DECISION TREE-BASED PARKINSON'S DISEASE DIAGNOSIS: A MOBILE-FIRST APPROACH

Syed Ajmal Nomaan[1], Fiaz Zafar[2], Damera Neeraj[3], Dr.Abdul Ahad Afroz[4]

[1,2,3]B. E Student, Department of IT, ISL College of Engineering, India.

[4]Associate Professor, Department of IT, ISL College of Engineering, Hyderabad, India.

Abstract: Accurate early detection of Parkinson's disease (PD) is essential to halt its progression and provide patients with access to disease-modifying medications. This study focuses on monitoring the premotor stage of PD to achieve early diagnosis using a novel deep-learning method. The proposed method quickly determines the presence of PD based on premotor traits, leveraging a range of indicators such as Rapid Eye Movement (REM) sleep behaviour disorder, olfactory loss, cerebrospinal fluid (CSF) data, and dopaminergic imaging markers.A comparative analysis was conducted between the proposed deep learning model and twelve other machine learning and ensemble learning techniques using a sample size of 183 healthy individuals and 401 early PD patients. The results highlight the superior detection performance of the designed model, which achieved an average accuracy of 96.45%, the highest among the tested methods.Additionally, the study employs a Boosting approach to provide feature importance in the PD detection process, offering insights into the most significant indicators of early PD. This information is critical for understanding the model's decision-making process and for further refining detection techniques.

The developed system includes both a PC website and a mobile website to enhance accessibility and usability. Utilizing Streamlit, the program provides a local host address and a network host address to facilitate the connection and execution of the website on mobile devices. This ensures that users can access the PD detection tool seamlessly across different platforms.By integrating these features, the study aims to provide a robust and user-friendly solution for the early detection of Parkinson's disease, ultimately contributing to better patient outcomes through timely intervention.

INTRODUCTION

Parkinson's disease (PD) is a progressive neurological disorder that impacts a large number of individuals globally. Detecting PD early is essential as it enables timely intervention and access to treatments that can modify the course of the disease and greatly enhance patient outcomes. Conventional diagnostic techniques typically identify PD at a later stage when motor symptoms become evident, which hampers the effectiveness of treatments. Consequently, there is an immediate requirement for innovative methods that can detect PD during its premotor stage, where early signs are present but less conspicuous.

Problem statement

Parkinson's disease (PD), which affects the quality of life for millions of elderly people worldwide, is emerging as a significant central nervous system degenerative illness. Due to the variability of the disease, PD symptoms might proceed differently from one individual to the next. Patients with Parkinson's disease may experience

symptoms, primarily tremors when at rest. There are several tremor kinds that can occur, including hand tremors, limb stiffness, and issues with walking and balance. Generally speaking, there are two categories of PD symptoms: those that are motor-related and those that are not (non-motor). Patients who exhibit non-motor symptoms are really more adversely impacted than those whose primary symptoms are motor. Depression, sleep behavior issues, a loss of smell, and cognitive impairment are examples of non-motor symptoms. The Centers for Disease Control and Prevention (CDC) has said that PD complications are the 14th most common cause of mortality in the US. The primary etiology of PD remains unclear as of this writing. In particular, it is estimated that the economic burden associated with PD, which includes treatment costs, social security benefits, and lost income, is over $52 billion per year in the United States alone. In actuality, there are more than 10 million PD sufferers globally. It should be highlighted that prompt diagnosis of PD enables effective therapy and dramatically reduces symptoms, as described. Therefore, detecting Parkinson's disease (PD) early on is crucial for slowing down the illness's course and may enable individuals to obtain disease-modifying therapies when they become available.

LITERATURE SURVEY

Early detection of Parkinson's disease through patient questionnaire and predictive modelling

AUTHORS: R. Prashanth and S. D. Roy

Timely identification of Parkinson's disease (PD) is crucial as it allows for the implementation of treatment measures and management techniques. Nevertheless, there is currently a lack of effective techniques for identifying Parkinson's disease at an early stage. This study utilizes the Patient Questionnaire (PQ) section of the widely employed Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS) to construct prediction models. These models aim to differentiate early Parkinson's disease (PD) cases from healthy individuals using machine learning methods that are gaining popularity in the field of biomedicine. The techniques employed include logistic regression, random forests, boosted trees, and support vector machine (SVM). We conducted validation for assessing machine learning algorithms using both subjectwise and record-wise approaches. These strategies demonstrate exceptional performance, achieving high accuracy and a high area under the ROC curve, both over 95%, in distinguishing between early Parkinson's disease and healthy individuals. The logistic model exhibited a statistically significant fit to the data, suggesting its efficacy as a prediction model. These prediction models have the potential to assist physicians in the diagnosis process by using machine learning to combine the components of a questionnaire.

Advances in the treatment of Parkinson's disease

AUTHORS: N. Singh, V. Pillay, and Y. E. Choonara

Approximately 1% of those over the age of 65 are affected with Parkinson's disease (PD), making it the second most prevalent neurodegenerative disorder, surpassed only by Alzheimer's disease. Parkinson's disease is a neurodegenerative disorder that causes profound impairments in motor function. The present medicines focus on enhancing the patient's functional ability for as long as feasible, but they do not alter the trajectory of the neurodegenerative process. The need for newer and more efficient agents is now attracting significant attention and is thus undergoing intensive investigation. This review succinctly summarizes the constraints of existing

treatments and the latest advancements in neuroprotective drugs, antioxidants, stem cell research, vaccinations, and surgical procedures for the treatment of PD.

