

**18CS3166S – MACHINE LEARNING**

**PROJECT BASED REPORT**

**ON**

**PREDICTION OF PARKINSON'S DISEASE**

*submitted in partial fulfilment of the requirement for the award of the degree of*

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**In**

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**By**

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**(2020-2021)**

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**CERTIFICATE**

This is certify that the project based report entitled “**PREDICTION OF PARKINSON’S DISEASE USING GAIT DATASET**” is a bonafide work done and submitted by SAI SOWRI VIKAS(180030271), G.LIKHITHA(180030305), P.V.SAI LATHA(180030350) in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF TECHNOLOGY** in Department of Computer Science Engineering, KLEF Guntur District during the academic year 2020-2021.

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By

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# INTRODUCTION

## **What is Parkinson's disease?**

Parkinson's disease is a brain disorder that leads to shaking, stiffness, and difficulty with walking, balance, and coordination.

Parkinson's symptoms usually begin gradually and get worse over time. As the disease progresses, people may have difficulty walking and talking. They may also have mental and behavioral changes, sleep problems, depression, memory difficulties, and fatigue. Both men and women can have Parkinson's disease. However, the disease affects about 50 percent more men than women.

One clear risk factor for Parkinson's is age. Although most people with Parkinson's first develop the disease at about age 60, about 5 to 10 percent of people with Parkinson's have "early-onset" disease, which begins before the age of 50. Early-onset forms of Parkinson's are often, but not always, inherited, and some forms have been linked to specific gene mutations.

## **What causes Parkinson's disease?**

Parkinson's disease occurs when nerve cells, or neurons, in an area of the brain that controls movement become impaired and/or die. Normally, these neurons produce an important brain chemical known as dopamine. When the neurons die or become impaired, they produce less dopamine, which causes the movement problems of Parkinson's.

## **Symptoms of Parkinson's Disease**

Parkinson's disease has four main symptoms:

- Tremor (trembling) in hands, arms, legs, jaw, or head
- Stiffness of the limbs
- Slowness of movement
- Impaired balance and coordination, sometimes leading to falls.

Other symptoms may include depression and other emotional changes; difficulty swallowing, chewing, and speaking; urinary problems or constipation; skin problems; and sleep disruptions.

## **Diagnosis of Parkinson's Disease**

There are currently no blood or laboratory tests to diagnose nongenetic cases of Parkinson's disease. Diagnosis is based on a person's medical history and a neurological examination.

## **Medicines for Parkinson's Disease**

Medicines prescribed for Parkinson's include:

- Drugs that increase the level of dopamine in the brain
- Drugs that affect other brain chemicals in the body
- Drugs that help control non motor symptoms

## Gait Dataset

Gait recognition is a popular pattern recognition problem for which attracts a lot of researchers from different communities such as computer vision, machine learning, biomedical, forensic studying and robotics. This problem also has great potential in industries such as visual surveillance.

Hence, The Intelligent Recognition & Digital Security Group, which was formed in 1998 by Prof. Tieniu Tan at NLPR (National Laboratory of Pattern Recognition), developed this dataset since Dec. 10, 2001. This Gait Recognition Dataset currently contains 4 subsets: Dataset A (standard dataset), Dataset B (multi view gait dataset) and Dataset C (infrared gait dataset), and Dataset D (gait and its corresponding footprint dataset).

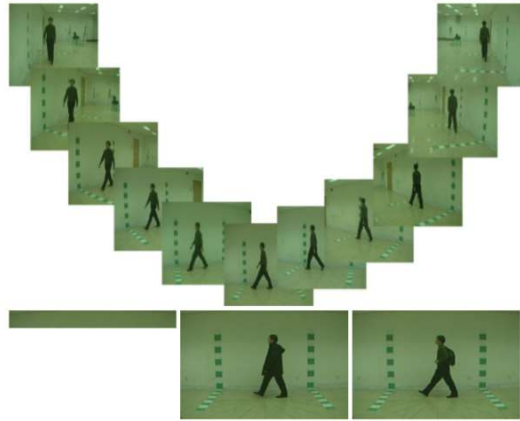
Basically, this dataset in a whole contains the Gaits (style of walking or movement of body) which is helpful for predicting the parkinson's disease.

This dataset contains 4 parts.

