PREDICTION OF PARKINSONS DISEASE AND SEVERITY OF THE DISEASE USING MACHINE LEARNING AND DEEP LEARNING ALGORITHMS

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ABSTRACT
Innovative advancements in predicting the progression of Parkinson's disease are revolutionizing the diagnosis and treatment of this debilitating condition. By utilizing deep neural networks trained on the UCI Parkinson's Tele monitoring Vocal Data Set, we have developed a cutting-edge methodology for forecasting disease severity and detecting disorders with unprecedented accuracy. Our neural network and machine learning models, powered by advanced techniques like Random Forest Classifier, are set to transform the way Parkinson's disease is diagnosed and managed. With this groundbreaking approach, we aim to improve the lives of patients living with Parkinson's by providing earlier and more precise interventions for better outcomes.

I INTRODUCTION

1.1 Overview
The aim of this project is to develop a deep learning model that can accurately classify Parkinson's disease severity based on voice data. By utilizing deep neural networks and analyzing unstructured speech signals, we aim to differentiate between "extreme" and "not severe" cases of the disease. The primary focus will be on identifying changes in the patient's voice quality as a key symptom of Parkinson's disease progression. The model will be trained using UPDRS scores to evaluate the patient's overall and motor capabilities. Ultimately, this project aims to provide a reliable tool for early detection and monitoring of Parkinson's disease through voice analysis.

1.2 About the project
The project is to identify Parkinson's disease and asses its severity by analyzing various clinical features and biomarkers. Parkinson's disease is a condition that impacts movement and manifests through symptoms like tremors, stiffness and balance issues. The project involves collecting datasets with patient information, including demographics and neurological exam results. The data will be crucial in developing a reliable predictive model for Parkinson's disease detection and severity examination.

1.3 Purpose
The main goal of the project is to create a machine learning-based model that can predict the presence of Parkinson's disease and determine the severity of the disease. The project will involve collecting datasets consisting of various patient information, including demographics, medical history, motor symptom evaluations.

1.4 **Scope**
The "Prediction of Parkinson's disease and severity using Machine Learning" gathers datasets from various sources of Parkinson's disease patients. This data is then cleaned, processed, and transformed to remove errors, handle missing values, and standardize the format for analysis. Feature engineering techniques are applied to extract useful information and reduce the complexity of the dataset.

II LITERATURE WORK

2.1 A comparison of multiple classification methods for diagnosis of Parkinson disease:"Effective Diagnosis of Parkinson's Diseases." by ResulDas. Four independent classification schemes were applied.These are Neural Networks,Deep Neural Networks, Regression and Decision Tree respectively. Various evaluation methods were employed for calculating the performance score of the classifiers. According to the application scores, neural networks classifier yields the best results. The overall classification score for neural network is 92.9%.

2.2 Predicting Severity Of Parkinson's Disease Using Deep Learning: The research paper on "Predicting Severity Of Parkinson's Disease Using Deep Learning" by Srishti Grover, Saloni Bhartia, Akshama, Abhilasha. We have used 'TensorFlow' deep learning library of python to implement our neural network for predicting the severity. The accuracy values obtained by our method are better as compared to the accuracy obtained in previous research work.

2.3 UPDRS tracking using linear regression and neural network for Parkinson's disease prediction: The research paper "UPDRS tracking using linear regression and neural network for Parkinson's disease" by Elmehdi BENMALEK, Jamal ELMHAMDI, Abdelilah JILBAB.It used to track Parkinson's disease (PD) but it requires costly and logistically inconvenient for patient and clinical staff. In this work we present clinically useful accuracy replication of UPDRS, so we can classify the disease's severity of the patients with, and predict the evolution of PD based on those results.

