Final Project Report

Applied Data Science

Team ID	PNT2022TMID38399
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Project Name	Project - Detecting Parkinson's Disease usingMachine Learning

1. INTRODUCTION

1.1 Project Overview

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. For detecting PD, various machine learning models such as logistic regression, naive Bayes, KNN, and forest decision tree were used, with the features used here being minimum-redundancy maximum-relevance and recursive feature elimination. The accuracy obtained was 95.3% using data from the UCI machine learning repository. The researchers found that the drawing speed was slower and the pen pressure is lower among Parkinson's patients. One of the indications of Parkinson's is tremors and rigidity in the muscles, making it difficult to draw smooth spirals and waves. It is possible to detect Parkinson's disease using the drawings alone instead of measuring the speed and pressure of the pen on paper. Our goal is to quantify the visual appearance (using HOG method) of these drawings and then train a machine learning model to classify them. In this project, We are using, Histogram of Oriented Gradients (HOG) image descriptor along with a Random Forest classifier to automaticallydetect Parkinson's disease in hand-drawn images of spirals and waves.

Purpose

By using machine learning techniques, the problem can be solved with minimal error rate. The voice dataset of Parkinson's disease from the UCI Machine learning library is used as input. Also, our proposed system provides accurate results by integrating spiral drawing inputs of normal and Parkinson's affected patients. Machine learning also allows for combining different modalities, such as magnetic resonance imaging (MRI) and single-photon emission computed tomography (SPECT) data. in the diagnosis of PD. By using machine learning approaches, we may therefore identify relevant features that are not traditionally used in the clinical diagnosis of PD and rely on these alternative measures to detect PD in preclinical stages or atypical forms. In recent years, the number of publications on the application of machine learning to the diagnosis of PD has increased. feasibility and efficiency of different machine learning methods in the diagnosis of PD, and (c) provide machine learning practitioners interested in the diagnosis of PD with an overview of previously used models and data modalities and the associated outcomes, and recommendations on how experimental protocols and results could be reported to facilitate reproduction. As a result, the application of machine learning to clinical and non-clinical data of different modalities has often led to high diagnostic accuracies in human participants, therefore may encourage the adaptation of machine learning algorithms and novel biomarkers in clinical settings to assist more accurate and informed decision making. While Parkinson’s cannot be cured, early detection along with proper medication can significantly improve symptoms and quality of life.

2. LITERATURE SURVEY

2.1 Existing Solution and Problem

[1] Author Name: . Jie Mei, Christian Desrosiers, Johannes Frasnelli, "Machine Learning for the Diagnosis of Parkinson’s Disease," 2021..

Title: "Machine Learning for the Diagnosis of Parkinson’s Disease,"

Published in: 2021

This paper conveys extremely about the importance of Diagnosis of Parkinson's disease (PD) is commonly based on medical observations and assessment of clinical signs, including the characterization of a variety of motor symptoms. However, traditional diagnostic approaches may suffer from subjectivity as they rely on the evaluation of movements that are sometimes subtle to human eyes and therefore difficult to classify, leading to possible misclassification. In the meantime, early non-motor symptoms of PD may be mild and can be caused by many other conditions. Therefore, these symptoms are often overlooked, making diagnosis of PD at an early stage challenging. To address these difficulties and to refine the diagnosis and assessment procedures of PD, machine learning methods have been implemented for the classification of PD and healthy controls or patients with similar clinical presentations (e.g., movement disorders).

[2] Author name: C K Gomathy,

Title: “The Parkinson’s Disease Detection using Machine Learning Techniques.”

Published in: 2020

The Parkinson's disease is progressive neuro degenerative disorder that affects a lot only people significantly affecting their quality of life. It mostly affects the motor functions of human. The main motor symptoms are called "parkinsonism" or "parkinsonian syndrome". The symptoms of Parkinson's disease will occur slowly, the symptoms include shaking, rigidity, slowness of movement and difficulty with walking, Thinking and behavior change, Depression and anxiety are also common. There is a model for detecting Parkinson's using voice. The deflections in the voice will confirm the symptoms of Parkinson's disease. This project showed 73.8% efficiency. In this model, a huge amount of data is collected from the normal person and previously affected person by Parkinson's disease. these data are trained using machine learning algorithms. From the whole data 60% is used for training and 40% is used for testing. The data of any person can be entered in db to check whether the person is affected by Parkinson’s disease or not.