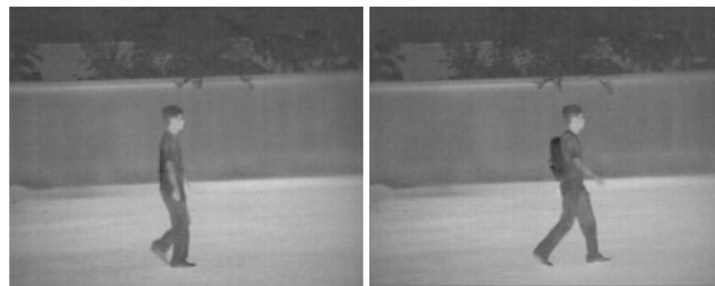
**Dataset A** (former NLPR Gait Database) was created on Dec. 10, 2001, including 20 persons. Each person has 12 image sequences, 4 sequences for each of the three directions, i.e. parallel, 45 degrees and 90 degrees to the image plane. The length of each sequence is not identical for the variation of the walker's speed, but it must ranges from 37 to 127. The size of Dataset A is about 2.2GB and the database includes 19139 images.



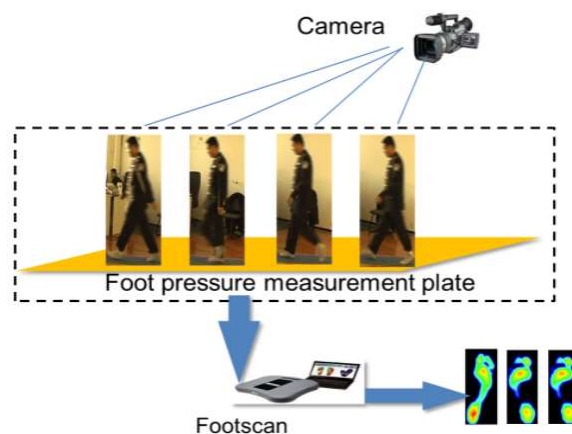
**Dataset B** is a large multiview gait database, which is created in January 2005. There are 124 subjects, and the gait data was captured from 11 views. Three variations, namely view angle, clothing and carrying condition changes, are separately considered.



**Dataset C** was collected by an infrared (thermal) camera in Jul.-Aug. 2005. It contains 153 subjects and takes into account four walking conditions: normal walking, slow walking, fast walking, and normal walking with a bag. The videos were all captured at night.



**Dataset D** was collected synchronously by camera and Rscan Footscan in Jul.-Aug. 2009. It contains 88 subjects and takes into account real surveillance scenes and wide age distribution.



The above mentioned details are about the first dataset created.

This is the information regarding the Parkinson's disease and the dataset (Gait dataset) that we are going to use in this project.

# METHODOLOGY

## **Problem statement:**

Prediction of Parkinson's Disease using Gait Dataset.

In this project, we should use Gait Dataset that represents the characteristics of a person i.e, movement of the body. Using this dataset and Machine learning algorithms we can predict if a person has the Parkinson's disease or not.

Here we used Random Forest Classifier algorithm to solve the problem.

## **Gait Dataset:**

Gait recognition is a popular pattern recognition problem for which attracts a lot of researchers from different communities such as computer vision, machine learning, biomedical, forensic studying and robotics. This problem also has great potential in industries such as visual surveillance.

Gait Dataset is a collection of different images of different objects in many angles or directions. Here, in this project, we use humans as the objects. The dataset contains images of humans, each human in various angles or postures.

The original Gait dataset is too large to handle. So, in this project we took a small gait dataset which is easier to handle with. The details regarding Gait dataset are already discussed in the introduction section.

## **Pre-processing:**

Pre-processing refers to the transformations applied to our data before feeding it to the algorithm.

Data Pre-processing is a technique that is used to convert the raw data into a clean data set. In other words, whenever the data is gathered from different sources it is collected in raw format which is not feasible for the analysis.

## **Need of Data Pre-processing:**

- For achieving better results from the applied model in Machine Learning projects the format of the data has to be in a proper manner. Some specified Machine Learning model needs information in a specified format,

for example, Random Forest algorithm does not support null values, therefore to execute random forest algorithm null values have to be managed from the original raw data set.

- Another aspect is that data set should be formatted in such a way that more than one Machine Learning and Deep Learning algorithms are executed in one data set, and best out of them is chosen.

Pre-processing involves mainly two steps



**Handling Categorical values:**

Categorical values are the values which are not numeric. If data contains this type of values the machine learning algorithm that we are using may not give proper results. So, to avoid the categorical values we use **LabelEncoder()**.

**LabelEncoder()** can be used to normalize labels. It can also be used to transform non-numerical labels (as long as they are hashable and comparable) to numerical labels. Transform labels back to original encoding. Transform labels to normalized encoding.

**Handling missing values:**

Missing values are nothing but the null values or N/A values in the data. These can be identified using functions like `isnull()` and we use `dropna()` to remove the missing values in the data.

The **`isnull()`** function is used to identify the missing values in the data.

The **`dropna()`** function is used to remove missing values. Determine if rows or columns which contain missing values are removed. 0, or 'index' : Drop rows which contain missing values. 1, or 'columns' : Drop columns which contain missing value.

Here, in the dataset we used the data is already cleaned. So we do not use `dropna()` function. We just use `isnull()` to check whether there are any null values. Since there are no null values we don't use `dropna()`.