2.4 High-accuracy detection of early Parkinson's disease using multiple characteristics of finger movement while typing:

There is a need for a more accurate, objective means of early detection, ideally one which can be used by individuals in their home setting. In this investigation, keystroke timing information from 103 subjects (comprising 32 with mild PD severity and the remainder non-PD controls) was captured as they typed on a computer keyboard over an extended period and showed that PD affects various characteristics of hand and finger movement and that these can be detected. A novel methodology was used to classify the subjects' disease status, by utilising a combination of many keystroke features which were analysed by an ensemble of machine learning classification models. When applied to two separate participant groups, this approach was able to successfully discriminate between early-PD subjects and controls with 96% sensitivity.

III PROBLEM SOLVING

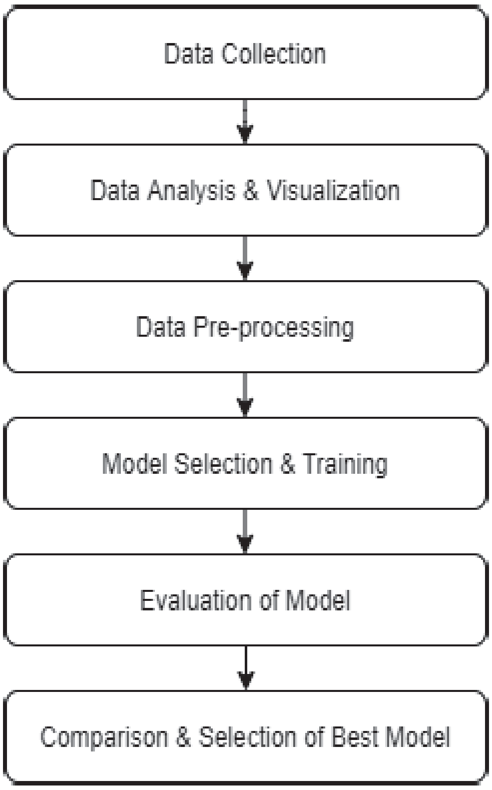
3.1 Existing System:

The term "Parkinsonism" or "patient with Parkinson's Disease" refers to the main motor disorders. Variations in the patient's speech are among the most prevalent symptoms that can be identified by analyzing their voice data. As the illness worsens, the patient has more stuttering in their speech. The field of deep learning has gained prominence in the analysis of unstructured data, including audio and speech signals. In deep neural networks, layers of neurons are frequently employed; in feature selection and classification models, these layers are layered as a single unit. Many of the existing algorithms' approaches are unsuitable for assisting experts in various fields, as they heavily rely on the statistics they use. As a result, they find it difficult to sustain effectiveness when data varies.

3.2 Proposed System:

In the proposed work, two feature compressing techniques—CGS with best-first search and Gain ratio with ranker mechanism—as well as four distinct classification algorithms were used. Every algorithm is created with an achievable process in an optimized form, as stated in the literature review; nonetheless, this chosen process might not be used to create a more capable approach. The suggested approach looks into and evaluates two additional feature compression techniques in addition to the four selected methods—the Hidden Markov Model (HMM), Artificial Neural Network (ANN), Support Vector Machine (SVM), and Decision Tree (J48). [2, 17] Combine these feature compression techniques with the linear models after analyzing them.The comparative values demonstrate that the proposed method outperforms other current approaches in terms of accuracy.The suggested methods are compared with the proposed approach's appropriateness and efficiency.

