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# Parkinson Disease Prediction

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***Abstract:*** *Parkinson's disease is a progressive disorder of the central nervous system affecting movement and inducing tremors and stiffness. It has 5 stages to it and affects more than 1 million individuals every year in India. This is chronic and has no cure yet. It is a neurodegenerative disorder affecting dopamine-producing neurons in the brain.With the increase in the severity of the disease, the patient's voice gets more and more deteriorated. The non-invasive treatments for voice analysis are available that helps in ameliorating the life quality of a patient. Thus, for building the telemonitoring and telediagnosis models for prediction, the speech analysis has been tremendously increased. The proper interpretation of speech signals is one of the important classification problems for Parkinson's disease diagnosis. Deep learning and machine learning techniques have been used as a part of the discovery for the efficient classification of PD. The various classification models like support vector machines, naive Bayes, deep neural networks, decision tree and random forest are effectively employed for classification purposes.The analysis of results of different research works showed that both machine learning and deep learning algorithms have shown promising future and therefore paving a better way for the detection of Parkinson's disease at its earlier stages. The classification accuracy achieved by the machine learning classifier.*

## I. INTRODUCTION

Parkinson's disease (PD) is currently the second most frequent neurodegenerative disease, after Alzheimer disease. Generally, there are two kinds of symptoms of PD, motor symptoms and non-motor symptoms. The main motor symptoms of PD are tremor, slowness of movement (bradykinesia), stiffness (rigidity), and poor balance (postural instability). Non-motor symptoms mainly include mood disorders, cognitive dysfunction, pain, sensory dysfunction, and dysautonomia. Motor speech disorders are common among PD patients. Speech disturbances such as very quiet and hurried speech occur in more than half of the patients. Analysis of speech signals is considered as an important non-invasive method for PD identification.

Non-invasive identification and prediction technology of PD is attractive to clinicians and neuroscientist. In addition, detection of voice changes in PD patients would make it possible for early detection and intervention before the onset of disabling physical symptoms.

Parkinson's Disease (PD) is a debilitating neurodegenerative disease which cannot be diagnosed through standardized blood tests, so a faster, cheaper diagnostic tool is essential. Using machine learning algorithms to analyse the variations in voice patterns is a novel method of predicting the existence of PD in patients. This paper proposes a predictive model that effectively diagnoses PD with maximum accuracy using a dataset that consists of extrapolated data from voice recordings of Parkinson's patients and unaffected subjects.

Parkinson's Disease is a chronic, progressive disease which affects movement throughout the body. There are many symptoms of PD, including tremors, bradykinesia, muscle rigidity, impaired balance, micrographic, changes in facial expressions, orthostatic hypotension, and many more. PD is a devastatingly widespread movement disorder, with nearly one million Americans currently suffering from it scientists have been looking into creating machine learning models to predict the symptoms of PD without conducting invasive clinical tests. There has also been work regarding the diagnosis of PD by analysing existing symptoms using machine learning techniques. One symptom of PD that has not been extensively researched is the effects it has on vocal patterns.

Researchers hypothesize that the disease can be diagnosed with a short voice recording, done even on a common smartphone. With smartphones and cheap recording devices being as ubiquitous as they currently are, there exists a need for machine learning models that are compact, lightweight, and accurate enough to detect voice patterns from a limited amount of data.

## II. PROBLEM DEFINATION

Prediction and Detection of Parkinson Disease using Machine Learning algorithms with the Dataset. So far existing systems are all about Parkinson Disease (PD) is detected at the secondary stage which leads to medical facilities and challenges. PD can generally be diagnosed with the following methods like MRI or CT scan but are not used to detect early signs of PD.Use Python and Jupyter Notebook for Data Visualization and Data Analytics.

## III. ANALYSIS AND DESIGN

**Hardware Requirements:**

- Laptop with Windows 10 and above
- 8GB RAM and above
- Any Processor will be compatible (Intel or Ryzen)
- 250 MB HDD.

**Software Requirements:**

- PYTHON (IDLE VERSION 3.7 AND ABOVE)
- JUPYTER NOTEBOOK

Python is an interpreted high-level general-purpose programming language. Its design philosophy emphasizes code readability with its use of significant indentation. Its language constructs as well as its object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.
Jupyter supports over 40 programming languages, including Python, R, Julia, and Scala.The best environment to capture this style of programming is Jupyter notebooks. You can work on bits of code, spell out your thoughts and when you are satisfied, put it all together.
Matplotlib You can generate static, dynamic, and interactive visuals with the Python programme Matplotlib. Matplotlib makes both challenging and basic tasks possible.
Seaborn A Python data visualisation toolkit called Seaborn uses the matplotlib library. It provides a sophisticated interface for designing eye-catching and illuminating statisticalgraphics. Seaborn helps you explore and understand your data.
Scikit or Sklearn Without a doubt, Python's most useful machine learning library is Scikit-learn. The sklearn toolkit for machine learning and statistical modelling includes a number of helpful features, including classification, regression, clustering, & dimensionality reduction. With sklearn, machine learning models were developedStreamlite Streamlit is a free and open-source framework to rapidly build and share beautiful machine learning and data science web apps. It is a Python-based library specifically designed for machine learning engineers. Data scientists or machine learning engineers are not web developers and they're not interested in spending weeks learning to use these frameworks to build web apps.