**Feature Description:**

In our project the features are –

name, MDVP:Fo(Hz), MDVP:Fhi(Hz), MDVP:Flo(Hz), MDVP:Jitter(%), MDVP:Jitter(Abs), MDVP:RAP, MDVP:PPQ, Jitter:DDP, MDVP:Shimmer, MDVP:Shimmer(dB), Shimmer:APQ3, Shimmer:APQ5, MDVP:APQ, Shimmer:DDA, NHR, HNR, status, RPDE, DFA, spread1, spread2, D2, PPE.

Some basic terms,

MDVP – Multi Dimensional Voice Program

Jitter - slight irregular movement, variation, or unsteadiness, especially in an electrical signal or electronic device.

Shimmer – A new tool for gait analysis.

**Features:**

Name – The name of the patient

MDVP:Fo (Hz) - Average vocal fundamental frequency

MDVP:Fhi (Hz) - Maximum vocal fundamental frequency

MDVP:Flo (Hz) - Minimum vocal fundamental frequency  
MDVP:Jitter(%) – MDVP jitter in percentage  
MDVP:Jitter(Abs) - the average absolute difference of differences between **jitter** cycles  
MDVP:RAP - Five measures of variation in fundamental frequency  
MDVP:PPQ - MDVP five-point period perturbation quotient  
Jitter:DDP - This is the average absolute difference between consecutive differences between consecutive periods, divided by the average period.  
MDVP:Shimmer - MDVP local shimmer  
MDVP:Shimmer(dB) - MDVP local shimmer in dB  
Shimmer:APQ3 - Three-point amplitude perturbation quotient  
Shimmer:APQ5 - Five-point amplitude perturbation quotient  
MDVP:APQ11 - MDVP 11-point amplitude perturbation quotient  
Shimmer:DDA - Average absolute differences between the amplitudes of consecutive periods  
NHR - Noise-to-harmonics ratio  
HNR - Harmonics-to-noise ratio  
RPDE - Recurrence period density entropy measure  
D2 - Correlation dimension  
DFA - Signal fractal scaling exponent of detrended fluctuation analysis  
Spread1 - Two nonlinear measures of fundamental  
Spread2 - Frequency variation  
PPE - Pitch period entropy  
Status – The output of the data i.e., If the patient has the Parkinson's disease or not.

### **Algorithm:**

In this project, we used Random Forest Classifier Algorithm to predict the parkinson's disease.

### **Random Forest Classifier:**

Random forest is a supervised learning algorithm which is used for both classification as well as regression. But however, it is mainly used for classification problems. As we know that a forest is made up of trees and more trees means more robust forest.

Similarly, random forest algorithm creates decision trees on data samples and then gets the prediction from each of them and finally selects the best solution by means of voting. It is an ensemble method which is better than a single decision tree because it reduces the over-fitting by averaging the result.

For optimization, we used Recursive Feature Elimination With Cross-Validation. This indicates the features which are important with importance ranking. This enables us to build the model with optimal dimensions.

**Steps to predict Parkinson's disease using Random forest classifier:**

- Importing Libraries
- Loading Dataset
- Pre-processing of data
- Dividing the dataset
- Visualization of data
- Splitting the dataset into training and testing
- Initializing models and fitting the models with data
- Plotting with number of features and selected features
- Predicting the data
- Accuracy and Confusion matrix

By following these steps we can predict the Parkinson's disease using Gait dataset using the Random Forest Classifier algorithm.