IV ARCHITECTURE

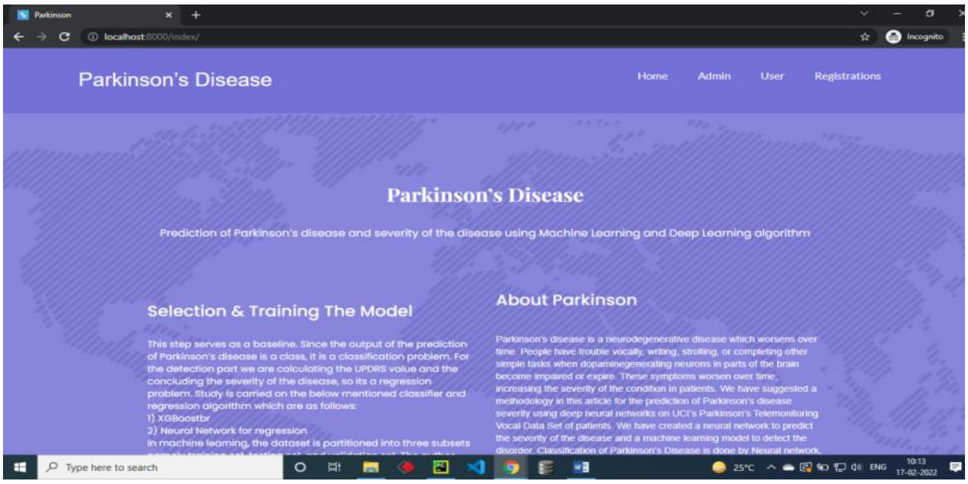


V METHADOLOGY

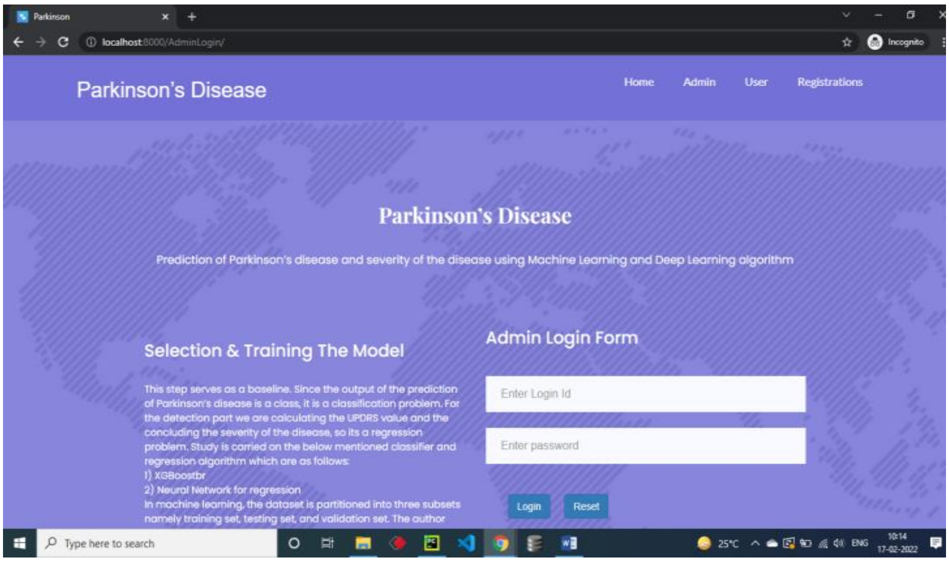
To begin controlling Parkinson's disease, a medical expert must properly diagnose the condition. In most cases, this entails a physical examination, a review of medical history, and perhaps imaging studies like CT or MRI scans. Individuals suffering from Parkinson's disease may find their movement, flexibility, and balance improved with physical therapy. Stretches and workouts can help keep muscles strong and reduce the risk of falling.

This study makes use of the UCI Parkinson's Tele monitoring Vocal Data Set. This dataset includes a variety of patient speech recordings that are utilised to forecast the degree of Parkinson's disease. The preprocessed and cleaned dataset gets rid of any irrelevant or missing information. Jitter, shimmer, NHR, and other characteristics are taken out of the voice recordings. Using methods like feature importance from Random Forest Classifier and correlation analysis, the most significant features are chosen. Based on the chosen features, a deep neural network is constructed with TensorFlow and Keras to predict the severity of Parkinson's disease. The dataset is used to train the model, and it is then adjusted for best results. To identify Parkinson's disease, a machine learning model like Random Forest Classifier or XGBoost is also constructed.