## IV. SYSTEM FLOW

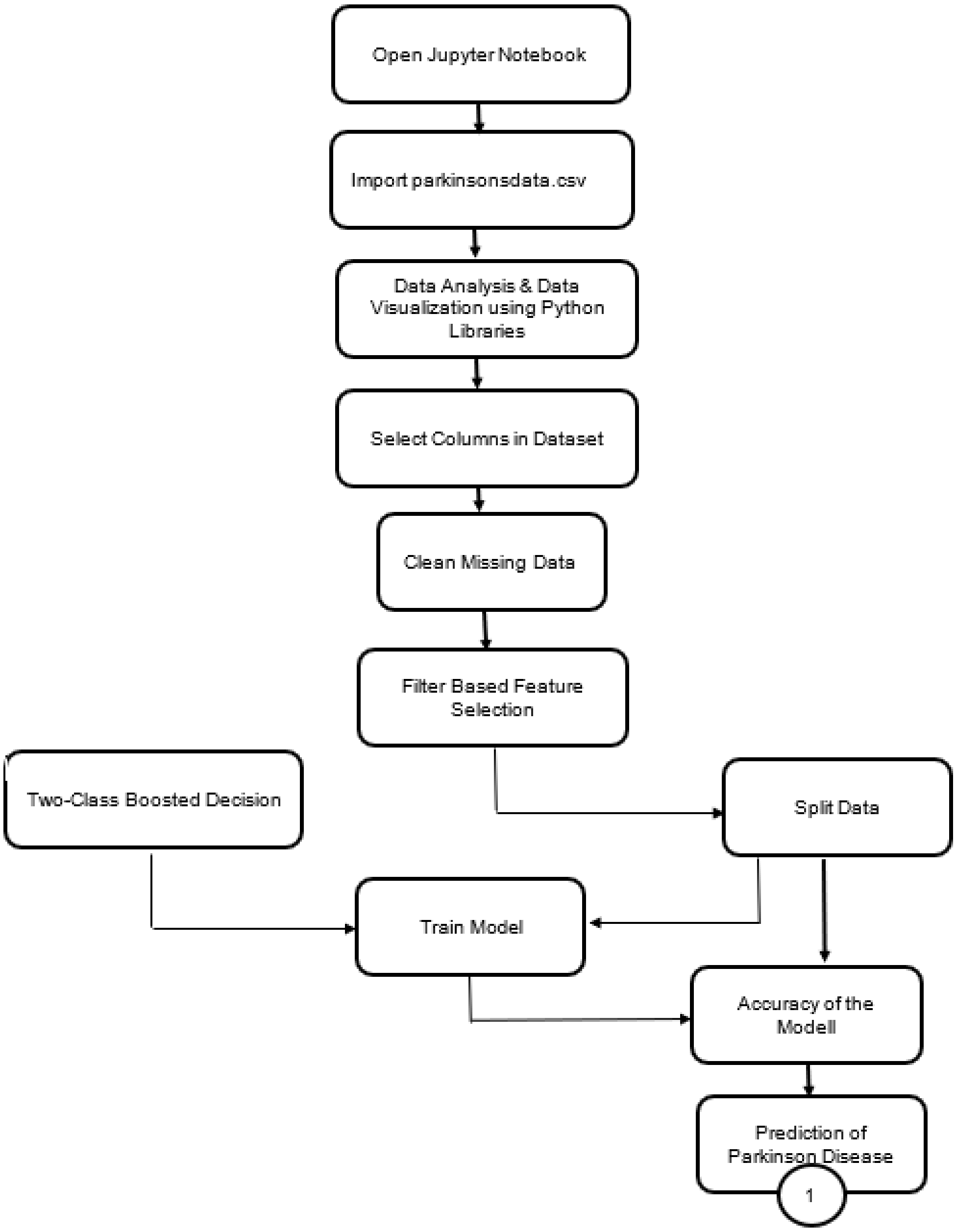


**Figure 3.1:** Flowchart of the Model

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## V. DATA FLOW DIAGRAM

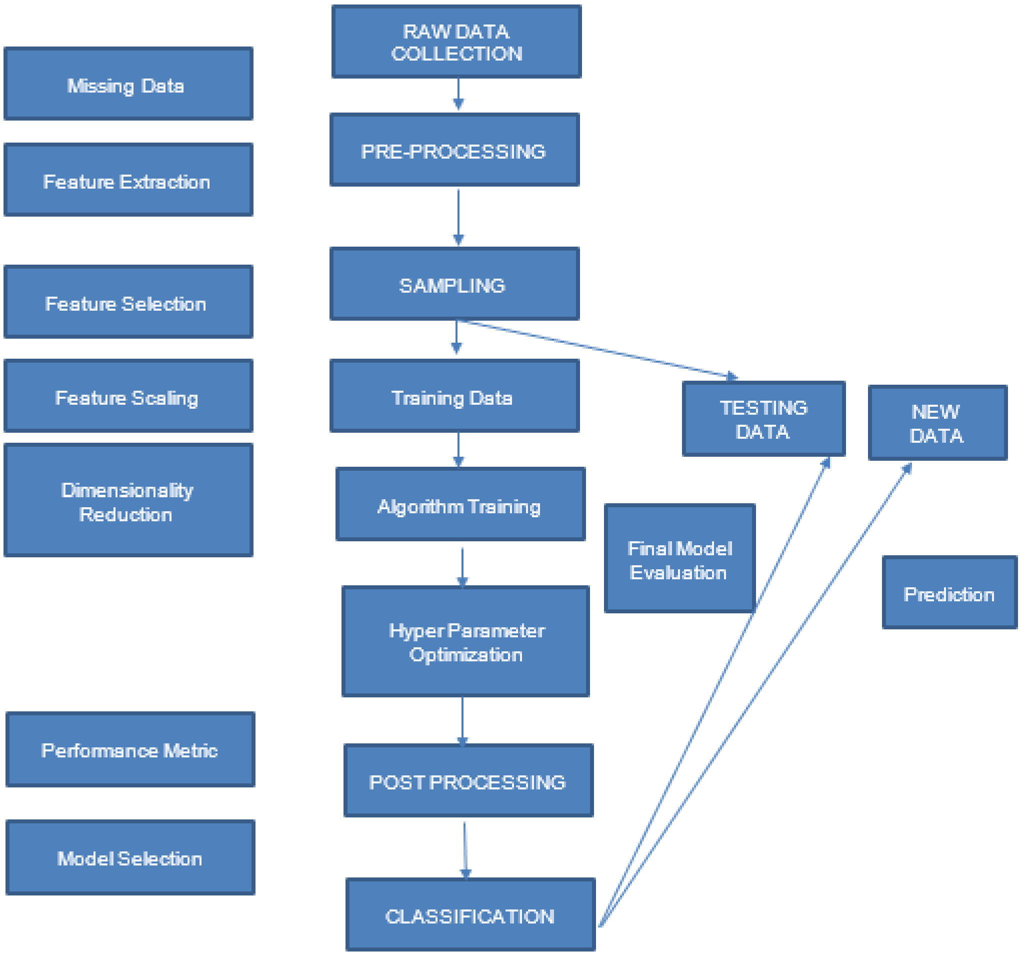


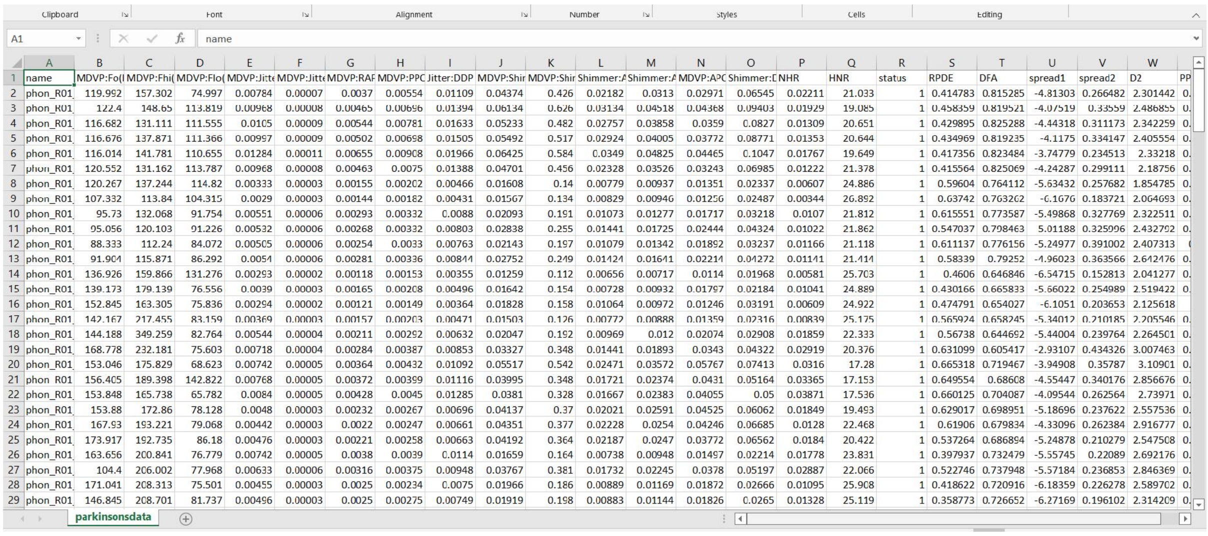

**Figure 3.2**: Dataflow Diagram of the Project

## VI. IMPLEMENTATION & RESULTS

To explore the data, I utilised Pandas, NumPy, matplotlib, and seaborn libraries. We created a model using the Sklearn library as well. After imported everything, we chose a present resolution for a graph to display at while I was exploring the data. Then I used pandas to import our dataset.