Machine Learning for the Diagnosis of Parkinson's Disease: A Review of Literature

Jie Mei,[1,*] Christian Desrosiers,[2] and Johannes Frasnelli[1,3]

Medical observations and clinical evidence, including motor symptoms, are used to diagnose Parkinson's disease (PD). Traditional diagnostic procedures may be subjective since they evaluate small motions that are hard to categorize, resulting to misdiagnosis. Early non-motor symptoms of PD may be minor and caused by other illnesses. Thus, these symptoms are typically missed, making early PD diagnosis difficult. Machine learning algorithms have been used to classify PD and healthy controls or patients with comparable clinical presentations (e.g., movement disorders or other Parkinsonian syndromes) to improve diagnosis and evaluation. This research reviewed PubMed and IEEE Xplore articles published till February 14, 2020, to offer a thorough overview of data modalities and machine learning approaches utilized in PD diagnosis and differential diagnosis. This study examined 209 research' goals, data sources, data kinds, machine learning methodologies, and results. These findings show that machine learning and new biomarkers may be used in clinical decision making to lead to more systematic, informed PD diagnosis.

A survey of deep learning techniques based Parkinson's disease recognition methods employing clinical data

Author links open overlay panelAmin ul Haq [a], Jian Ping Li [a], Bless Lord Y. Agbley [a], Cobbinah Bernard Mawuli [a], Zafar Ali [b], Shah Nazir [c], Salah Ud Din [d e]

Parkinson's disease (PD) is a serious neurological disorder affecting millions globally. Successful Parkinson's disease therapy requires an accurate diagnosis. Deep learning (DL) systems based on multiple diagnostic methods may identify PD and fix diagnostic difficulties. Published surveys and DL-based PD diagnostic methods are thoroughly examined in this study. This study covers DL-based diagnostic methods for PD detection, including dataset pre-processing, feature extraction and selection, and classification. The approaches' drawbacks and advantages have been analyzed. We also examined the datasets used to assess the recommended PD recognition algorithms to better understand them. This survey also examined model assessment metrics and cross-validation methods utilized in related publications. After reviewing the literature, we investigated hot research challenges and solutions. Finally, we identified numerous trends and opportunities for future research to further automated illness identification, notably Parkinson's disease detection and E-healthcare implementation.

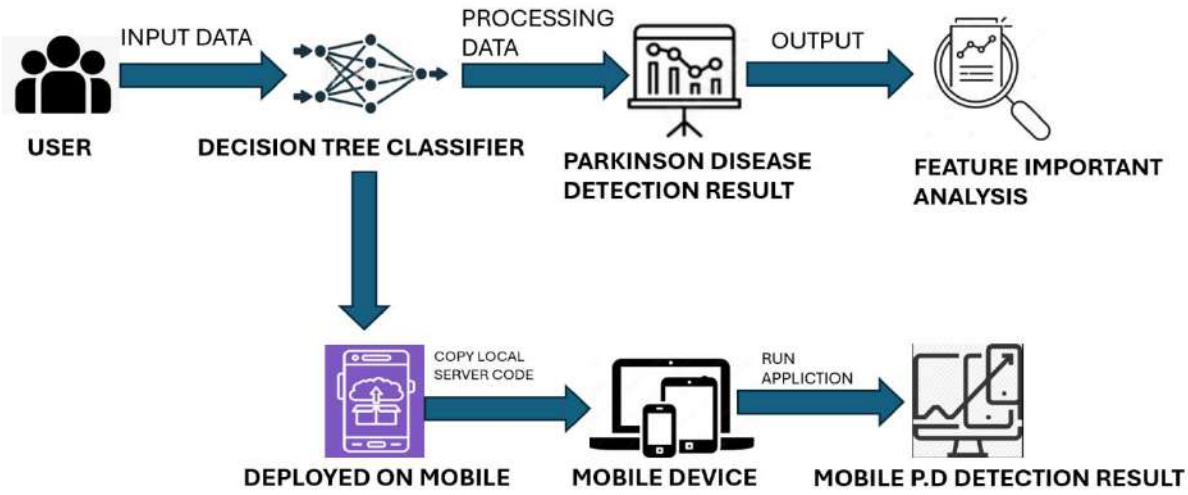
Early detection of Parkinson's disease using machine learning

Author links open overlay panelAditi Govindu [a], Sushila Palwe [a]

PD is a neurodegenerative ailment that affects 60% of persons over 50. Parkinson's (PWP) patients have movement and communication issues, making treatment and monitoring challenging. Early identification may treat PD, allowing people to live normally. Global aging underlines the need to identify PD early, remotely, and correctly. This research describes how telemedicine uses machine learning to identify early PD. Training 4 ML