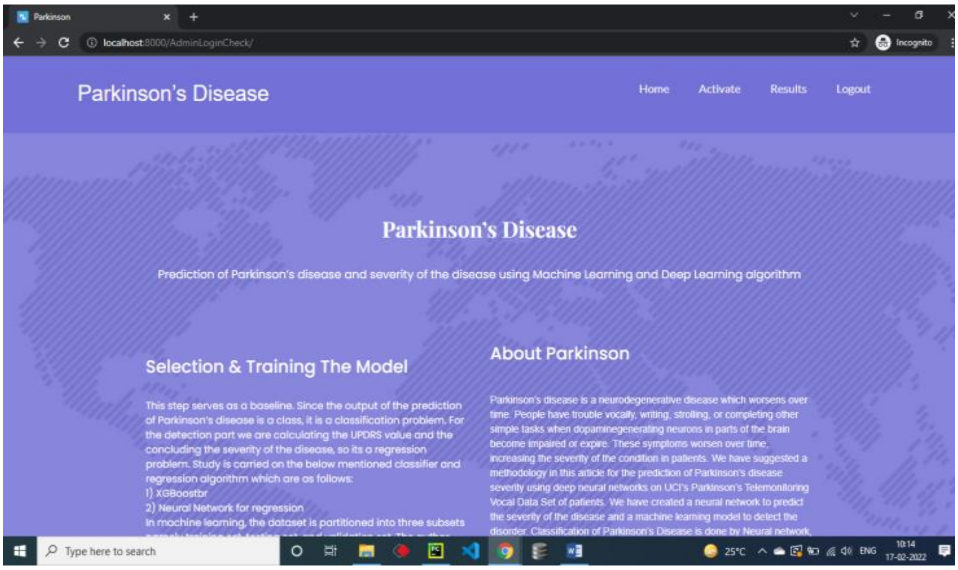
VI RESULTS AND ANALYSIS



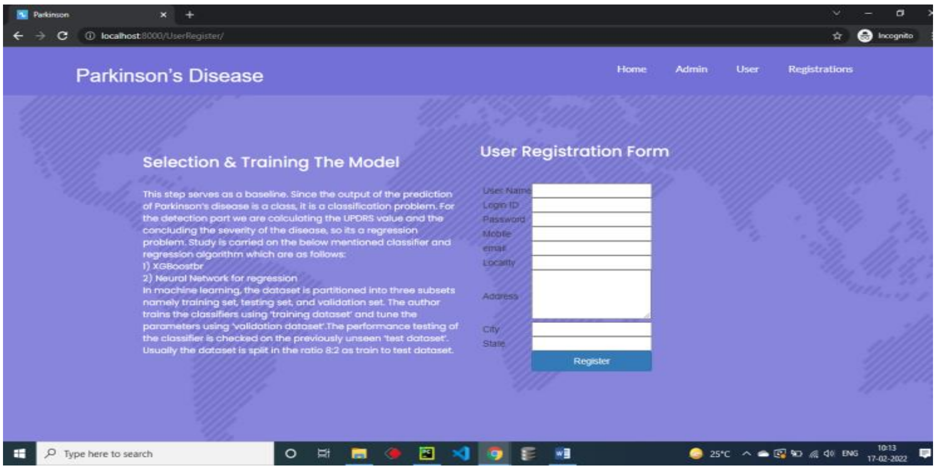
6.1 The page above displays the home page for a machine learning and deep learning algorithm used to predict the severity of Parkinson's disease.