# RESULTS AND DISCUSSION

## Dataset:

```
https://raw.githubusercontent.com/kanishksharma/Parkinson-Disease-Prediction-in-Early-Stages/master/parkinsons.csv
name,MDDP:Fo(Hz),MDDP:Fhi(Hz),MDDP:Flo(Hz),MDDP:Fjitter(%) ,MDDP:Fjitter(Abs),MDDP:RAP,MDDP:PPQ,Jitter:DDP,MDDP:Shimmer,MDDP:Shimmer(db),Shimmer:APQ3,Shimmer:APQ5,MDDP:APQ,Shimmer:DDA,HNR,HNR,status,RPDE,DFA,sprea
di,sread2,D2,PPE
phon_R01_S01_1,119.99200,157.36200,74.99700,0.00784,0.00007,0.00370,0.00554,0.01109,0.04374,0.42600,0.02182,0.03130,0.02071,0.06545,0.02211,21.03300,1,0.414783,0.815285,-4.81303,0.266482,2.301442,0.284654
phon_R01_S01_2,122.40000,148.65000,113.81900,0.00968,0.00008,0.00465,0.00696,0.01394,0.06134,0.62600,0.03134,0.04518,0.04368,0.09403,0.01929,10.08500,1,0.458359,0.819521,-4.075192,0.335590,2.486855,0.368674
phon_R01_S01_3,116.68200,131.11100,111.55500,0.00500,0.00009,0.00544,0.00781,0.01633,0.05233,0.48200,0.02757,0.03858,0.03590,0.08270,0.01309,20.65100,1,0.429895,0.825288,-4.443179,0.311173,2.342259,0.332634
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phon_R01_S01_5,116.01400,141.78100,110.45500,0.01284,0.00011,0.00655,0.00908,0.01966,0.06425,0.58000,0.03400,0.04825,0.04465,0.10470,0.01767,19.64900,1,0.417356,0.823484,-3.747787,0.234513,2.332180,0.410335
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phon_R01_S07_3,198.38300,215.20300,193.10400,0.00233,0.00001,0.00113,0.00135,0.00339,0.01263,0.11100,0.00640,0.00825,0.00951,0.01919,0.00115,30.77500,0,0.465546,0.738703,-7.067931,0.175181,1.512275,0.096320
phon_R01_S07_4,202.26600,211.60400,197.07000,0.00180,0.00009,0.00093,0.00107,0.00278,0.00954,0.08500,0.00469,0.00606,0.00719,0.01407,0.00072,32.68400,0,0.368535,0.742133,-7.695734,0.178540,1.544609,0.056141
phon_R01_S07_5,203.18400,211.52600,196.16000,0.00178,0.00009,0.00094,0.00106,0.00283,0.00958,0.08500,0.00468,0.00610,0.00726,0.01403,0.00065,33.04700,0,0.340068,0.741899,-7.964984,0.163519,1.423287,0.044539
phon_R01_S07_6,201.46400,210.56500,195.70800,0.00190,0.00105,0.00115,0.00314,0.01194,0.10700,0.00586,0.00760,0.00957,0.01758,0.00135,31.73200,0,0.344252,0.742757,-7.777865,0.170183,2.447064,0.057610
phon_R01_S08_1,177.87600,192.92100,168.01300,0.00411,0.00002,0.00233,0.00241,0.00700,0.02126,0.18900,0.01154,0.01347,0.01612,0.03463,0.00586,23.21600,1,0.360148,0.778834,-6.146653,0.180371,2.477082,0.165827
phon_R01_S08_2,176.17800,185.60400,163.56400,0.00369,0.00002,0.00205,0.00218,0.00616,0.01851,0.16800,0.00938,0.01160,0.01491,0.02814,0.00340,24.95100,1,0.341435,0.783626,-6.006414,0.196371,2.536527,0.173218
phon_R01_S08_3,180.19800,201.24900,175.45600,0.00284,0.00002,0.00133,0.00166,0.00459,0.01444,0.13100,0.00726,0.00885,0.01190,0.02177,0.00231,26.73800,1,0.403884,0.766209,0.452088,0.212294,2.269398,0.141929
phon_R01_S08_4,187.73300,202.32400,173.01500,0.00316,0.00002,0.00168,0.00182,0.00504,0.01663,0.15100,0.00829,0.01083,0.01366,0.02408,0.00265,26.31000,1,0.396793,0.758324,-6.006647,0.266892,2.382544,0.160691
phon_R01_S08_5,186.16300,197.72400,177.58400,0.00298,0.00002,0.00165,0.00175,0.00496,0.01495,0.13500,0.00774,0.00941,0.01233,0.02321,0.00231,26.82200,1,0.326480,0.765623,-6.647379,0.201095,2.374073,0.130554
phon_R01_S08_6,184.05500,196.53700,166.97700,0.00258,0.00001,0.00134,0.00147,0.00403,0.01463,0.13200,0.00742,0.00901,0.01234,0.02226,0.00257,26.45300,1,0.306443,0.759203,-7.044105,0.063412,2.361532,0.115730
phon_R01_S10_1,127.22600,247.32600,225.22700,0.00298,0.00001,0.00169,0.00182,0.00507,0.01752,0.16400,0.01035,0.01024,0.01133,0.03104,0.00740,22.73600,0,0.305062,0.654172,-7.310590,0.098648,2.416838,0.095932
phon_R01_S10_2,241.40400,248.83400,232.48300,0.00281,0.00001,0.00157,0.00173,0.00470,0.01760,0.15400,0.01006,0.01038,0.01251,0.03017,0.00675,23.14500,0,0.457702,0.634267,-6.793547,0.158266,2.256699,0.117399
phon_R01_S10_3,243.43900,250.91200,232.43500,0.00210,0.00009,0.00109,0.00137,0.00327,0.01413,0.12600,0.00777,0.00898,0.01033,0.02330,0.00454,25.36800,0,0.438296,0.635285,-7.057869,0.091608,2.330716,0.091470
phon_R01_S10_4,242.85200,255.03400,227.91300,0.00225,0.00009,0.00117,0.00139,0.00350,0.01494,0.13400,0.00847,0.00879,0.01014,0.02542,0.00476,25.03200,0,0.431285,0.638928,-6.995820,0.162083,2.365800,0.102706
phon_R01_S10_5,245.51000,263.00000,231.84800,0.00235,0.00010,0.00127,0.00148,0.00360,0.01608,0.14100,0.00806,0.00877,0.01149,0.02718,0.00476,24.60200,0,0.467480,0.631653,-7.156076,0.197127,2.307236,0.107236
```