Based on the characteristics offered, we can conclude that pandas are the finest data processing tool. It can operate with different file kinds, maintain missing data, clean up data, and manage missing data. This suggests that it has the ability to read or write the data in a wide range of formats, include CSV, Excel, SQL, and many others.

The biological voice measures in this collection come from 31 people, 23 of whom suffer from Parkinson's disease (PD). Each row in the table correlates to being one of the 195 voice recordings that these persons made, and each column in the table denotes a distinct voice measure ("name" column). The "status" column, which would be set to 0 for healthy individuals and 1 for those with Parkinson's disease, is used to distinguish between healthy individuals and those with the condition.



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | name | MDVP:Fo( | MDVP:Fhi( | MDVP:Flo( | MDVP:Jitt | MDVP:Jitt | MDVP:RAF | MDVP:PPC | Jitter:DDP | MDVP:Shir | MDVP:Shir | Shimmer:A | Shimmer:A | MDVP:APC | Shimmer:D | NHR | HNR | status | RPDE | DFA | spread1 | spread2 | D2 | PP |
| 2 | phon_R01_ | 119.992 | 157.302 | 74.997 | 0.00784 | 0.00007 | 0.0037 | 0.00554 | 0.01109 | 0.04374 | 0.426 | 0.02182 | 0.0313 | 0.02971 | 0.06545 | 0.02211 | 21.033 | 1 | 0.414783 | 0.815285 | -4.81303 | 0.266482 | 2.301442 | 0. |
| 3 | phon_R01_ | 122.4 | 148.65 | 113.819 | 0.00968 | 0.00008 | 0.00465 | 0.00696 | 0.01394 | 0.06134 | 0.626 | 0.03134 | 0.04518 | 0.04368 | 0.09403 | 0.01929 | 19.085 | 1 | 0.458359 | 0.819521 | -4.07519 | 0.33559 | 2.486855 | 0. |
| 4 | phon_R01_ | 116.682 | 131.111 | 111.555 | 0.0105 | 0.00009 | 0.00544 | 0.00781 | 0.01633 | 0.05233 | 0.482 | 0.02757 | 0.03858 | 0.0359 | 0.0827 | 0.01309 | 20.651 | 1 | 0.429895 | 0.825288 | -4.44318 | 0.311173 | 2.342259 | 0. |
| 5 | phon_R01_ | 116.676 | 137.871 | 111.366 | 0.00997 | 0.00009 | 0.00502 | 0.00698 | 0.01505 | 0.05492 | 0.517 | 0.02924 | 0.04005 | 0.03772 | 0.08771 | 0.01353 | 20.644 | 1 | 0.434969 | 0.819235 | -4.1175 | 0.334147 | 2.405554 | 0. |
| 6 | phon_R01_ | 116.014 | 141.781 | 110.655 | 0.01284 | 0.00011 | 0.00655 | 0.00908 | 0.01966 | 0.06425 | 0.584 | 0.0349 | 0.04825 | 0.04465 | 0.1047 | 0.01767 | 19.649 | 1 | 0.417356 | 0.823484 | -3.74779 | 0.234513 | 2.33218 | 0. |
| 7 | phon_R01_ | 120.552 | 131.162 | 113.787 | 0.00968 | 0.00008 | 0.00463 | 0.0075 | 0.01388 | 0.04701 | 0.456 | 0.02328 | 0.03526 | 0.03243 | 0.06985 | 0.01222 | 21.378 | 1 | 0.415564 | 0.825069 | -4.24287 | 0.299111 | 2.18756 | 0. |