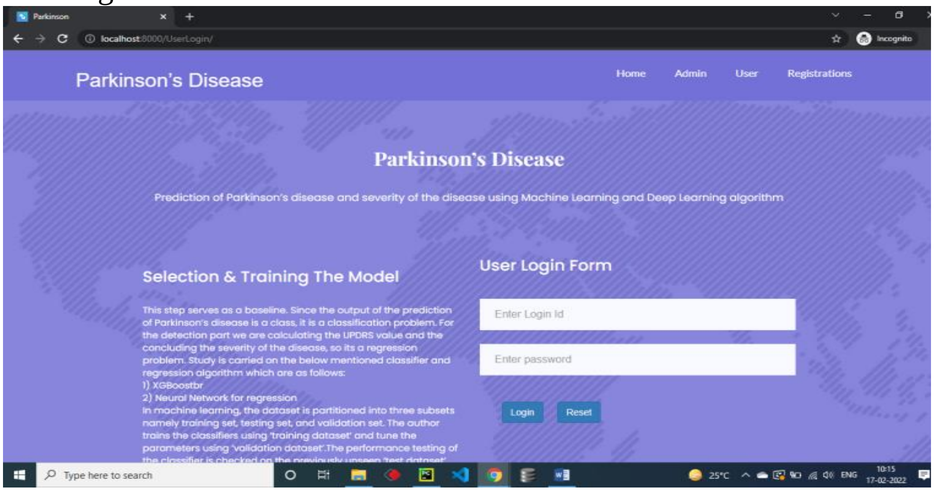
6.2 The above page shows the Admin Login Page, where Admin can log into by using Admin credentials.



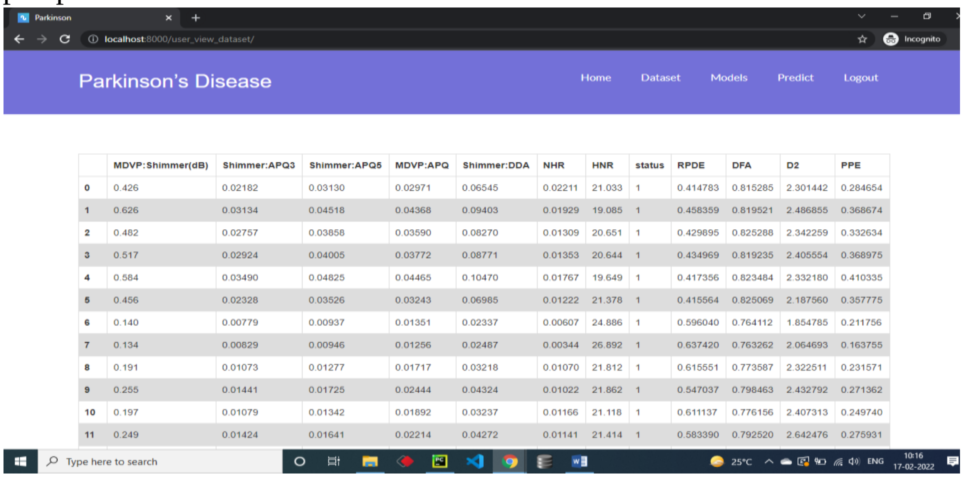
6.3 The above page shows the Dashboard of the Admin.



6.4 The above page shows the Register Page of the User and how they can use the credentials to login into the website.

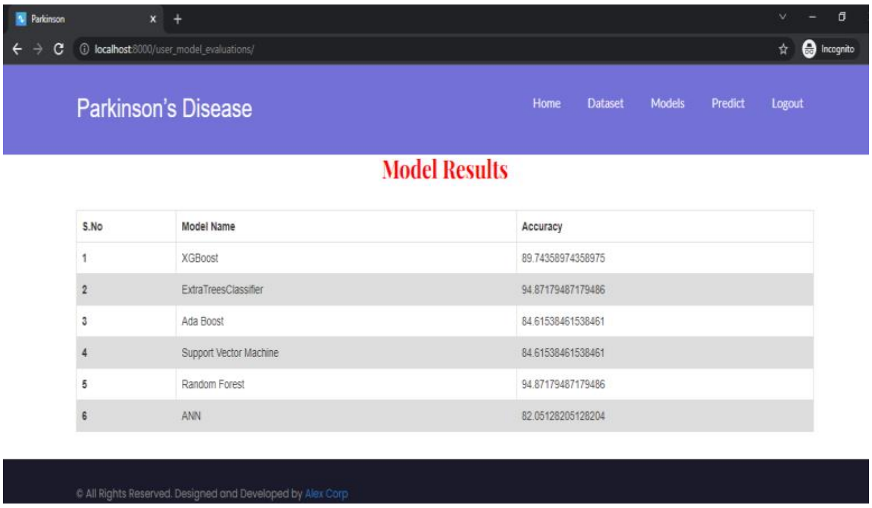


6.5 The above page shows the login page for Students, where they can log into the website using their perspective credentials.