[3] Author name: Iqra Nissar, Waseem Ahmad Mir, Izharuddin, Tawseef Ayoub Shaikh,
Title: “Machine Learning Approaches for Detection and Diagnosis of Parkinson’s Disease,”
Published in: 2021
Parkinson's disease (PD) is disabling disease that affects the quality of life. It happens due to the death of cells that produce dopamine's in the substantia nigra part of the central nervous system (CNS) which affects the human body. People who have Parkinson's disease feel difficulty in doing activities like speaking, writing, and walking. However, speech analysis is the most considered technique to be used. Researches have shown that 90% of the people who suffer from Parkinson's disease have speech disorders. With the increase in the severity of the disease, the patient's voice gets more and more deteriorated. The proper interpretation of speech signals is one of the important classification problems for Parkinson's disease diagnosis. This paper contemplates the survey work of the machine learning techniques and deep learning procedures used for Parkinson's disease classification.

[4] Author name: Radouani Laila, Lagdali Salwa, Rziza Mohammed
Title: “Detection of voice impairment for parkinson’s disease using machine learning tools,”
Published in: 2021
In this paper, it proposes that Parkinson's disease (PD) is disabling disease that affects the quality of life. It happens due to the death of cells that produce dopamine's in the substantia nigra part of the central nervous system (CNS) which affects the human body. People who have Parkinson's disease feel difficulty in doing activities like speaking, writing, and walking. Speech analysis is the most considered technique to be used. Researches have shown that 90% of the people who suffer from Parkinson's disease have speech disorders. With the increase in the severity of the disease, the patient's voice gets more and more deteriorated. The proper interpretation of speech signals is one of the important classification problems for Parkinson's disease diagnosis. The main purpose of this paper is to contemplate the survey work of the machine learning techniques and deep learning procedures used for Parkinson's disease classification.

2.2 References

[1] Jie Mei, Christian Desrosiers, Johannes Frasnelli, "Machine Learning for the Diagnosis of Parkinson’s Disease," 2021.
[2] C K Gomathy, “The Parkinson’s Disease Detection using Machine Learning

Techniques." 2021

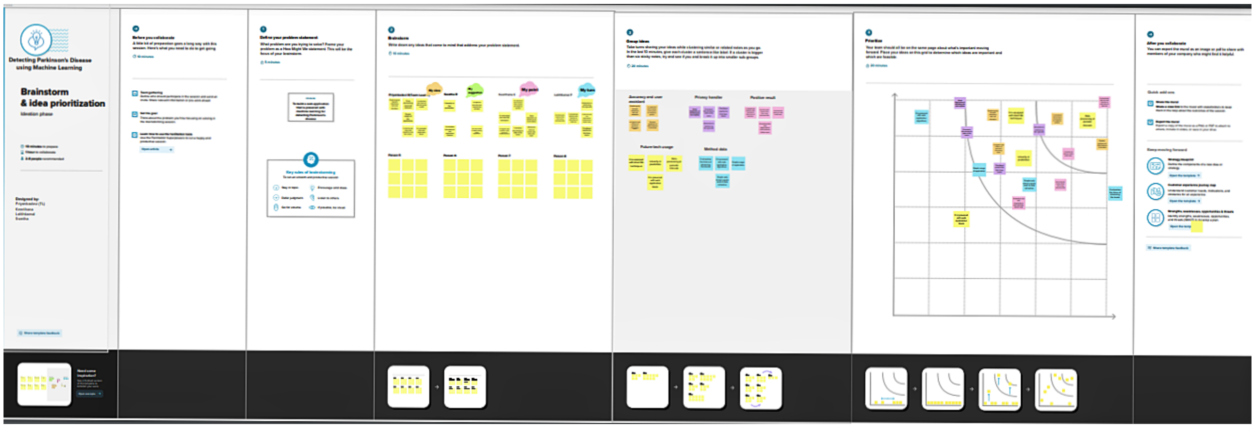
2.3 Problem Statement Definition

It processes the breathing signals using a neural network that infer whether the person has parkinson's disease, and if they are identified then it assesses the severity of their disease in accordance with the Movement Disorder Society Unified Parkinson's Disease using ML algorithms. Great classification of the right variation of true and fake samples of data that is created by users in the application