| 8 | phon_R01_ | 120.267 | 137.244 | 114.82 | 0.00333 | 0.00003 | 0.00155 | 0.00202 | 0.00466 | 0.01608 | 0.14 | 0.00779 | 0.00937 | 0.01351 | 0.02337 | 0.00607 | 24.886 | 1 | 0.59604 | 0.764112 | -5.63432 | 0.257682 | 1.854785 | 0. |
| 9 | phon_R01_ | 107.332 | 113.84 | 104.315 | 0.0029 | 0.00003 | 0.00144 | 0.00182 | 0.00431 | 0.01567 | 0.134 | 0.00829 | 0.00946 | 0.01256 | 0.02487 | 0.00344 | 26.892 | 1 | 0.63742 | 0.763262 | -6.1676 | 0.183721 | 2.064693 | 0. |
| 10 | phon_R01_ | 95.73 | 132.068 | 91.754 | 0.00551 | 0.00006 | 0.00293 | 0.00332 | 0.0088 | 0.02093 | 0.191 | 0.01073 | 0.01277 | 0.01717 | 0.03218 | 0.0107 | 21.812 | 1 | 0.615551 | 0.773587 | -5.49868 | 0.327769 | 2.322511 | 0. |
| 11 | phon_R01_ | 95.056 | 120.103 | 91.226 | 0.00532 | 0.00006 | 0.00268 | 0.00332 | 0.00803 | 0.02838 | 0.255 | 0.01441 | 0.01725 | 0.02444 | 0.04324 | 0.01022 | 21.862 | 1 | 0.547037 | 0.798463 | 5.01188 | 0.325996 | 2.432792 | 0. |
| 12 | phon_R01_ | 88.333 | 112.24 | 84.072 | 0.00505 | 0.00006 | 0.00254 | 0.0033 | 0.00763 | 0.02143 | 0.197 | 0.01079 | 0.01342 | 0.01892 | 0.03237 | 0.01166 | 21.118 | 1 | 0.611137 | 0.776156 | -5.24977 | 0.391002 | 2.407313 | 0 |
| 13 | phon_R01_ | 91.904 | 115.871 | 86.292 | 0.0054 | 0.00006 | 0.00281 | 0.00336 | 0.00844 | 0.02752 | 0.249 | 0.01424 | 0.01641 | 0.02214 | 0.04272 | 0.01141 | 21.414 | 1 | 0.58339 | 0.79252 | -4.96023 | 0.363566 | 2.642476 | 0. |
| 14 | phon_R01_ | 136.926 | 159.866 | 131.276 | 0.00293 | 0.00002 | 0.00118 | 0.00153 | 0.00355 | 0.01259 | 0.112 | 0.00656 | 0.00717 | 0.0114 | 0.01968 | 0.00581 | 25.703 | 1 | 0.4606 | 0.646846 | -6.54715 | 0.152813 | 2.041277 | 0. |
| 15 | phon_R01_ | 139.173 | 179.139 | 76.556 | 0.0039 | 0.00003 | 0.00165 | 0.00208 | 0.00496 | 0.01642 | 0.154 | 0.00728 | 0.00932 | 0.01797 | 0.02184 | 0.01041 | 24.889 | 1 | 0.430166 | 0.665833 | -5.66022 | 0.254989 | 2.519422 | 0. |
| 16 | phon_R01_ | 152.845 | 163.305 | 75.836 | 0.00294 | 0.00002 | 0.00121 | 0.00149 | 0.00364 | 0.01828 | 0.158 | 0.01064 | 0.00972 | 0.01246 | 0.03191 | 0.00609 | 24.922 | 1 | 0.474791 | 0.654027 | -6.1051 | 0.203653 | 2.125618 | |
| 17 | phon_R01_ | 142.167 | 217.455 | 83.159 | 0.00369 | 0.00003 | 0.00157 | 0.00203 | 0.00471 | 0.01503 | 0.126 | 0.00772 | 0.00888 | 0.01359 | 0.02316 | 0.00839 | 25.175 | 1 | 0.565924 | 0.658245 | -5.34012 | 0.210185 | 2.205546 | 0. |
| 18 | phon_R01_ | 144.188 | 349.259 | 82.764 | 0.00544 | 0.00004 | 0.00211 | 0.00292 | 0.00632 | 0.02047 | 0.192 | 0.00969 | 0.012 | 0.02074 | 0.02908 | 0.01859 | 22.333 | 1 | 0.56738 | 0.644692 | -5.44004 | 0.239764 | 2.264501 | 0. |