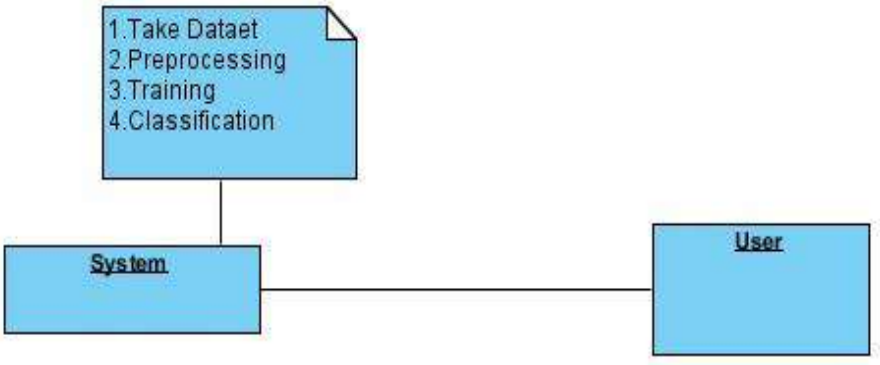
models with MDVP audio data from 30 PWP and healthy patients was studied. Comparing SVM, Random Forest, K-Nearest Neighbors (KNN), and Logistic Regression classification results, Random Forest classifier is the best Machine Learning (ML) approach for PD detection. Random Forest classifier has 91.83% detection accuracy and 0.95 sensitivity. This study promotes ML in telemedicine to provide Parkinson's sufferers a fresh lease of life.

SYSTEM ARCHITECTURE



COLLABORATION DIAGRAM:

In collaboration diagram the method call sequence is indicated by some numbering technique as shown below. The number indicates how the methods are called one after another. We have taken the same order management system to describe the collaboration diagram. The method calls are similar to that of a sequence diagram. But the difference is that the sequence diagram does not describe the object organization whereas the collaboration diagram shows the object organization.

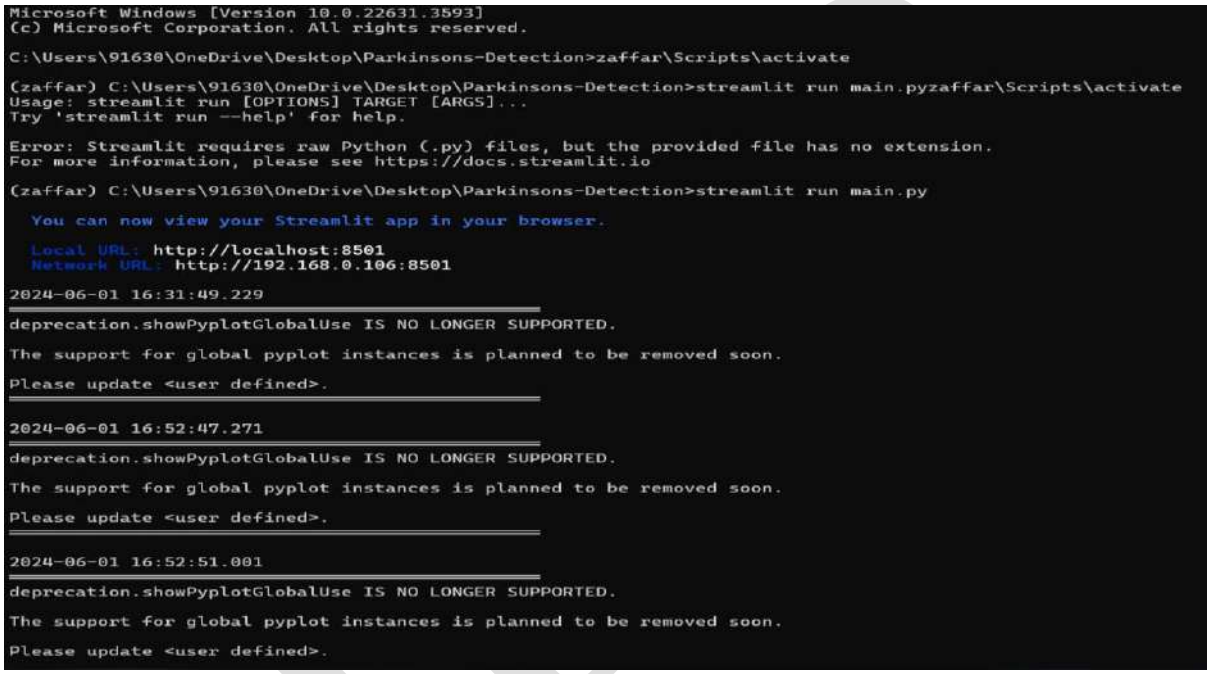


SYSTEM TESTING

TEST CASES:

