Parkinson's Disease Detection

Sunidhi H Ashwath[1], Arunkumar K L[2]

[1]Department of Computer Application, JNNCE, Shimoga
[2]Department of Computer Application, JNNCE, Shimoga

sunidhiashwath@gmail.com, arunkumarkl@jnnce.ac.in

Abstract

In the current era, everything like our whole lifestyle is dependent on the technology. Similarly, technology in the healthcare department plays an important role, technology is helping in healthcare in many ways to detect the various diseases and symptoms, one of such disease is Parkinson's disease. Parkinson's disease (PD) is among the most common age-related neurodegenerative disorders that mainly affects the motion related symptoms. It is caused as anoutcome of the degeneration of dopamine-producing neurons which leads to the symptoms like having tremors while at rest, slow movements in the body, not having a stable posture or like having the rigidity in the muscles. Other symptoms such as non-motor symptoms include cognitive impairment, disturbances in sleep, disorders in mood.This is progressive in nature which affects the nervous system and the body parts which are controlled by the nerves. The disease does not have a cure but some medications can be used to get rid of few symptoms that occurs by the disease. This work focuses on distinguishing an individual between the Parkinson's disease people and normal people. This discrimination is done on the basis of the body posture of an individual. So, it is much preferable and necessary to detect the disease and it could be avoided at its progress. In this project Parkinson's Disease can be detected using deep learning (DL) and YOLO (You Only Look Once) algorithm which helps to distinguish between PD people and normal people.

Keywords: Parkinson's disease, deep learning, YOLO

1. Introduction

Millions of people worldwide are impacted by Parkinson's disease (PD), a long-time disease with symptoms that advance over time. Although symptoms appear in individuals above the age of 50. Parkinson's disease reasons the loss of particular neurons in the substantianigra that produce dopamine, the chemical that is responsible for the direct movement of the human body. Deficiency in the dopamine can be responsible for the symptoms the develop over the time. The symptoms for the PD often start with the tremors or the stiffness on any either side of the body like in the hand. Over the past twenty years from 1996-2016 the Parkinson's disease took a huge growth that it enlarged over 4 times in the span of twenty years, this has happened as the elongated life span which hassled to population of older people. Brain in the human body is the major organ which is responsible for all the functions that take place in the body. Any issues such as diseases or an injury that occur to the brain happens to affect different parts of the human body. Similarly, Parkinson's disease causes many problems which includes either a part or full loss of motor reflexes, problems in speech which generally leads to failure of speech and some changes in the behavior of a person. As the Parkinson's disease occurs to the people who are above 50 years it will be hard to discriminate between whether it is an aging problem or early symptoms of Parkinson's disease. Everyday there are lots of new cases of Parkinson coming into the hospitals showing various new symptoms. Parkinson is a very complex problem and there are no proper way to predict the severity of PD. Everyday there are lots of new cases of Parkinson coming into hospitals showing various new symptoms. Parkinson is a very complex problem and there is no proper way to predict the severity of PD. The effects

that occur very slowly to the person who start to suffer from the disease, usually these small symptoms don't seem to be visible until the condition of the paper gets worse.

2. Literature Survey

Liaqat Ali et al. [1], The given work contains how the previous studies about the detection of the Parkinson's disease have lower accuracy and not proper validation process, while this paper does the detection of the disease through the voice samples of a person. Here the voice samples are distributed into two parts on the base of the period of the disease the person is suffering from. Here SVM has obtained 91% accuracy.

Raya Alshammri et al. in 2023 [2] has described about the identification of Parkinson's disease using different voice notes of people from the dataset University of Oxford (UO) repository and used Multi-Layer Perceptron (MLP), Support Vector Machine (SVM) algorithm to predict the identification of the Parkinson disease, with the accuracy of 95%.

Faisal Saeed et al. [8], the following work depicts how Parkinson is a neuro degenerative disease and this disease leads to the issues in the motor issues or voice impairments in the person who is suffering from PD. Some abnormalities in the speech of a PD patient cannot be observed through the listeners but technology can catch it. This work makes use of ML classifiers such as SVM, K-NN, MLP, and RF, with K-NN outperforming the others by 88.33%.

Pooja Raundale et al. [12], their work considers to get the data of the intensity of the Parkinson's disease present in a person. The authors use few algorithms like XGBoost and Neural Networks for the identification of the disorder with the use of the dataset which consists of vocal information from different individuals. XGBoost has achieved the accuracy of 95%.