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy map canvas

3.2 Ideation & brainstorming



3.3 Proposed Solution

S.NO	Parameter	Description
1.	Problem Statement (Problem to be solved)	Parkinson's disease is a neurodegenerative movement disease where the symptoms gradually develop start with a slight tremor in one hand and a feeling of stiffness in the body and it became worse over time. It affects over 6 million people worldwide. At present there is no conclusive result for this disease by non-specialist clinicians, particularly in the early stage of the disease where identification of the symptoms is very difficult in its earlier stages. The disease is majorly is affects the

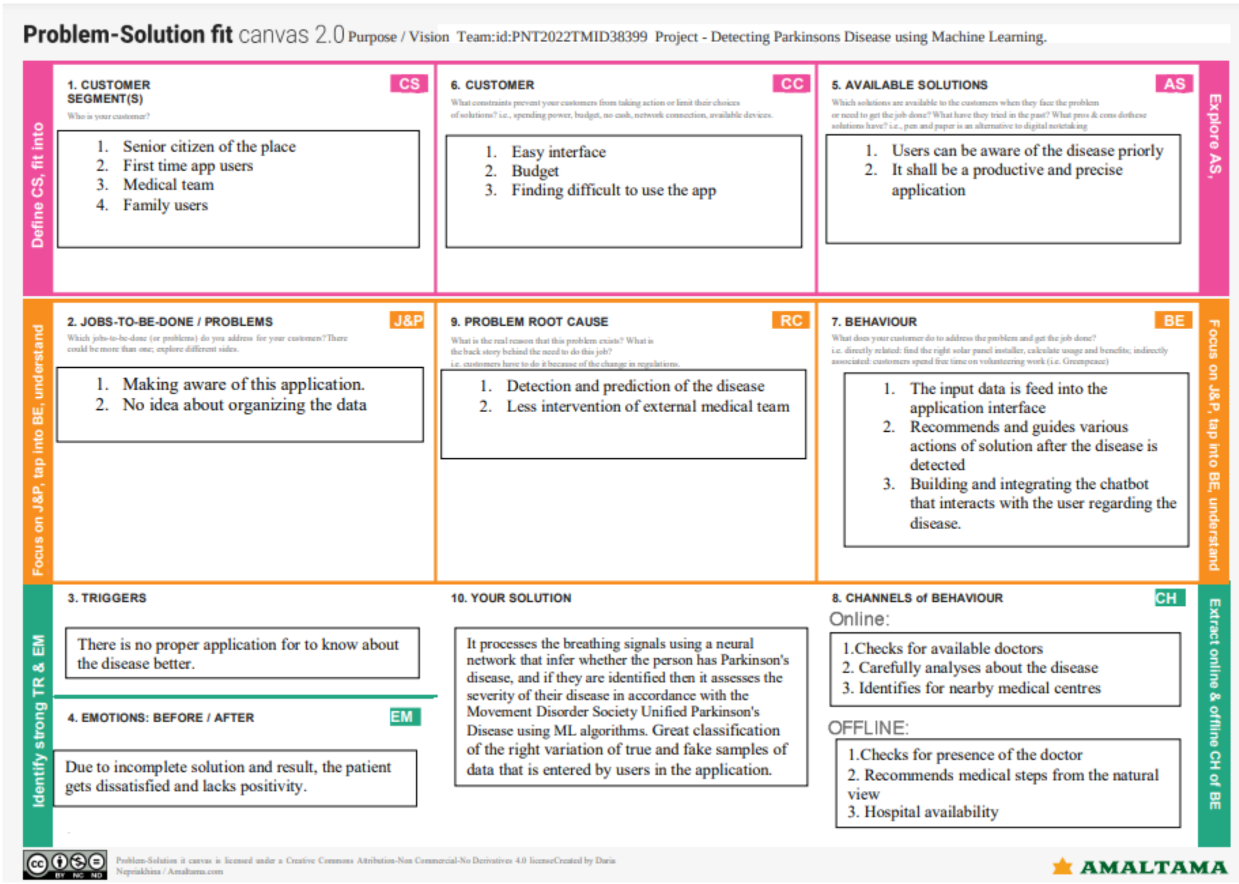
		individuals who are living in village areas with their respective ages over 40 and 50 which outcomes itself as a reason for Parkinson’s disease to occur at unexpected times. Lack of adequate knowledge poses a barrier in the provision of appropriate treatment and care for individuals with Parkinson’s Disease which causes Dopamine deficiency in the secondary stage. We researched and analyzed the data that was gathered from all over the network for figuring out the accurate reason for why this disease majorly affects the agricultural life. So, we found that as Parkinson's disease is believed to be caused by a combination of environmental risk factors and genetic susceptibility. As use of pesticides and Parkinson's disease have been associated,