	MDVP:Shimmer(dB)	Shimmer:APQ3	Shimmer:APQ5	MDVP:APQ	Shimmer:DDA	NHR	HNR	status	RPDE	DFA	D2	PPE
0	0.426	0.02182	0.03130	0.02971	0.06545	0.02211	21.033	1	0.414783	0.815285	2.301442	0.284654
1	0.626	0.03134	0.04518	0.04368	0.09403	0.01929	19.085	1	0.458359	0.819521	2.486855	0.368674
2	0.482	0.02757	0.03858	0.03590	0.08270	0.01309	20.651	1	0.429895	0.825288	2.342259	0.332634
3	0.517	0.02924	0.04005	0.03772	0.08771	0.01353	20.644	1	0.434969	0.819235	2.405554	0.368975
4	0.584	0.03490	0.04825	0.04465	0.10470	0.01767	19.649	1	0.417356	0.823484	2.332180	0.410335
5	0.456	0.02328	0.03526	0.03243	0.06985	0.01222	21.378	1	0.415564	0.825069	2.187560	0.357775
6	0.140	0.00779	0.00937	0.01351	0.02337	0.00607	24.886	1	0.596040	0.764112	1.854785	0.211756
7	0.134	0.00829	0.00946	0.01256	0.02487	0.00344	26.892	1	0.637420	0.763262	2.064693	0.163755
8	0.191	0.01073	0.01277	0.01717	0.03218	0.01070	21.812	1	0.615551	0.773587	2.322511	0.231571
9	0.255	0.01441	0.01725	0.02444	0.04324	0.01022	21.862	1	0.547037	0.798463	2.432792	0.271362
10	0.197	0.01079	0.01342	0.01892	0.03237	0.01166	21.118	1	0.611137	0.776156	2.407313	0.249740
11	0.249	0.01424	0.01641	0.02214	0.04272	0.01141	21.414	1	0.583390	0.792520	2.642476	0.275931

6.6 The page above displays the dataset that the user has examined.



S.No	Model Name	Accuracy
1	XGBoost	89.74358974358975
2	ExtraTreesClassifier	94.87179487179486
3	Ada Boost	84.61538461538461
4	Support Vector Machine	84.61538461538461
5	Random Forest	94.87179487179486
6	ANN	82.05128205128204