Shivangi et al. (2019) [13], This work comprises of finding of presence of Parkinson's disease in a person. It is decided based on walking patterns of a person where an individual is analyzed using the vertical ground force reaction (VGFR) in which a person's data is recorded as they walk at a normal speed on a flat surface with each person's foot has been connected with sensors to analyze their walking pattern. It has also used voice impairment classifier to find the impairments present in the speech of a person which is analyzed by the voice recordings of people. The accuracy obtained are 88.1% and 89.15% accuracy respectively.

Shreevallabha datta G et al. in 2022, [14] The following study shows that how technology have evolved over the time in the domain of healthcare industry which is very helpful in many cases for detecting and diagnosing the diseases at the initial stage which saves many lives. This study inculcate about how a person can be discriminated based on voice signals produced by each person. This voice samples consists of both noise and noiseless feature, from which acquisition of data is done later the required feature is extracted and classified. Various techniques like SVM, RF, XGBoost are used, but RF achieved greater accuracy.

Soumanas Kar et al.[15], this work utilizes Machine Learning for initial identification of Parkinson's disease through handwriting analysis. It uses Static Spiral Test and KNN algorithm to discriminate between spirals drawn by the individual who are anguish from Parkinson's disease and those individuals who are healthy individuals. Spiral test has obtained the greater accuracy.

WuWang et al. [16], this work focuses on a deep learning technique that is utilized for the purpose of the early detection of the Parkinson's disease. This consists of information from nearly 600 people which consists of data like sleep behavior and rapid eye movement for the detection the disease. This technique

uses machine learning and deep learning procedures for the prediction of Parkinson's disease. The deep learning outperformed other methods like Random Forest, SVM and logistic regression.
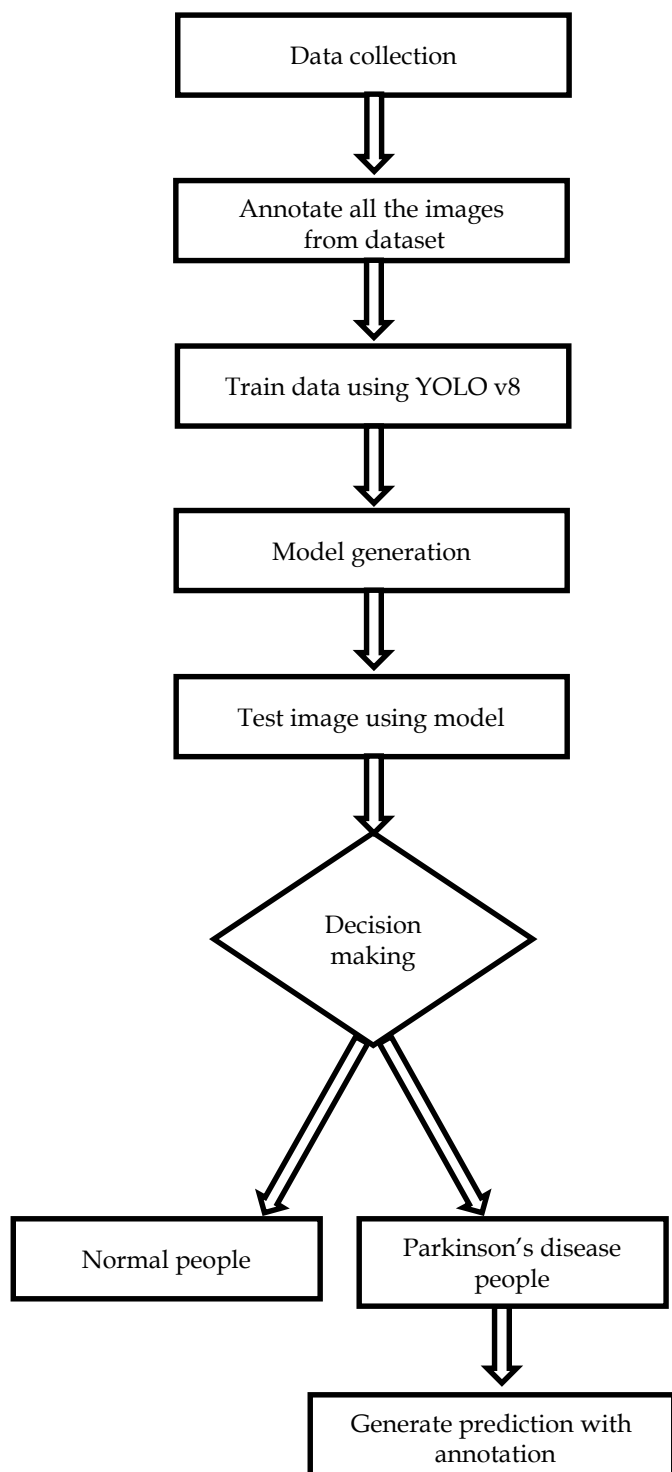
3.Methodology

Figure 1: Proposed system flowchart

3.1 Data collection: The first step is the data collection from which the data required and relevant for the project will be collected from the internet. The data consists of the body posture of the human beings of both the Parkinson's disease people and normal people.