## Outputs:

```
https://raw.githubusercontent.com/kanishksharma/Parkinson-Disease-Prediction-in-Early-Stages/master/parkinsons.csv
localhost:8889/notebooks/180030350_ML_FINAL_PROJECT.ipynb
jupyter 180030350_ML_FINAL_PROJECT Last Checkpoint: 28 minutes ago (autosaved)
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In [ ]: import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import statistics as s

Loading Dataset
In [2]: data=pd.read_csv('https://raw.githubusercontent.com/kanishksharma/Parkinson-Disease-Prediction-in-Early-Stages/master/parkinsons.csv')
data.head()

Out[2]: MDDP:RAP MDDP:PPQ Jitter:DDP MDDP:Shimmer ... Shimmer:DDA NHR HNR status RPDE DFA spread1 spread2 D2 PPE
0.00370 0.00564 0.01109 0.04374 ... 0.06545 0.02211 21.033 1 0.414783 0.815285 -4.81303 0.266482 2.301442 0.284654
0.00465 0.00696 0.01394 0.06134 ... 0.09403 0.01929 10.085 1 0.458359 0.819521 -4.075192 0.335590 2.486855 0.368674
0.00544 0.00781 0.01633 0.05233 ... 0.08270 0.01309 20.651 1 0.429895 0.825288 -4.443179 0.311173 2.342259 0.332634
0.00502 0.00698 0.01505 0.05492 ... 0.08771 0.01533 20.644 1 0.434969 0.819235 -4.117501 0.334147 2.405554 0.368975
0.00655 0.00908 0.01966 0.06425 ... 0.10470 0.01767 19.649 1 0.417356 0.823484 -3.747787 0.234513 2.332180 0.410335

Preprocessing of data
```

https://raw.githubusercontent.com/180030350\_ML\_FINAL\_PROJECT x +

localhost:8889/notebooks/180030350\_ML\_FINAL\_PROJECT.ipynb

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### Preprocessing of data

```
In [3]: data.columns
```

```
Out[3]: Index(['name', 'MDVP:F0(Hz)', 'MDVP:F1(Hz)', 'MDVP:F2(Hz)', 'MDVP:Jitter(X)',  
            'MDVP:Jitter(Abs)', 'MDVP:RAP', 'MDVP:PPQ', 'Jitter:DDP',  
            'MDVP:Shimmer', 'MDVP:Shimmer(db)', 'Shimmer:APQ3', 'Shimmer:APQ5',  
            'MDVP:APQ', 'Shimmer:DDA', 'HNR', 'HNR', 'status', 'RPDE', 'DFA',  
            'spread1', 'spread2', 'D2', 'PPE'],  
            dtype='object')
```

```
In [4]: data.isnull().sum()
```

```
Out[4]: name                0  
MDVP:F0(Hz)              0  
MDVP:F1(Hz)              0  
MDVP:F2(Hz)              0  
MDVP:Jitter(X)           0  
MDVP:Jitter(Abs)         0  
MDVP:RAP                  0  
MDVP:PPQ                  0  
Jitter:DDP                0  
MDVP:Shimmer              0  
MDVP:Shimmer(db)         0  
Shimmer:APQ3              0  
Shimmer:APQ5              0  
MDVP:APQ                  0  
Shimmer:DDA               0  
HNR                       0  
HNR                       0  
status                    0  
RPDE                      0  
DFA                       0  
spread1                   0  
spread2                   0  
D2                        0  
dtype: object
```

https://raw.githubusercontent.com/180030350\_ML\_FINAL\_PROJECT x +

localhost:8889/notebooks/180030350\_ML\_FINAL\_PROJECT.ipynb

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```
spread1                0  
spread2                0  
D2                     0  
PPE                    0  
dtype: int64
```

### Dividing the dataset