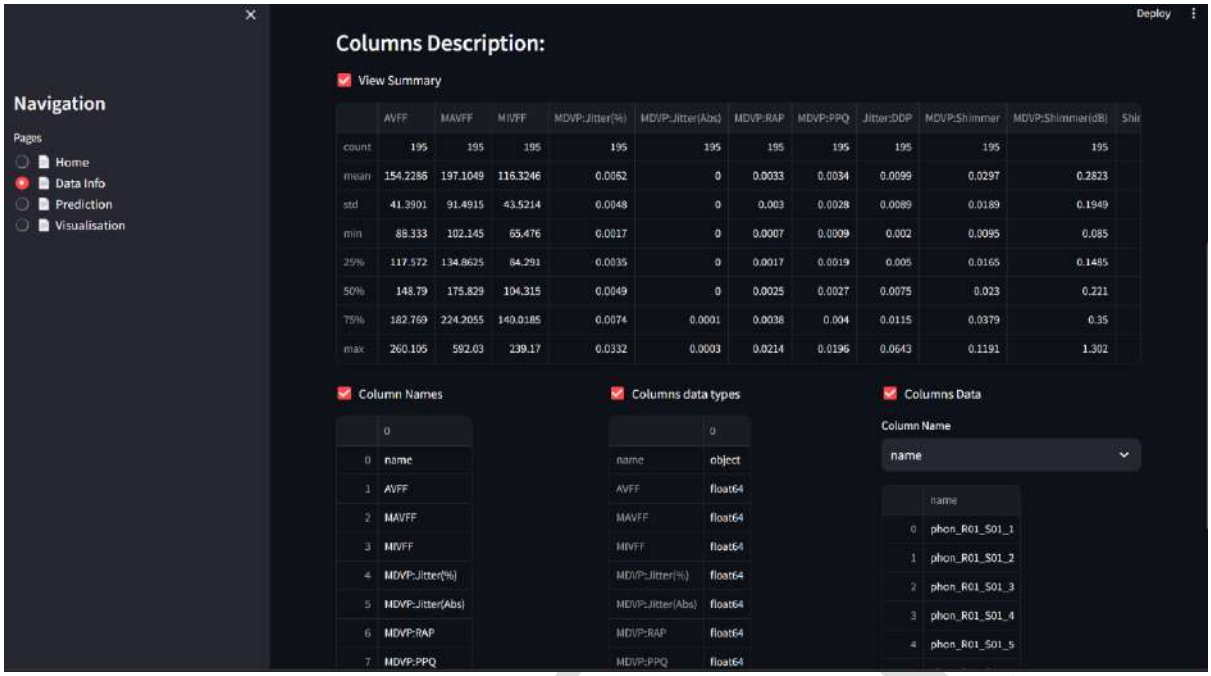
The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