| 19 | phon_R01_ | 168.778 | 232.181 | 75.603 | 0.00718 | 0.00004 | 0.00284 | 0.00387 | 0.00853 | 0.03327 | 0.348 | 0.01441 | 0.01893 | 0.0343 | 0.04322 | 0.02919 | 20.376 | 1 | 0.631099 | 0.605417 | -2.93107 | 0.434326 | 3.007463 | 0. |
| 20 | phon_R01_ | 153.046 | 175.829 | 68.623 | 0.00742 | 0.00005 | 0.00364 | 0.00432 | 0.01092 | 0.05517 | 0.542 | 0.02471 | 0.03572 | 0.05767 | 0.07413 | 0.0316 | 17.28 | 1 | 0.665318 | 0.719467 | -3.94908 | 0.35787 | 3.10901 | 0. |
| 21 | phon_R01_ | 156.405 | 189.398 | 142.822 | 0.00768 | 0.00005 | 0.00372 | 0.00399 | 0.01116 | 0.03995 | 0.348 | 0.01721 | 0.02374 | 0.0431 | 0.05164 | 0.03365 | 17.153 | 1 | 0.649554 | 0.68608 | -4.55447 | 0.340176 | 2.856676 | 0. |
| 22 | phon_R01_ | 153.848 | 165.738 | 65.782 | 0.0084 | 0.00005 | 0.00428 | 0.0045 | 0.01285 | 0.0381 | 0.328 | 0.01667 | 0.02383 | 0.04055 | 0.05 | 0.03871 | 17.536 | 1 | 0.660125 | 0.704087 | -4.09544 | 0.262564 | 2.73971 | 0. |
| 23 | phon_R01_ | 153.88 | 172.86 | 78.128 | 0.0048 | 0.00003 | 0.00232 | 0.00267 | 0.00696 | 0.04137 | 0.37 | 0.02021 | 0.02591 | 0.04525 | 0.06062 | 0.01849 | 19.493 | 1 | 0.629017 | 0.698951 | -5.18696 | 0.237622 | 2.557536 | 0. |
| 24 | phon_R01_ | 167.93 | 193.221 | 79.068 | 0.00442 | 0.00003 | 0.0022 | 0.00247 | 0.00661 | 0.04351 | 0.377 | 0.02228 | 0.0254 | 0.04246 | 0.06685 | 0.0128 | 22.468 | 1 | 0.61906 | 0.679834 | -4.33096 | 0.262384 | 2.916777 | 0. |
| 25 | phon_R01_ | 173.917 | 192.735 | 86.18 | 0.00476 | 0.00003 | 0.00221 | 0.00258 | 0.00663 | 0.04192 | 0.364 | 0.02187 | 0.0247 | 0.03772 | 0.06562 | 0.0184 | 20.422 | 1 | 0.537264 | 0.686894 | -5.24878 | 0.210279 | 2.547508 | 0. |
| 26 | phon_R01_ | 163.656 | 200.841 | 76.779 | 0.00742 | 0.00005 | 0.0038 | 0.0039 | 0.0114 | 0.01659 | 0.164 | 0.00738 | 0.00948 | 0.01497 | 0.02214 | 0.01778 | 23.831 | 1 | 0.397937 | 0.732479 | -5.55745 | 0.22089 | 2.692176 | 0. |
| 27 | phon_R01_ | 104.4 | 206.002 | 77.968 | 0.00633 | 0.00006 | 0.00316 | 0.00375 | 0.00948 | 0.03767 | 0.381 | 0.01732 | 0.02245 | 0.0378 | 0.05197 | 0.02887 | 22.066 | 1 | 0.522746 | 0.737948 | -5.57184 | 0.236853 | 2.846369 | 0. |
| 28 | phon_R01_ | 171.041 | 208.313 | 75.501 | 0.00455 | 0.00003 | 0.0025 | 0.00234 | 0.0075 | 0.01966 | 0.186 | 0.00889 | 0.01169 | 0.01872 | 0.02666 | 0.01095 | 25.908 | 1 | 0.418622 | 0.720916 | -6.18359 | 0.226278 | 2.589702 | 0. |
| 29 | phon_R01_ | 146.845 | 208.701 | 81.737 | 0.00496 | 0.00003 | 0.0025 | 0.00275 | 0.00749 | 0.01919 | 0.198 | 0.00883 | 0.01144 | 0.01826 | 0.0265 | 0.01328 | 25.119 | 1 | 0.358773 | 0.726652 | -6.27169 | 0.196102 | 2.314209 | 0. |