```
In [6]: list=['name','status']  
X=data.drop(list,axis = 1)  
X
```

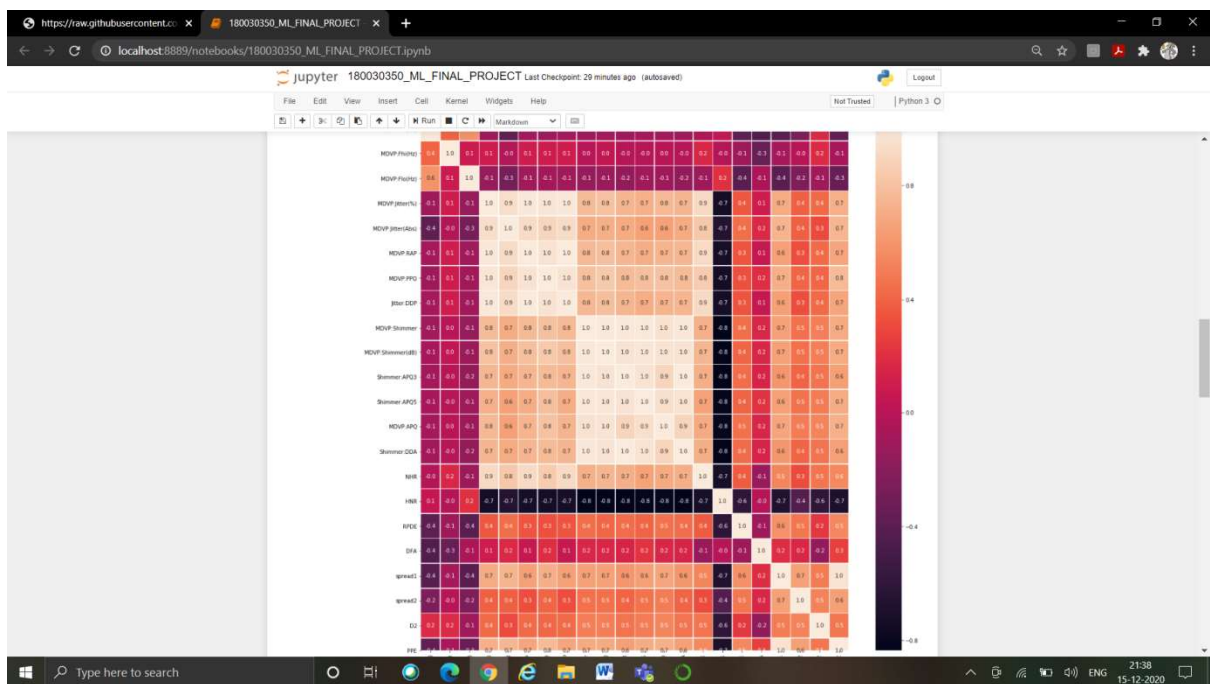
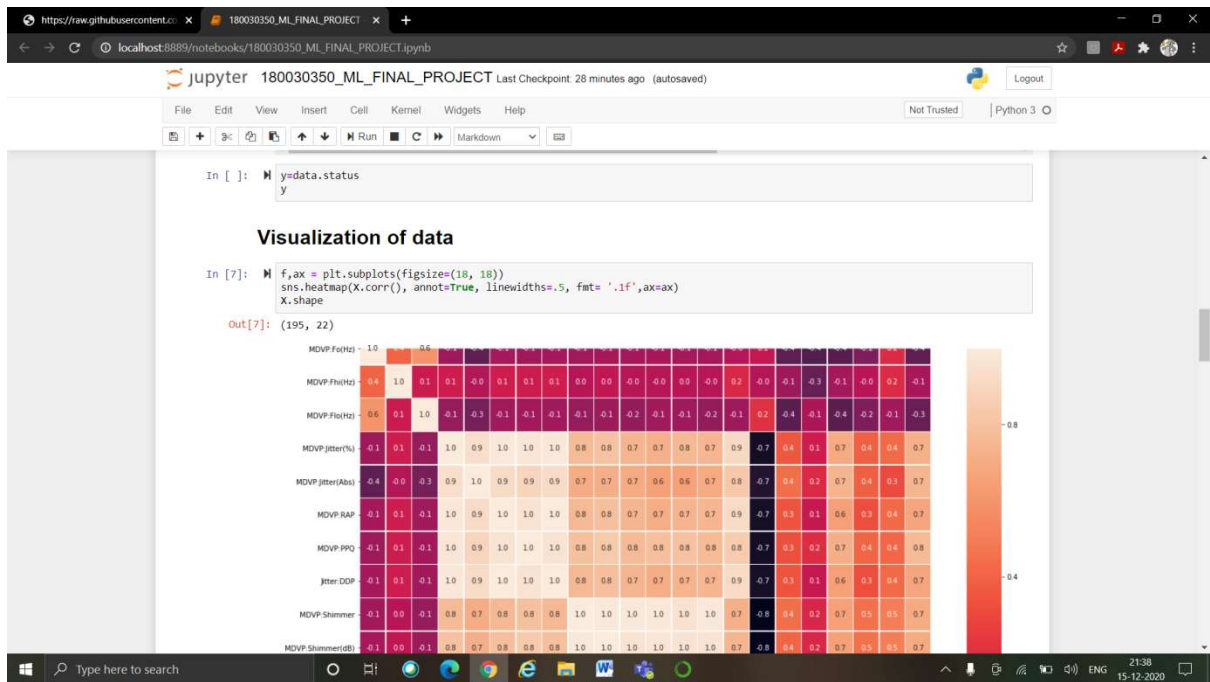
```
Out[6]:
```

	MDVP:F0(Hz)	MDVP:F1(Hz)	MDVP:F2(Hz)	MDVP:Jitter(X)	MDVP:Jitter(Abs)	MDVP:RAP	MDVP:PPQ	Jitter:DDP	MDVP:Shimmer	MDVP:Shimmer(db)
0	119.992	157.302	74.997	0.00784	0.00007	0.00370	0.00554	0.01109	0.04374	0.426
1	122.400	148.650	113.819	0.00968	0.00008	0.00465	0.00696	0.01394	0.06134	0.626
2	116.682	131.111	111.555	0.01050	0.00009	0.00544	0.00781	0.01633	0.05233	0.482
3	116.676	137.871	111.366	0.00997	0.00009	0.00502	0.00698	0.01505	0.05492	0.517
4	116.014	141.781	110.655	0.01284	0.00011	0.00655	0.00908	0.01966	0.06425	0.584
...	...	...	...	...	...	...	...	...	...	...
190	174.188	230.978	94.261	0.00459	0.00003	0.00263	0.00259	0.00790	0.04087	0.406
191	209.516	253.017	89.488	0.00564	0.00003	0.00331	0.00292	0.00994	0.02751	0.263
192	174.688	240.005	74.287	0.01360	0.00008	0.00624	0.00564	0.01873	0.02308	0.256
193	198.764	396.961	74.904	0.00740	0.00004	0.00370	0.00390	0.01109	0.02296	0.241
194	214.289	260.277	77.973	0.00567	0.00003	0.00295	0.00317	0.00885	0.01884	0.196

195 rows x 22 columns