RESULTS

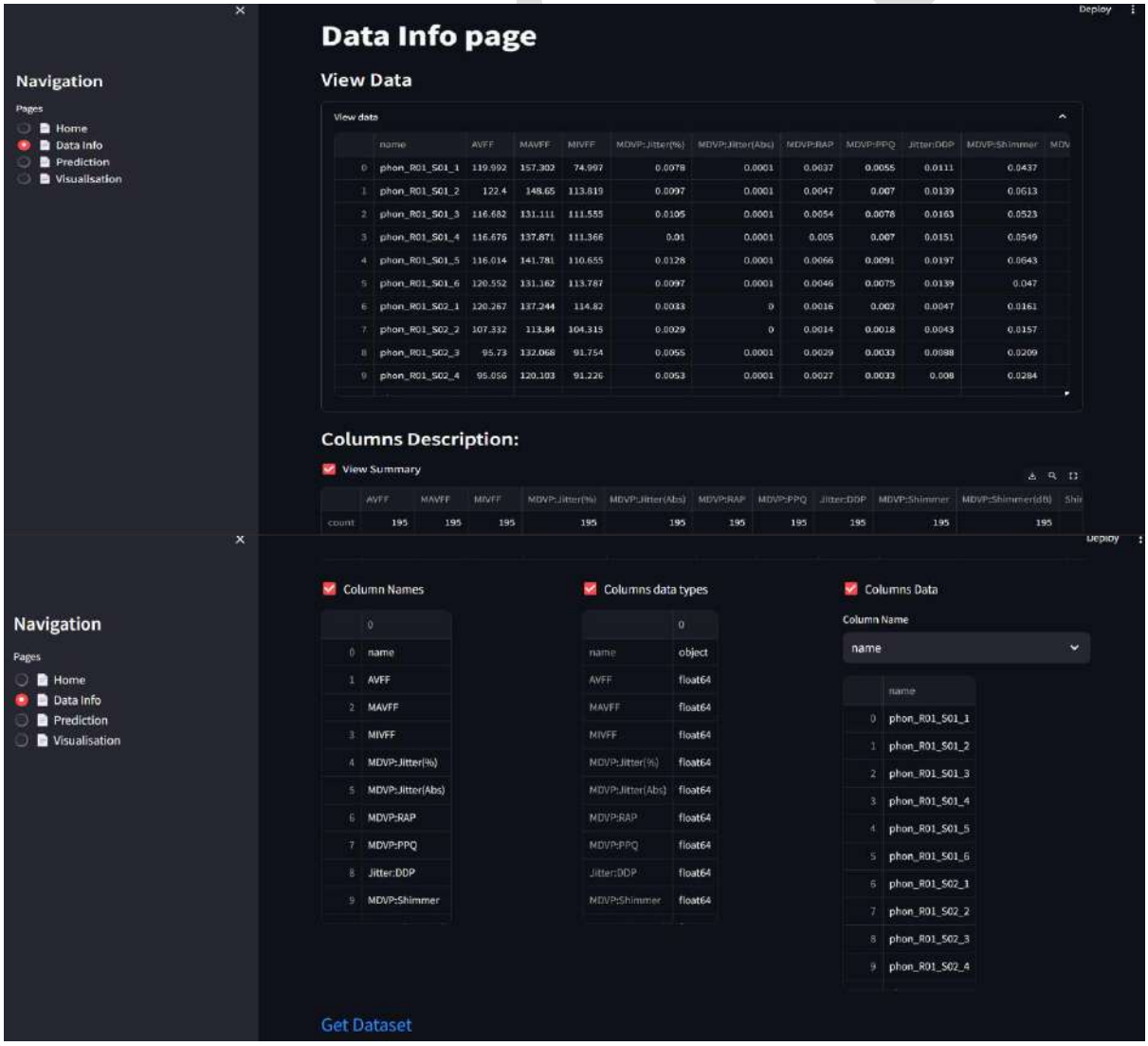


CMD terminal from this we get local and network host links

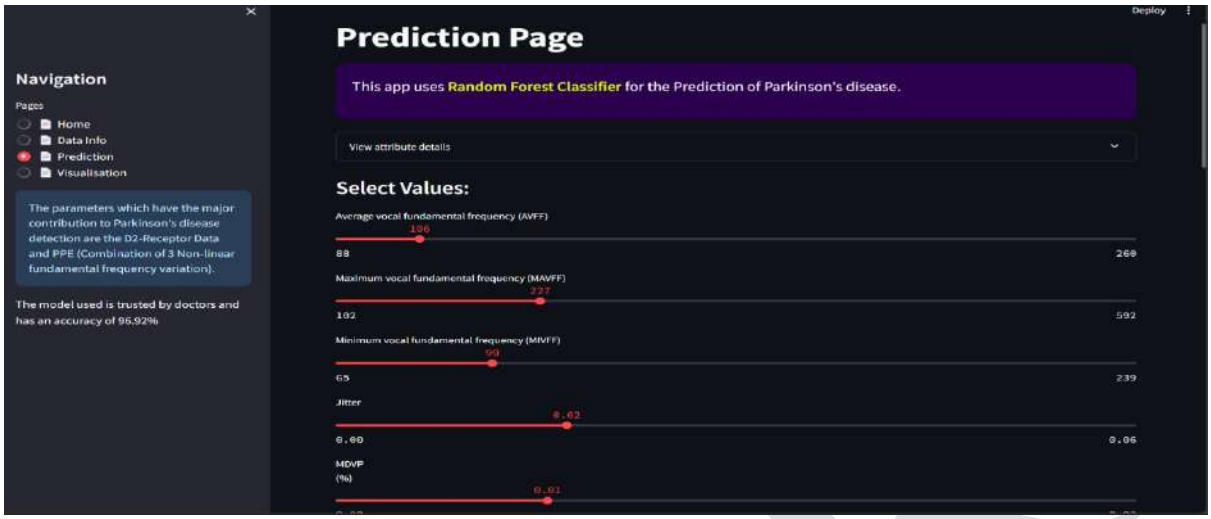
Home page


Navigation
Pages
Home
Data Info
Prediction
Visualisation
Columns Description:
View Summary
Column Names
Columns data types
Columns Data
Column Name
name

