.l.], v. 7, n. 2.32, p. 131-135, may 2018. ISSN 2227-524X. Available at: <https://www.sciencepubco.com/index.php/ijet/article/view/15386>. Date accessed: 17 feb. 2020. doi:<http://dx.doi.org/10.14419/ijet.v7i2.32.15386>.
- [7] V. V. Meshram, K. Patil, V. A. Meshram and F. C. Shu, "An Astute Assistive Device for Mobility and Object Recognition for Visually Impaired People," in IEEE Transactions on Human-Machine Systems, vol. 49, no. 5, pp. 449-460, Oct. 2019.
- [8] Aniket Kudale, Kirti Wanjale, "Real Time Webcam based Infrared Tracking for Projection Display System", International Journal of Mathematical Sciences and Computing (IJMSC), Vol.2, No.4, pp.41-53, 2016. DOI: 10.5815/ijmsc.2016.04.05.

V. AUTHOR'S PROFILE



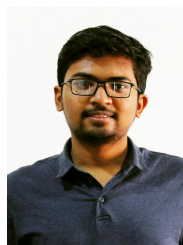
Mrs. Kirti Wanjale Mrs. Kirti Wanjale completed her graduation and post-graduation from Pune University in 1999 and 2006. She is currently pursuing her PhD from Thapar University, Punjab. She is currently a member of CSI (00128359) and IET. She is also a life member of ISTE (LM45081) and IEANG. She is presently working at Vishwakarma Institute of Information Technology, since July 2006. She has held previously held academic positions at Cummins college of Engineering, Pune, (July 2001 – June 2003) and at Seagull Informatics Pvt. Ltd., Pune, (Jan 2000 – Jan 2001). Her current research interests are in the areas of : Data Science, Natural Language Processing, Cyber Physical System and Image Processing. She is currently working in the Editorial Board Member of International Journal of Research Publications in Engineering and Technology, also in the Editorial Board Member of International Journal of Scientific and Engineering Research and in the Editorial Board Member of International Journal of Wireless Communications and Mobile Computing. She is also working on reviewer board of International Journal of Research in Engineering and Technology and has worked as reviewer for many conferences at International and National Level.



Mr. Subhnanil Bala has completed SSE in Sanskrit and HSE in Computer Science from Kendriya Vidyalaya, ONGC, Panvel. He is pursuing BE in Computer Science from Vishwakarma Institute Of Information Technology, Pune. He has an industrial experience of 1 month on Web Development with IKF Technologies. He has done research work on various types of Minor Bridges in collaboration with Prof. Shardul Joshi and Prof. Rahul Joshi for Smart India Hackathon 2019. He is currently a member of Computer Society of India. He has completed several certified courses like ML from NPTEL, Python course from Udemy, Java from Cambridge Certification Authority, was finalist of the SIH 2019 (Ministry of Transport held at SOA, Bhubaneswar).



Miss. Madhavi Nagapurkar has completed her SSE and HSE in Computer Science from Kendriya Vidyalaya Ganesh Khind, Pune. She is currently a graduate student at the Vishwakarma Institute of Information Technology. She will graduate with Bachelor's degree in Computer Science in 2020. She is a member of Computer Society of India. She has a background in Machine Learning and has completed various certified courses like Machine Learning from NPTEL, Python course from Udemy. Her research interests include Artificial Intelligence, Data Mining and HCI.



Mr. Parag Kaldade has completed his HSC from Dada Patil Mahavidyalaya Karjat, Ahmednagar. He is currently pursuing BE in computer science from VIIT, Pune. He has worked as Angular.js intern at Up-tricks Services Pvt. Ltd. Pune for the period of 1 month. He has also participated in and coordinated various technical and cultural events at college and University level as well. He is currently a member of Computer Society of India. He has completed several certified courses like ML(nptel), Angular.js(Udemy), Python(udemy), web technology(microsoft).



Mr. Onkar Kumbhar has done his secondary education under CBSE at St. Michael's School, Hyderabad and higher secondary education at Arya Gurukul International College, Navi Mumbai. He is a Computer Engineering Bachelor's student at VIIT, Pune graduating 2020. He has 1 month of work experience at F5 Techno Solutions, Mumbai and is working as an application developer for National Service scheme. He has completed several courses like NPTEL certified Machine Learning, Microsoft certified HTML5 Application development, Udemy certified Python and Udemy certified Android Developer. He is a member of Computer society of India.