```
In [ ]: y=data.status
```







https://raw.githubusercontent.com/180030350/ML\_FINAL\_PROJECT x +

localhost:8889/notebooks/180030350\_ML\_FINAL\_PROJECT.ipynb

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```

min_weight_fraction_leaf=0.0,
n_estimators=600, n_jobs=None,
oob_score=False, random_state=0,
verbose=0, warm_start=False),
min_features_to_select=1, n_jobs=None, scoring='accuracy', step=1,
verbose=0)

In [13]: rfecv = rfecv.fit(X_train, y_train)

In [14]: rfecv.grid_scores_

Out[14]: array([0.81604269, 0.84292282, 0.85609085, 0.88408867, 0.89052545,
0.87719212, 0.89075534, 0.8636289 , 0.87029557, 0.87029557,
0.87719212, 0.88385878, 0.88385878, 0.87719212, 0.88385878,
0.88385878, 0.88385878, 0.87052545, 0.87719212, 0.87052545,
0.87052545, 0.87719212])

In [15]: print('Optimal number of features :', rfecv.n_features_)
rfecv.predict_proba(X)

print('Best features :', X.columns[(rfecv.get_support())])

Optimal number of features : 7
Best features : Index(['MDVP:F0(Hz)', 'Shimmer:APQ5', 'MDVP:APQ', 'Shimmer:DDA', 'spread1',
'spread2', 'ppt'],
dtype='object')

```

### Plotting with Number of features and selected features

```

In [16]: import matplotlib.pyplot as plt
plt.figure()
plt.xlabel("Number of features selected")
plt.ylabel("Cross validation score of number of selected features")
plt.plot(range(1, len(rfecv.grid_scores_) + 1), rfecv.grid_scores_)
plt.show()

```

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localhost:8889/notebooks/180030350\_ML\_FINAL\_PROJECT.ipynb

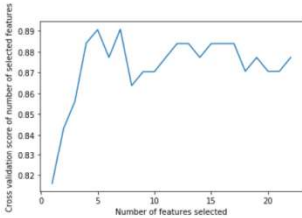
jupyter 180030350\_ML\_FINAL\_PROJECT Last Checkpoint: 29 minutes ago (autosaved) Logout

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```

plt.plot(range(1, len(rfecv.grid_scores_) + 1), rfecv.grid_scores_)
plt.show()

```



### Predicting the data

```

In [17]: from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
clf_rf_4 = clf_rf_4.fit(X_train, y_train)