parkinsonsdata

**Figure**: Dataset of Parkinson Disease

## VII. OUTPUT FORMS WITH DATA

We discovered that the data consists of 195 rows and 24 columns by using “shape" Then I used the.info extension to validate the types of data of each column. We then looked at the null values. Null values are merely the absence of data. () is essentially utilized to determine whether or not our dataset contains the 11-missing data. There were no missing values in the dataset, we discovered. We then witness several statistical calculations of our dataset, such as mean, median, count, etc., using. Describe ().

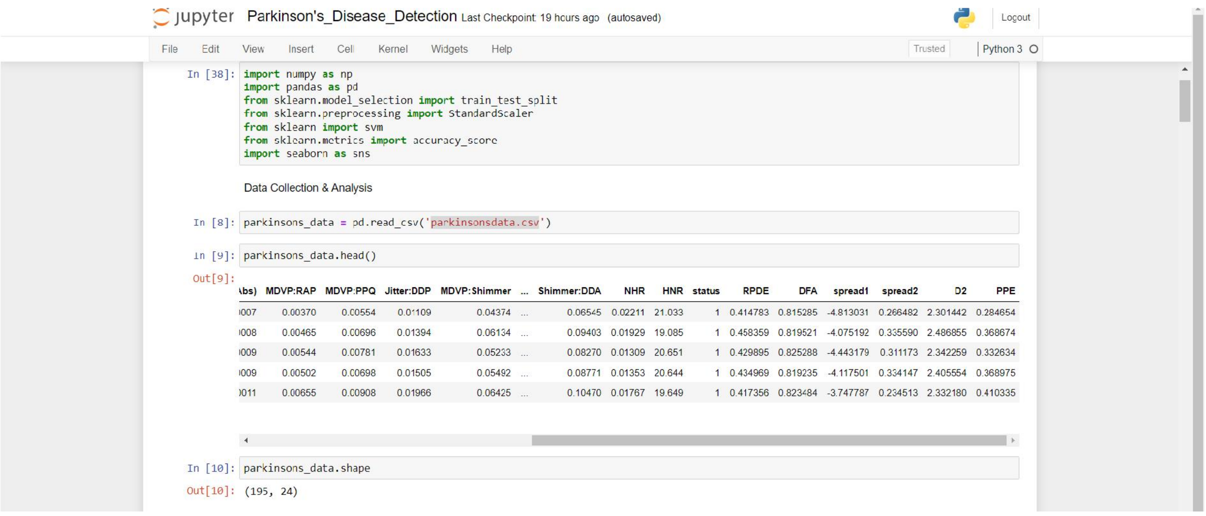



**Figure:** Importing Dataset into Jupyter Notebook

The Support Vector Machine, or SVM, is a popular Supervised Learning method that may be used to solve both classification and regression issues. However, it is mostly utilised in Machine Learning for Classification difficulties. The goal of the SVM algorithm is to determine the best decision boundary or line for classifying n-dimensional space into groups so that future additions of data points can be quickly assigned to the appropriate group. The border of the ideal choice is called a hyperplane.

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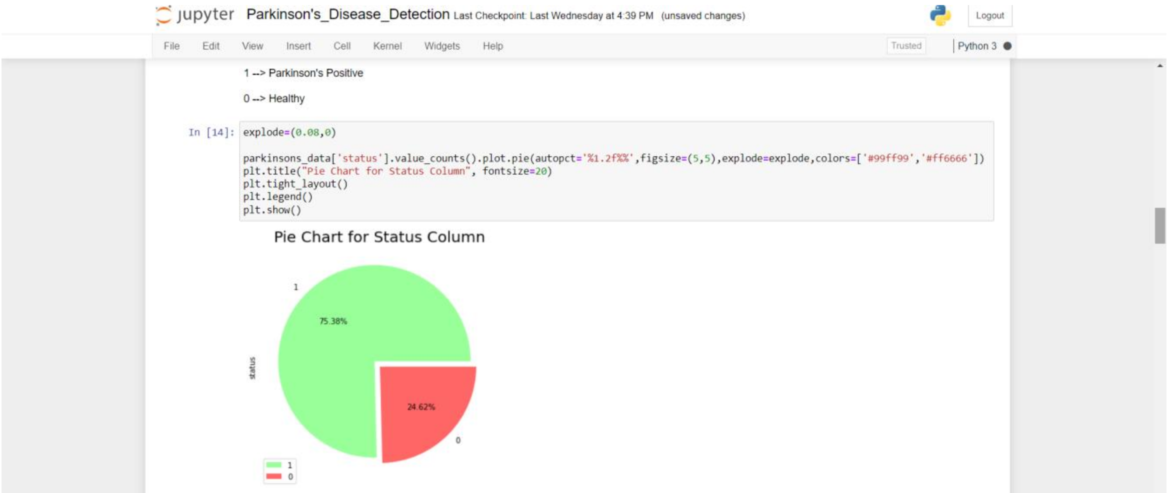


**Figure 4.3:** Data Visualization

Support vector machines (SVMs) were robust yet adaptable supervised machine learning techniques used for outlier detection, regression, and classification. SVMs are frequently employed in classification issues and are extremely effective in large dimensional spaces. Because they only use a portion of the training points inside the decision function, SVMs are well-liked and memory-efficient algorithms.

To determine the maximum marginal hyperplane (MMH), SVMs divide datasets into a number of classes, which can be accomplished in the following two steps: Support Vector Machines would first produce hyperplanes that best divide the classes through iterative generation.The hyperplane that properly separates the classes will then be selected.

Data Splitting is done to avoid a small concept called overfitting, a process where machine learning dataset is split into further sets to avoid wrong prediction.

