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An LSTM based DNN Model for Neurological Disease Prediction Using Voice Characteristics

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Abstract

INTRODUCTION: A neurological condition known as Parkinson's disease (PD); it affected millions of individuals worldwide. An early diagnosis can help enhance the quality of life for those who are affected with this disease. This paper presents a novel Deep neural network model based on Long Short-Term Memory (LSTM) design for the identification of PD using voice features.
OBJECTIVES: This research work aims to Identify the presence of PD using voice features of individuals. To achieve this, a Deep neural Network with LSTM is to be designed. Objective of the work is to analyse the voice data and implement the model with good accuracy.
METHODS: The proposed model is a Deep Neural Network with LSTM.
RESULTS: The proposed method uses the features gleaned from voice signals for training phase of LSTM model which achieved an accuracy of 89.23%, precision value as 0.898, F1-score of 0.965, and recall value as 0.931and is observed as best when compared to existing models.
CONCLUSION: Deep Neural Networks are more powerful than ANNs ahd when associated with LSTM , the model outperformed the job of identifying PD using voice data.

Keywords: Voice features, Deep Neural Network, LSTM, Parkinson's Disease, Machine Learning (ML)

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1. Introduction

Worldwide, many people are afflicted by the neurological condition, called Parkinson's disease [1]. It is observed with biomarkers like with tremors, stiffness, and reduced motor skills that largely affects the central nervous system. Early detection of PD can enhance the patient's quality of life by enabling early intervention and treatment [2]. However, traditional methods for detecting Parkinson's disease are subjective and depend on the experience of the clinician. Therefore, there is a need for automated and objective methods that can accurately detect PD.

Many Machine Learning and Deep Learning models developed by various researchers are observed as automated methods that help detecting Parkinson's disease [3]. LSTM neural networks is observed with great potential for processing time-series data and have been used in different applications.

The proposed technique in this paper utilizes the features extracted from speech signals to train an LSTM model that accurately classifies the samples. The approach is of three

5. Conclusion and Future Scope

A promising method for the early and precise identification of Parkinson's disease (PD) utilising speech features is the Parkinson's disease detection system employing LSTM. With great accuracy and precision, the LSTM model can identify data in two categories, either affected with PD or healthy control by learning complicated patterns in the voice signal. The use of the UCI Parkinson's dataset provides a standardized and reliable dataset for training and evaluating the LSTM model. The dataset contains many voice data entries from individuals with and without Parkinson's disease, allowing the model to learn well. In order to assess the performance of the model, various metrics like accuracy, precision, recall, and F1 score are used which could assist pinpoint areas that need development. The model's accuracy rating of 89.23%, which is extremely desirable, shows that the model may be employed for accurate and timely PD detection. The optimization of the model architecture and hyperparameters, as well as the use of regularization techniques and early stopping, helps prevent overfitting. Overall, the Parkinson's disease detection system based on LSTM is an extremely effective method for detecting PD early and precisely utilising speech recordings. Through facilitating early detection and prompt intervention, it has the potential to enhance the lives of people with Parkinson's disease (PD) through improving disease management and quality of life. The proposed method is LSTM-based and observed with divergence, it can be enhanced by inclusion of more hidden layers and hyperparameter tuning with other values.

In addition to voice recordings, other modalities such as gait analysis and hand-writing analysis can also provide valuable information for PD detection. Integrating multiple modalities could enhance the accuracy and consistency of the PD detection system. The LSTM model can be integrated into wearable devices such as smartwatches or earbuds for real-time monitoring of PD symptoms. This would enable early detection of symptom onset and could improve the management of PD. Large-scale studies involving diverse populations could further validate the effectiveness of the LSTM model for PD detection. Such studies would also enable the identification of additional features or modalities that also im-prove the accuracy of PD detection system. Also, LSTM model could be fine-tuned using data from related diseases such as Alzheimer's or Huntington's dis-ease. This would enable the development of a more generalized disease detection system that could be used for multiple neurodegenerative diseases.

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