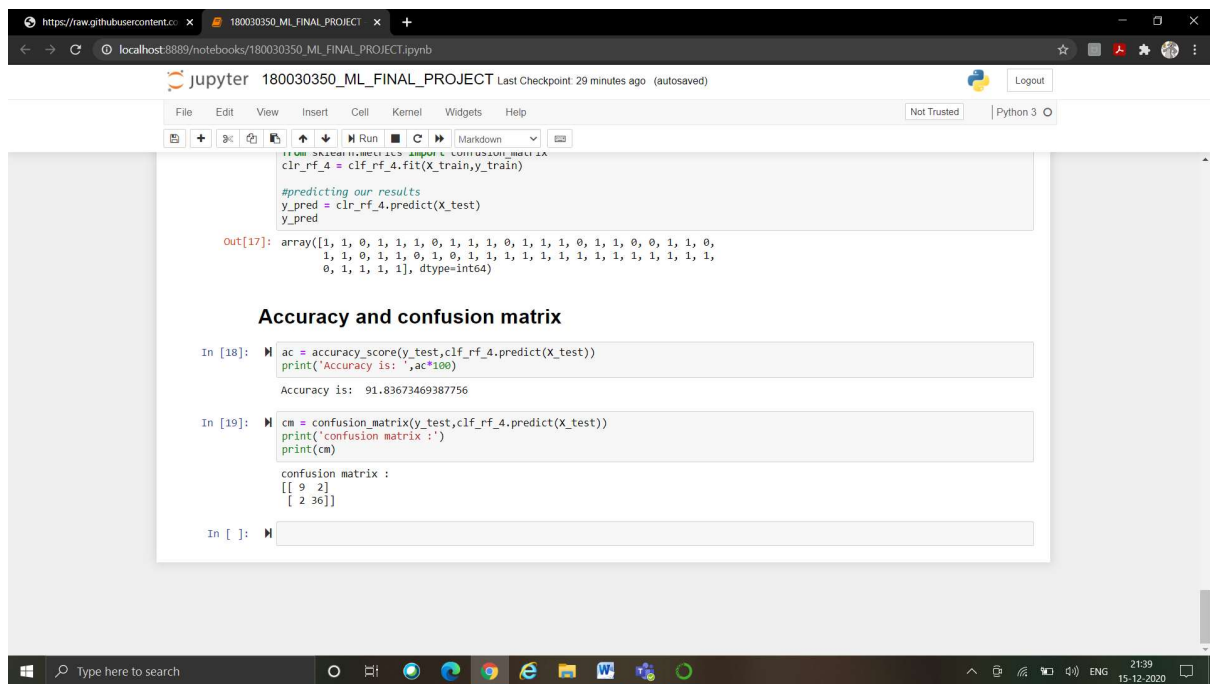
#predicting our results
y_pred = clf_rf_4.predict(X_test)
y_pred

Out[17]: array([1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0,
1, 1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
0, 1, 1, 1, 1], dtype=int64)

```

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The screenshot shows a Jupyter Notebook titled "180030350\_ML\_FINAL\_PROJECT" running on a local host. The notebook contains the following code and output:

```
clf_rf_4 = clf_rf_4.fit(X_train,y_train)

#predicting our results
y_pred = clf_rf_4.predict(X_test)
y_pred

out[17]: array([1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0,
                1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
                0, 1, 1, 1, 1], dtype=int64)
```

**Accuracy and confusion matrix**

```
In [18]: ac = accuracy_score(y_test,clf_rf_4.predict(X_test))
print('Accuracy is: ',ac*100)

Accuracy is: 91.83673469387756

In [19]: cm = confusion_matrix(y_test,clf_rf_4.predict(X_test))
print('confusion matrix :')
print(cm)

confusion matrix :
[[ 9  2]
 [ 2 36]]

In [ ]:
```

The bottom of the image shows a Windows taskbar with the date and time "21:39 15-12-2020".

If the status is 1 then the patient has Parkinson's Disease. Otherwise, no disease.

# CONCLUSION

In this machine learning project, we learned to detect the presence of Parkinson's Disease in individuals using various factors. We used an RandomForestClassifier for this and made use of the sklearn library to prepare the dataset. This gives us an accuracy of 91%, by using a optimization technique "RFECV"( Recursive feature elimination with cross-validation) which will use the most important features of data.

Our Feature scope is to try this model for bigger dataset (real world example) and improve the model to get the best accuracy.

## **References:**

Information about Parkinson's disease -

<https://www.google.com/search?q=parkinson%27s+disease&oq=parkinson&aqs=chrome.0.35i39i457j69i57j0j0i433l2j69i65j69i60j69i61.3101j0j7&sourceid=chrome&ie=UTF-8>

Some more references:

[https://www.researchgate.net/publication/304450806\\_Diagnosis\\_of\\_Parkinson's\\_disease\\_progress\\_and\\_future\\_prospects](https://www.researchgate.net/publication/304450806_Diagnosis_of_Parkinson's_disease_progress_and_future_prospects)

[http://www.cbsr.ia.ac.cn/users/szheng/?page\\_id=71](http://www.cbsr.ia.ac.cn/users/szheng/?page_id=71)

**\*THANK YOU\***