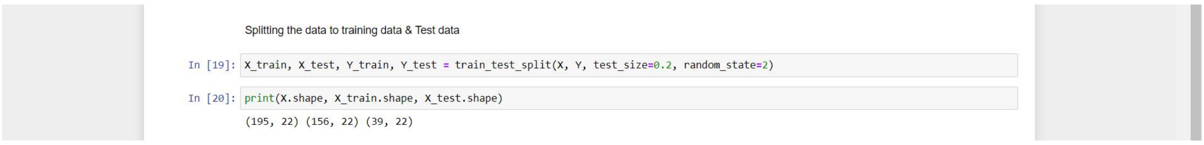


**Figure:**Splitting Dataset into Training and Testing

Accuracy of our Test Data and Train data is shown below where we reached accuracy of 87.00%

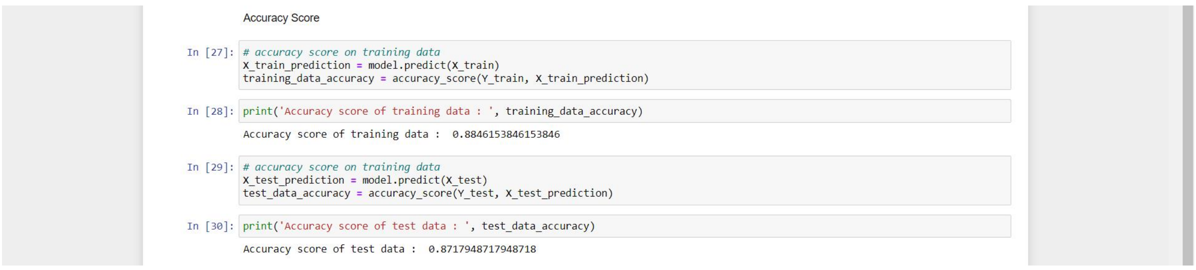


**Figure:** Accuracy of the Model

## VIII. TESTING

By feeding the values manually our machine learning model using Support vector machine will tell us whether the person is suffering from Parkinson Disease or not and the accuracy of our model is also accurate and good.


**Figure:** Prediction of person suffering from Parkinson Disease

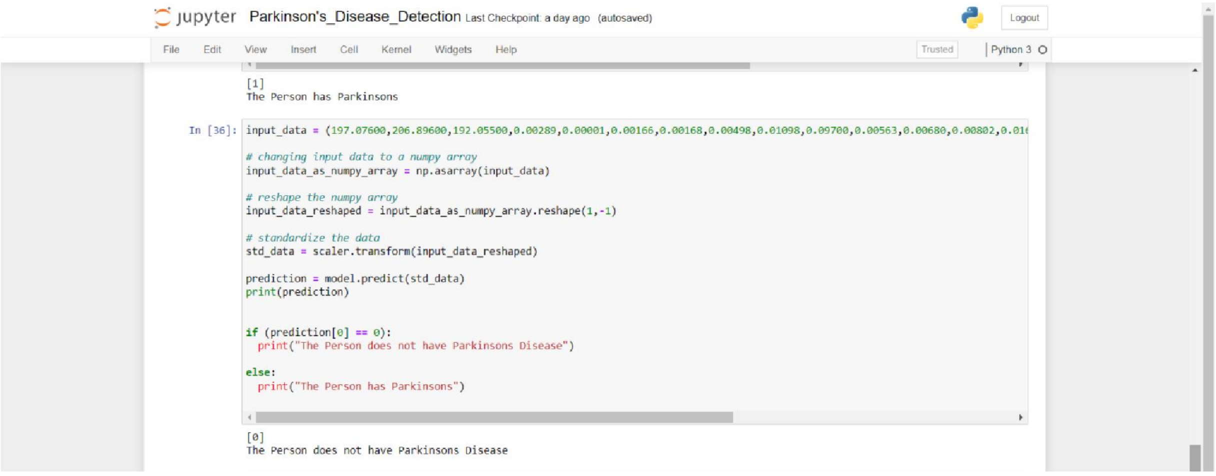


**Figure:** Prediction of person not suffering from Parkinson Disease

## IX. CONCLUSION

We have successfully made a machine learning model which can detect Parkinson disease in a person by providing certain information. With digitalization taking over every industry, including healthcare, Machine Learning helping healthcare industry and normal people to diagnose the diseases (like Parkinson disease) easily and at cheaper cost. Not only this, there are numerous applications of machine learning in Pharmaceutical and Healthcare industry, detection of disease is just a one part/one application of it.

Data Analytics and Data Visualization is another Step of Machine Learning where we can visualize the data and plot some graphs, we can use many other machine learning algorithms like Naïve Bayes, Linear Regression, Decision Tress, K-Mean Clustering but here we have used Support Vector Machine and got the training accuracy of 0.8846153846153846 %.

Our analysis provides a comparison of the effectiveness of various machine learning classifiers in disease diagnosis with noisy and high dimensional data. After thorough feature selection, clinical level accuracy is possible. These results are promising because they may introduce novel means to assess patient health and neurological diseases using voice data. Due to the high accuracy performed by the models with these short audio clips there is reason to believe denser feature sets with spoken word, video, or other modalities would aid in disease prediction and clinical validation of diagnosis in the future.

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