3.2 Annotation: The next step includes the performing of annotation for every input image that is collected in the process of data collection. Annotation is done with help of labelImg library, it is an annotation tool written in python. It is also used to draw the bounding boxes in the images. When bounding boxes are drawn and saved it creates a new text file and it consists of the data about the x-axis and y-axis measurements of the box drawn from the left-top to right-bottom of the image, of the bounding boxes drawn for the given images.

3.3 Training: The following step is training the images that have already got annotated by utilizing the labelImg library in which all the required features will be extracted using the YOLO v8 model. This technique extracts features only from the portion of the image that is existing in the bounding box. Then it draws a grid to the image to and it reads all the properties from the image and analyze which class it belongs to and saves the respective features to particular classes, which will be helpful to detect an image when an input image is given. This model is used as it does the real time object detection. It makes predictions using the bounding boxes and class in input image. It uses the convolutional neural network(CNN) for bounding boxes of an input image.

3.4 Model generation: The above step will generate a pre-trained model that is a technique that will be trained on a large dataset and could be fine-tuned for a particular task. The model file is created from the training process where the feature derived from the images will be analyzed and the available best result will be stored in a as a best pre-trained model in which all the required features will be saved that helps to classify the given input image.

3.5 Testing: The next one includes testing the images with the pre trained model to check if it

is obtaining the correct output by analyzing the given image.

3.6 Decision making: At the last step we will get to know whether the person is having the Parkinson's disease or not. After testing the image, the result will be interpreted on the basis of the image provided with the annotation for the image.

4. Experimental Result

This work aims to evolve a efficient method for detecting the PD with the consideration of body posture images dataset. The dataset consisted of both the PD people and normal people. With the use of the YOLO algorithm we are able to detect the presence of the diasease in a person. The feature extracted to detect a PD person is done on the basis of the body posture whether they are having low back curve or forward lean of either the whole body or the head.The accuarcy obtained from the YOLO algorithm to detect the Parkinson's disease is 96%.

Figure 2: Parkinson disease person

In the above figure ,our model correctly predicts the person as PD personwith annotation and 1.00indicates how much percentage the person is affected from the disease.

Figure 3: Normal person

In thefigure 3, our model excatly predicts the person in the image as the normal person with the annotation and 0.99 indicates the percentage.
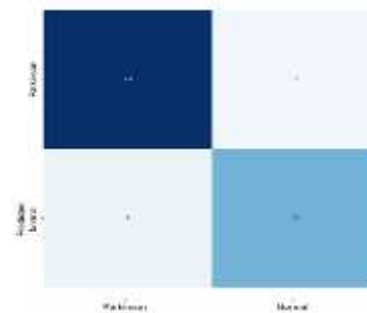

Figure 4: Confusion matrix of Parkinson's disease

The figure 4 contains the confusion matrix, which gives the information about the prediction summary. It consists of how many prediction are correct and how many prediction are incorrect.It shows the number of true positive, true negetive,false positive and false negative values.
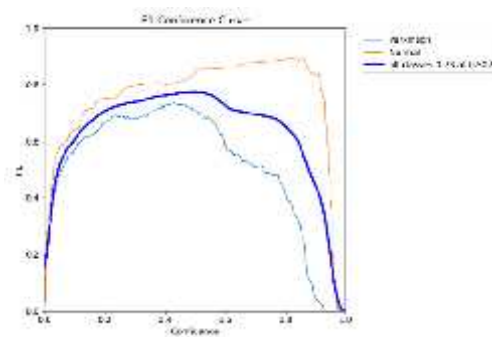

Figure 5: F1-Confidence curve of Parkinson disease

The figure 5 depicts about the detection of

Parkinson's disease, it indicates the connection between correctly identifying positive cases(Parkinson's people) and false positives(normal people).