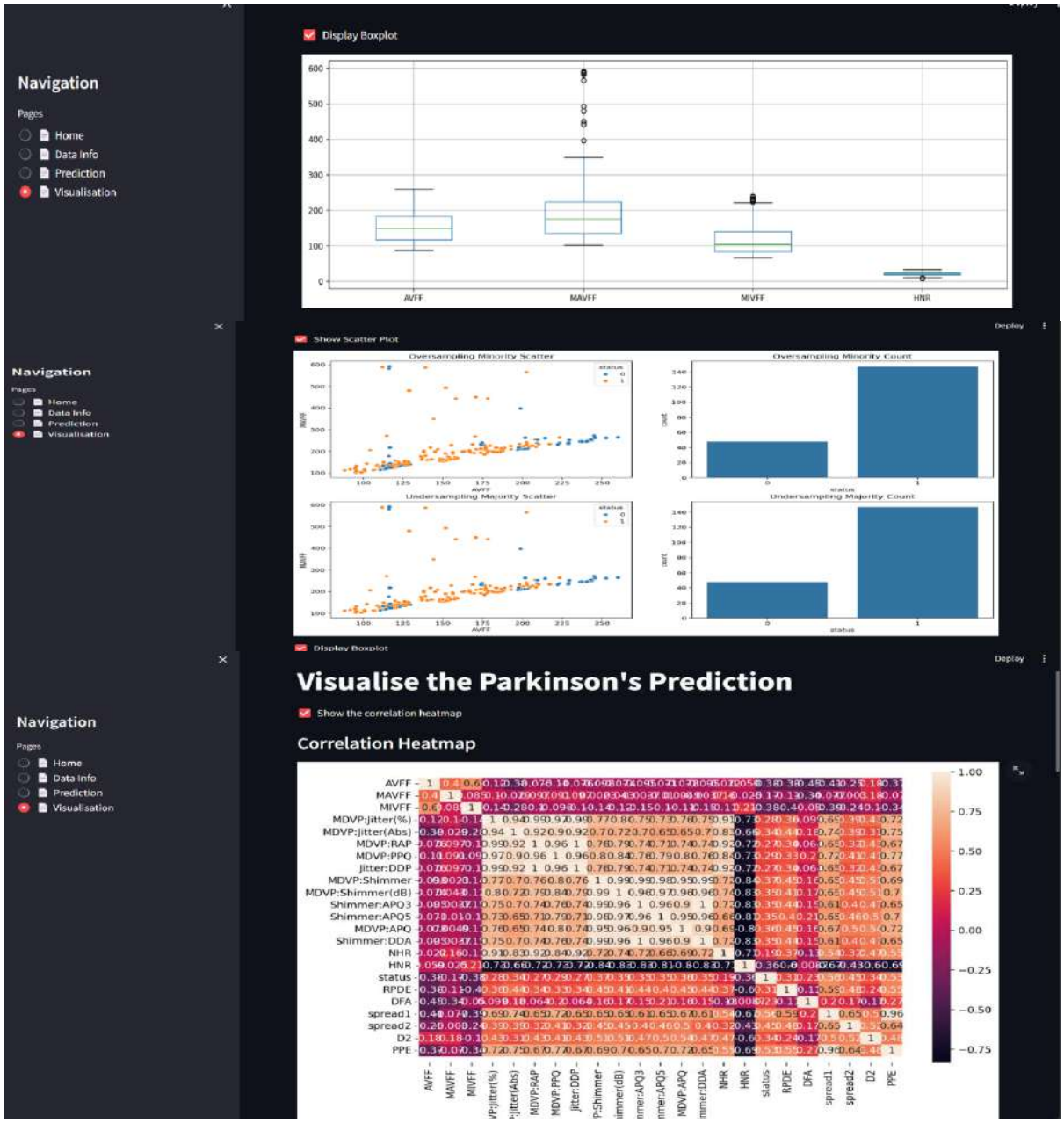
Data pages

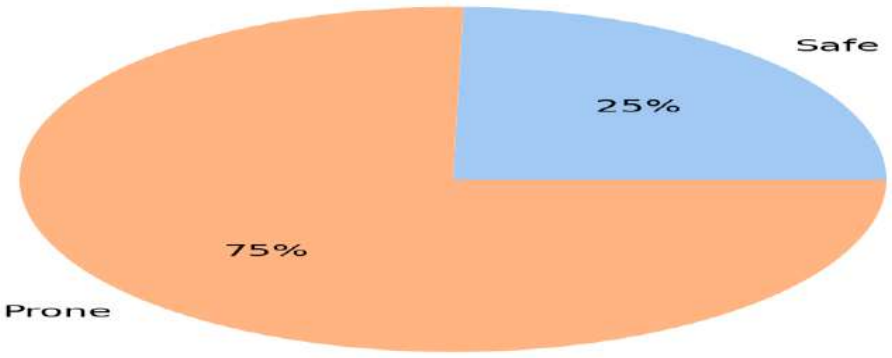

Navigation
Pages
Home
Data Info
Prediction
Visualisation
Data Info page
View Data
Columns Description:
View Summary
Column Names
Columns data types
Columns Data
Column Name
name
Get Dataset

