ASEC 2024 Conference
The 5th International Electronic Conference on Applied Sciences
04–06 December 2024 | Online
MDPI

IMPLEMENTATION OF PROTOTYPE BASED PARKINSON'S DISEASE DETECTION SYSTEM WITH RISC - V PROCESSOR

Krishna Dharavathu, Sai Priya kesapatnapu, Subhan Khan Mohammad, Sameer Shaik, Uma Maheswari Vullanki, Pavan Kumar Sankula
Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering and Technology, Vijayawada, Andhra Pradesh, India

INTRODUCTION & AIM

As we are all living in the 21st century, and lot of technology has evolved, and many changes have occurred in human culture. Neurological disorder has the first position when compared to all other diseases. There are different types of neurological diseases in the world. Just imagine living with a body that betrays your every move. A twitching hand that refuses to be still, a frozen gait that defines each step, a lower volume of words, a mind that is hoarse voice of slurring words, and a mind that is clouded by foggy thoughts. They may have Bradykinesia (which has a small hand, writing), Tremors (it usually gets one side of the body), Rigidity (difficulty in sitting or moving), and postural Instability (difficulty maintaining balance and falls). These are the voluntary movements and involuntary movements like dyskinesia. Let these be the Symptoms and behaviour of the Parkinson's disorder/diseases. According to recent estimates, more than seven million people are affected by Parkinson's Disease (PD) worldwide. Parkinson's Disease occurs at the superior colliculus of the brain, as shown in Figure 1; the high number of affected people makes Parkinson's Disease the second most common neurodegenerative disorder after Alzheimer's Disease. Our objective for this article is to implement a prototype-based Parkinson's disease detection system using RISC V PROCESSOR. The architecture of the RISC-V Processor is depicted as shown in Figure 2.

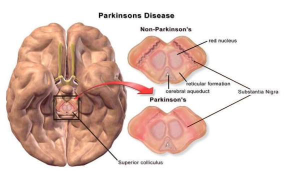

Fig:1 Non effected and effected Parkinson's Disease

Fig:2 RISC V PROCESSOR

METHOD

Our method contributed By combining conventional diagnostic indications with RISC V PROCESSOR; clinical staff may be able to identify these disease patients more accurately. Numerous contemporary machine learning methods, including KNN, SVM, Neural Networks, Naïve Bayes, Logistic Regression, AdaBoost boosting, and Random Forest, have been effectively employed to differentiate Parkinson's Disease (PD) cases from healthy controls. The Speech signals can be extracted using Digital Signal Processing (DSP) algorithms with the aid of Signal Processing & Feature Extraction techniques. Through speech signals, Parkinson's disease can be detected, as shown in Figure 3. The classifier modules are used to categorize these speech signals. To categorize the speech signals, a variety of classifier modules are employed, along with MATLAB tools for Mel frequency cepstral coefficient (MFCC) extraction approaches, as shown in figure 4.

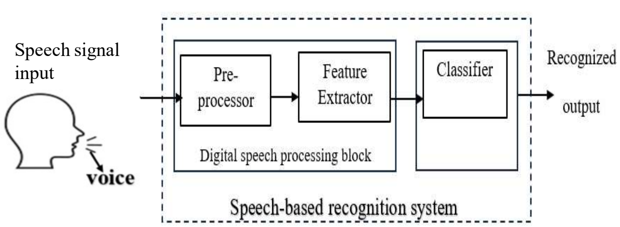

Fig:3 Parkinson's disease detection system

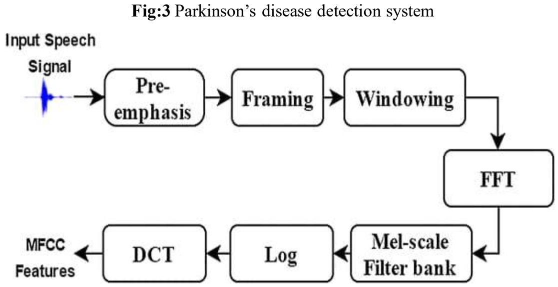

Fig:4 MFCC block diagram

RESULTS & DISCUSSION

As shown in Figure 5, we obtained the scatter plot for healthy people in differentiation from Parkinson's Diseased persons using the SVM classifier. The blue plots are represented as Healthy persons, and the red plots are defined as people with Parkinson's disease.