5. Conclusion

Parkinson's disease is a disease which is progressive in nature. It is the neurodegenerative disease which leads to the stage of affecting motion related issues. Initial detection of this disease helps to improve the patients health. With the help of evolution of the technology we are able to detect the disorder using deep learning and YOLO algorithm. The utilization of this algorithm is useful in the better detection due to its speed and accuracy and also its ability process image in real-time.Feature extraction through body posture of a person is much helpful for the deetction of the disease.This could also be utilized as live detection of the disorder through webcam.So it could be used as a application in many public places such bustands or railway stations through which people can be continuoslymonitored and the if any individual suffering from disease are found they can be assisted till they board the bus or train as they face difficulty issues due to tremors or other symptoms.

References

1. Ali L., JaveedA., Noor A. *et al.,"* Parkinson's disease detection based on features refinement through L1 regularized SVM and deep neural network",Sci Rep, Vol.14,2024.

2. Alshammri Raya, Alharbi Ghaida, Alharbi Ebtisam, Almubark Ibrahim," Machine learning approaches to identify Parkinson's disease using voice signal features", Frontiers in Artificial Intelligence, Vol.6, 1-8, 2023.

3. Arunkumar K L, Ajit Danti, "Recognition of Vehicle using geometrical features of a tail light in the night vision", National Conference on Computation Science and Soft Computing (NCCSSC),2018

4. Arunkumar K L, Ajit Danti, Manjunatha H T, "Estimation of vehicle distance based on feature points using monocular vision", IEEE 8816996, 1-5, 2019

5. Arunkumar K L, Ajit Danti, Manjunatha HT, D Rohith, "Classification of Vehicle Type on Indian Road Scene Based on Deep Learning", Springer, Singapore 1380, 1-10, 2021

6. Arunkumar K L, Ajit Danti,"A NOVEL APPROACH FOR VEHICLE RECOGNITION BASED ON THE TAIL LIGHTS GEOMETRICAL FEATURES IN THE NIGHT VISION", International Journal of Computer Engineering and Applications, Volume XII, Issue I, www.ijcea.com ISSN 2321-3469,2018

7. Aunkumar K L, Ajit Danti, Manjunatha H T, "Classification of Vehicle Make Based on Geometric Features and Appearance-Based Attributes Under Complex Background", Springer 1035 (CCIS), 41-48,2019

8. Faisal Saeed, Mohammad Al-Sarem, Muhannad Al-Mohaimeed, Abdelhamid Emara, Wadii Boulila, Mohammed Alasli and Fahad Ghabban," Enhancing Parkinson's Disease Prediction Using Machine Learning and Feature Selection Methods", Tech Science Press, Vol.71, 5639-5657,2022.

9. Manjunatha H T Arunkumar K L, Ajit Danti,"A Novel Approach for Detection and Recognition of Traffic Signs for Automatic Driver Assistance System Under Cluttered Background", Springer 1035 (CCIS), 407-419,2019

10. Manjunatha H T, Ajit Danti, ArunKumar K L, D Rohith, "Indian Road Lanes Detection Based on Regression and clustering using Video Processing Techniques", Springer, Singapore 1380 (CCIS), 193-206 ,2021

11. Nrupatunga, KL Arunkumar, "Peruse and Recognition of Old Kannada Stone Inscription Characters", CM, Springer, Singapore, 2020

12 P. Raundale, C. Thosar and S. Rane, "Prediction of Parkinson's disease and severity of the disease using Machine Learning and Deep Learning algorithm", 2nd International Conference for Emerging Technology (INCET), 1-5,2021.

.

13. Shivangi, A. Johri and A. Tripathi, "Parkinson Disease Detection Using Deep Neural Networks", 2019 Twelfth International Conference on Contemporary Computing (IC3), 1-4,2019.

14. Shreevallabhadatta G, Suhas M S, Vignesh1, Manoj C, Rudramurthy V C, Bhagyashri R Hanji," PARKINSON'S DISEASE DETECTION USING MACHINE LEARNING", International Research Journal of Engineering and Technology (IRJET), Vol.9, 1805-1811,2022.

15. Soumanas Kar, Shreya Chakraborty," DETECTION OF PARKINSON'S DISEASE THROUGH IMAGE CLASSIFICATION AND MACHINE LEARNING", International Research Journal of Modernization in Engineering Technology and Science (IRJMETS), Vol.3, 97-100,2021.

16. WuWang, JUNHO LEE, FOUZI HARROU, AND YING SUN," Early Detection of Parkinson's Disease Using Deep Learning and Machine Learning", IEEE Access, Vol.4, 1-12,2016.