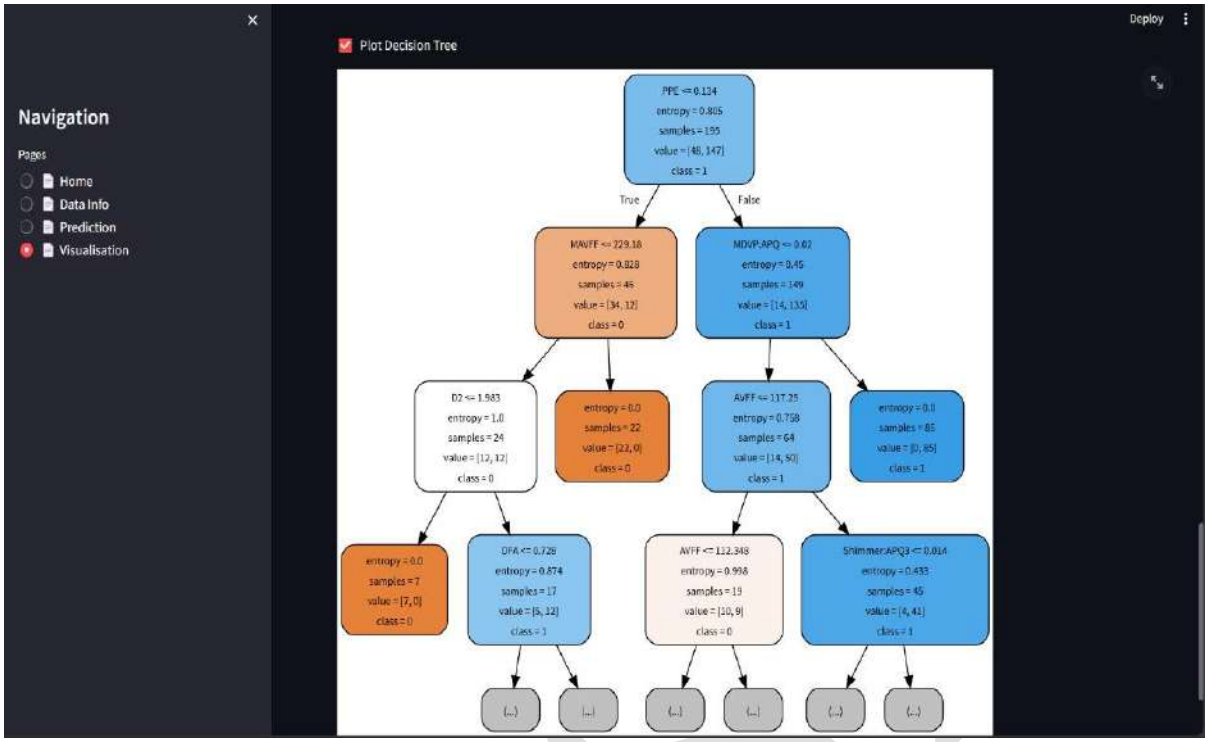
Prediction pages



Visualization pages





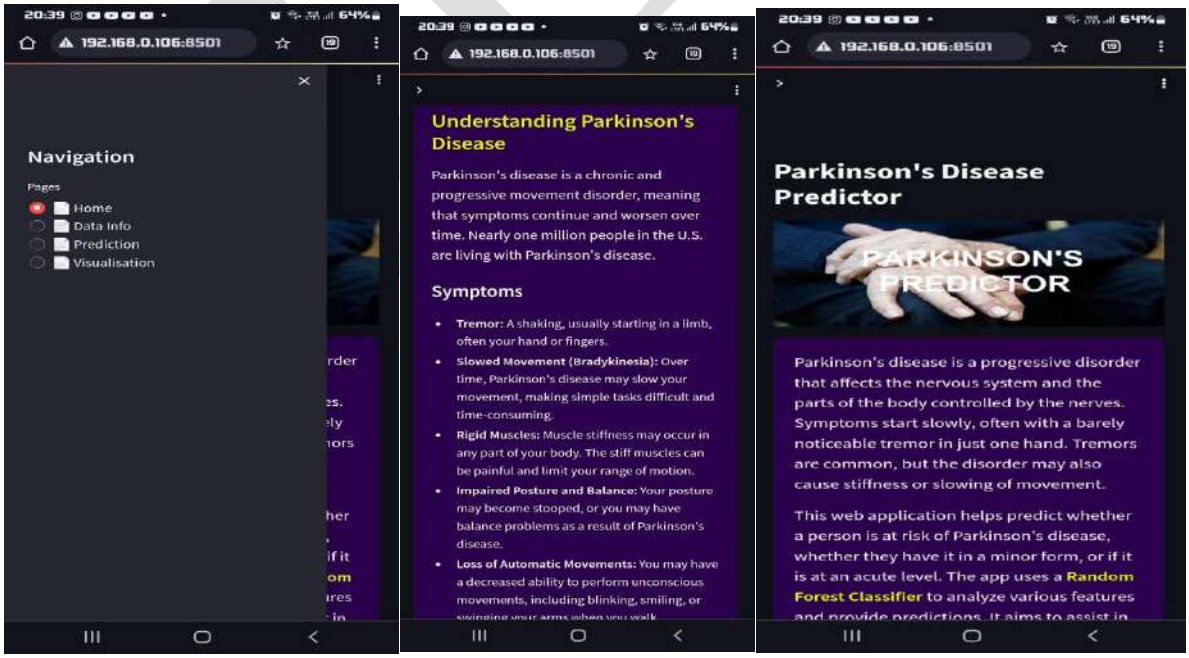


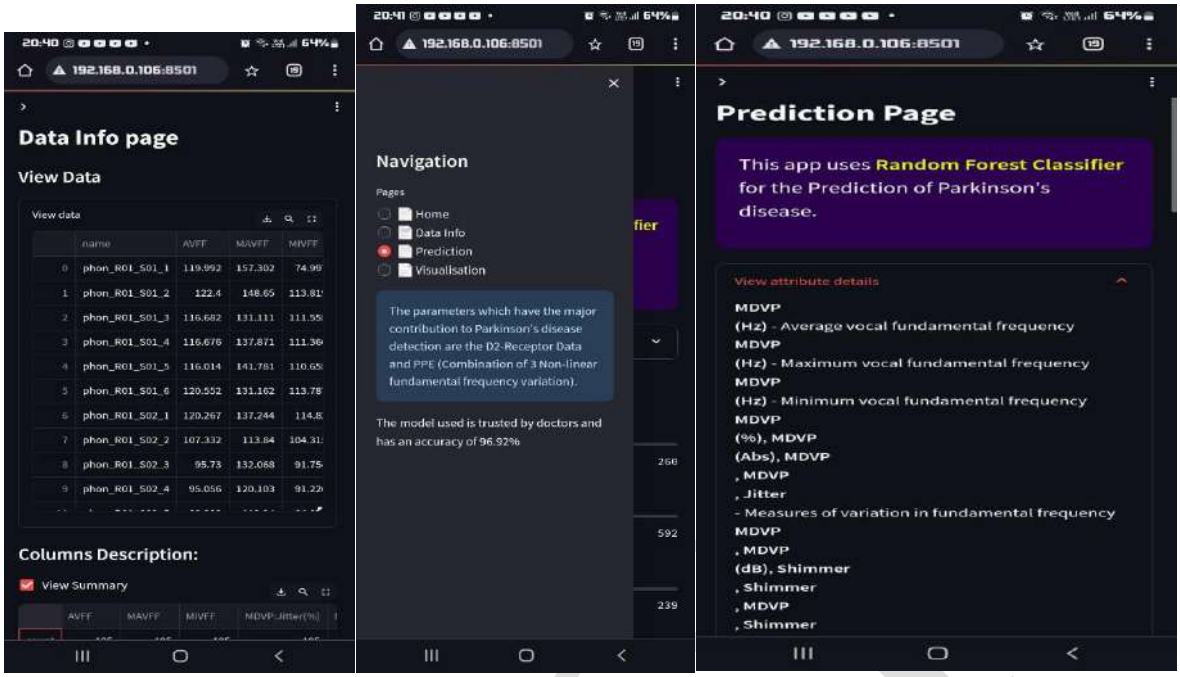
MOBILE OUTPUTS

Like the pc version has it output like this we also have mobile version which is generated when project executed in pc