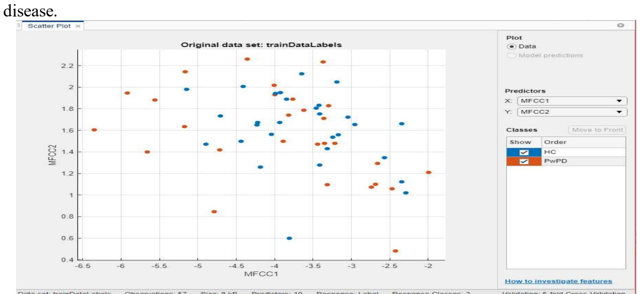

Fig:5 Scatter plot for Healthy person & People with Parkinson's Disease

As shown in Figure 6, we obtained the number of observations in the confusion matrix using the SVM Classifier. This model detected healthy and unhealthy persons and mentioned them diagonally.

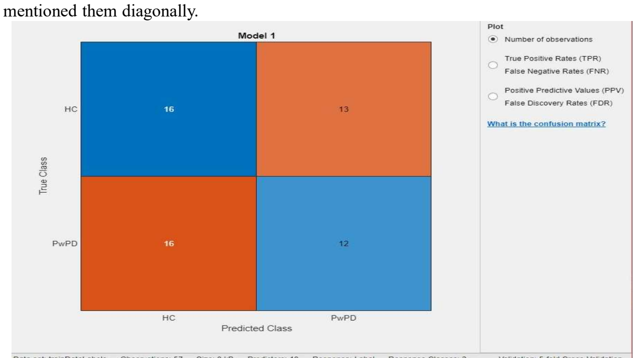

Fig:6 Confusion Matrix for number of observation

From the above results, the MATLAB environment is used to run the code for training the model using an SVM classifier. The prediction speed of the model is around -440 obs/sec. Our model training time is 9.9637 sec. The accuracy for our trained model using the SVM classifier is 49.1% for 80 samples. However, for 175 samples, we got 90.1% accuracy.

CONCLUSION

This work utilizes Machine learning techniques, Which are also used to extract features such as pitch and tremor. In the Mel-frequency cepstral coefficients (MFCCs) technique, we use the SVM algorithm to distinguish between individuals with Parkinson's disease and those under normal conditions. Machine learning classifiers have a strong performance when applied to speech data that involve the extraction of many phonetic characteristics. From the experiment results, recognized Support Vector Machine (SVM), achieving 90.1% accuracy for 175 samples. The early detection of Parkinson's disease has the potential to facilitate accurate diagnosis and ease the progression of symptoms. As shown in Figure 6, we obtained the number of observations in the confusion matrix using the SVM Classifier. This model detected healthy and unhealthy persons and mentioned them diagonally.

FUTURE WORK / REFERENCES

In future investigations, our work can contribute to the development of detection methods for Parkinson's Disease using Field Programmable Gate Arrays (FPGA) to analyze voice pathology.

REFERENCES:

[1] Gabriel Solana-Lavalle, Juan-Carlos Galan-Hernandez, Roberto Rosas-Romero, (2020)"Automatic Parkinson disease detection at early stages as a pre-diagnosis tool by using classifiers and a small set of vocal features". https://doi.org/10.1016/j.bbe.2020.01.003.

[2] Sreeja Sasidharan Rajeswari, Manjusha Nair, (2022) : "Prediction of Parkinson's disease from Voice Signals Using Machine Learning". doi: 10.47750/pnr.2022.13.S07.294.