6.7 The User View Models Results are displayed on the upper page.

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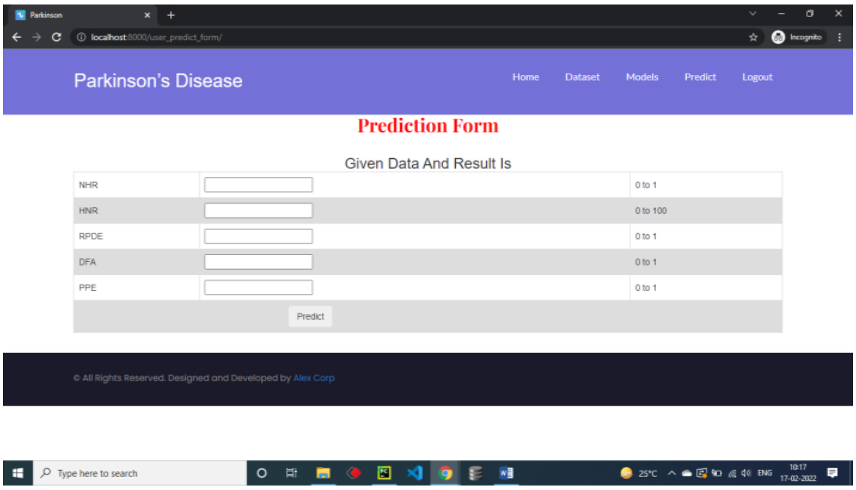
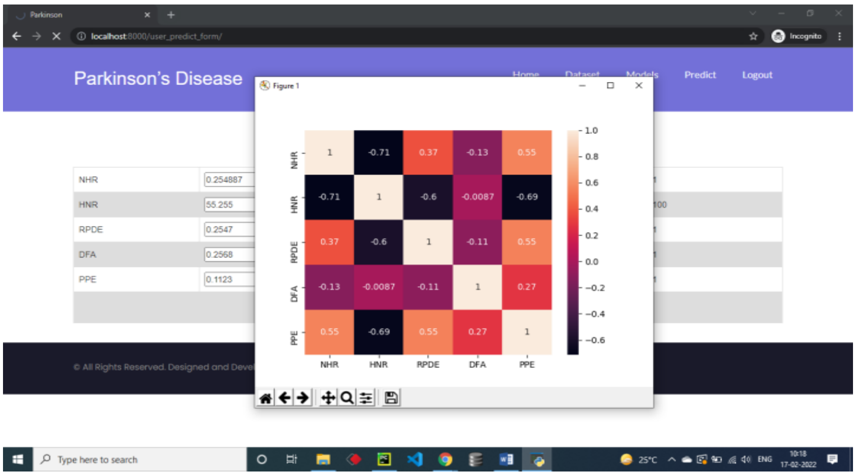
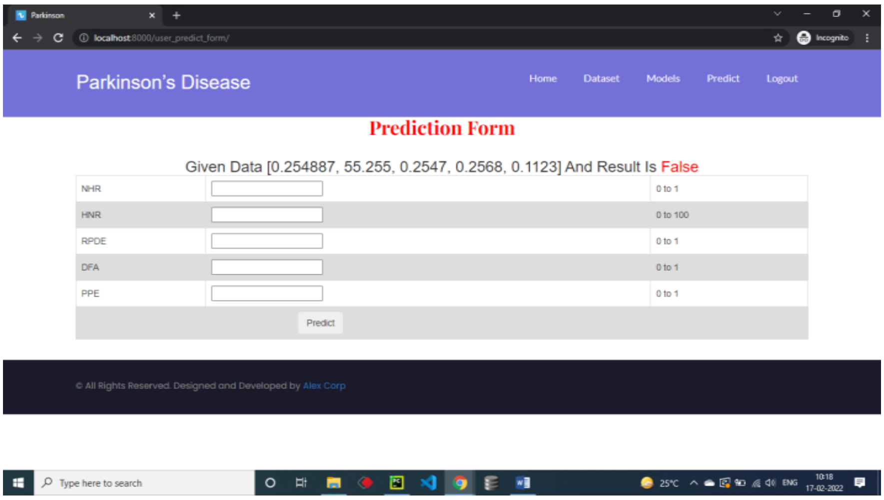


6.8 The page displays Prediction form using different attributes.



6.9 The above page displays the result of the predicted form using attributes.



6.10 The page displays the user's diagnosis of Parkinson's disease or not.

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VII CONCLUSION

Parkinson's disease detection:

1) Parkinson's disease research is important since early diagnosis can benefit patients' health.
2) With an area under the curve (AUC) between 0.97 and 1.00, a tolerance of 92 to 100%, and a specificity of 95 to 100%, this method could distinguish between people with early stages of Parkinson disease and controls.
3) It was discovered that those over 55 had positive tests for Parkinson's disease.
4) The study found that women are more likely than men to have Parkinson's disease.

Estimating Parkinson's disease Severity:

1) The study's most effective algorithm is the neural network.
2) Every acoustic element is a crucial component in the prediction.
3) The severity of the disease is determined by the motor and total UPDRS levels.

Thus, it can be said that the prognosis of Parkinson's disease is extremely complicated and contingent upon a wide range of constantly shifting variables. An efficient and optimized model that accurately determines the patient's disease severity and extent can be obtained if the features are chosen carefully.

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[7]Tappy keystroke dataset.

[8]Parkinson's telemonitoring dataset.

[9]Keras api reference.