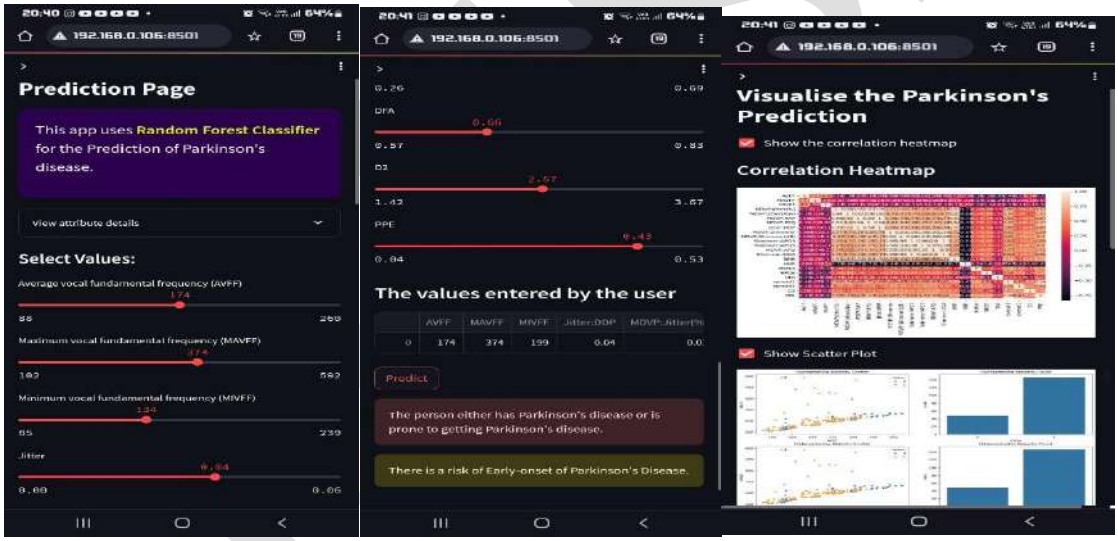
The mobile output screenshot are here

Home pages,Data page and Prediction page :





Prediction and visualization page



CONCLUSION AND FUTURE ENHANCEMENTS

The proposed system for the early detection of Parkinson's disease (PD) demonstrates significant potential in transforming PD diagnosis by leveraging advanced deep learning algorithms. By focusing on premotor symptoms such as REM sleep behavior disorder and olfactory loss, alongside cerebrospinal fluid (CSF) data and dopaminergic imaging markers, the system achieves a remarkable accuracy of 96.45%. This high level of accuracy underscores the system's capability to provide reliable early diagnosis, which is critical for timely intervention and better patient outcomes. The user-friendly interface, developed using Streamlit, ensures accessibility and ease of use across both PC and mobile platforms, making the system widely accessible. The system's ability to offer real-time analysis and feature importance insights further enhances its utility for

healthcare professionals and patients alike. Overall, the project not only addresses the need for early detection of PD but also aligns with the broader goals of preventive healthcare and equitable access to advanced diagnostic tools. The system's scalability and potential for integration into existing healthcare infrastructures highlight its readiness for widespread adoption and impact.Future enhancements for this project can significantly elevate its impact and usability. One major area of development is expanded data integration. By incorporating additional data sources such as genetic information, lifestyle factors, and detailed patient histories, the diagnostic accuracy can be further improved, providing a more comprehensive analysis. Another critical enhancement is the development of features for longitudinal tracking. This would allow for monitoring patient data over time, enabling the system to track disease progression and the effectiveness of interventions, thereby providing valuable insights for personalized treatment plans.These enhancements will not only improve the system's functionality but also ensure its broader adoption and impact on PD diagnosis and management.

REFERENCES

[1] R. Prashanth and S. D. Roy, ‘‘Early detection of Parkinson’s disease through patient questionnaire and predictive modelling,’’ Int. J. Med. Informat., vol. 119, pp. 75–87, Nov. 2018.

[2] N. Singh, V. Pillay, and Y. E. Choonara, ‘‘Advances in the treatment of Parkinson’s disease,’’ Prog. Neurobiol., vol. 81, pp. 29–44, Jan. 2007.

[3] H. Gunduz, ‘‘Deep learning-based Parkinson’s disease classification using vocal feature sets,’’ IEEE Access, vol. 7, pp. 115540–115551, 2019.

[4] A. Tsanas, M. A. Little, P. E. McSharry, and L. O. Ramig, ‘‘Accurate telemonitoring of Parkinson’s disease progression by noninvasive speech tests,’’ IEEE Trans. Biomed. Eng., vol. 57, no. 4, pp. 884–893, Apr. 2010.

[5] S. Lahmiri and A. Shmuel, ‘‘Detection of Parkinson’s disease based on voice patterns ranking and optimized support vector machine,’’ Biomed. Signal Process. Control, vol. 49, pp. 427–433, Mar. 2019.