		but it has not been narrowed down to specific pesticides or how the amount of exposure contributed. So most specifically, farmers are more prone to Parkinson’s Disease than the general population people.
2.		It processes the breathing signals using a neural network that infer whether the person has Parkinson's disease, and if they are identified then it assesses the severity of their disease in accordance with the Movement Disorder Society Unified Parkinson's Disease using ML algorithms. User can place their values and interact with the friendly user assistance bot which guides the person in using the application. Great classification of the right variation of true and fake samples of data that is entered by users in the application.
3.	Novelty / Uniqueness	Parkinson’s Disease is

		detected at the secondary stage only (Dopamine deficiency) which leads to medical challenges. Also, doctor must manually examine and suggest medical diagnosis in which the symptoms might vary from person to person so suggesting medicine is also a challenge. So , the disease examination varies at different instances of the medical operations. Here by using machine learning methods, the problem can be addressed with very less error rate. The voice dataset of Parkinson's disease from the UCI Machine learning library is used as input. Also, our proposed system provides accurate results by integrating spiral drawing inputs of normal and Parkinson’s affected patients. We propose a hybrid and accurate results analyzing patient both voice and spiral drawing data. This application offers medical advice and solutions as the next step after user is confirmed based on the presence of Parkinson’s disease. This can be used direct by medical team

		for analyzing and offering the solutions at much positive scaling time.
4.	Social Impact / Customer Satisfaction	An automated chatbot controls the user interaction environment. Personalize the UI experience. Improves accurate result as expected. Accurate prediction at good time complexity.
5.	Business Model (Revenue Model)	Solutions prospects of improvement. Suits for better saving of involvements. Economical Development . Easy interface.
6.	Scalability of the Solution	Good conversation with ethnicity people . Saves enough time for performing internal operations. On the spot result for the users. It does not require for the users to spend some money in offering their basic data into the model.

3.4 Problem solution fit



4. REQUIREMENTS ANALYSIS

4.1Functional requirement

Following are the functional requirements of the proposed solution.

FR NO.	Functional requirements(Epic)	Sub requirements(story/sub-task)
FR-1	User Registration	Registration through Form. Registration through Gmail.
FR-2	User Authorization	Verifying the user's account.
FR-3	Input data	Application received the data and processes its roles.
FR-4	Data classification	Classification of the real data for the user.
FR-5	Accuracy verification	Accuracy is determined in the application.
FR-6	Time efficient usage	Interaction with the chatbot till

		the result gets generated for the user
FR-7	Medical recommendations	User receives the medical suggestions and assistance for to offer speed
FR-8	Data extraction	User gets their personal disease report data from the application.

4.2 Non-Functional requirements

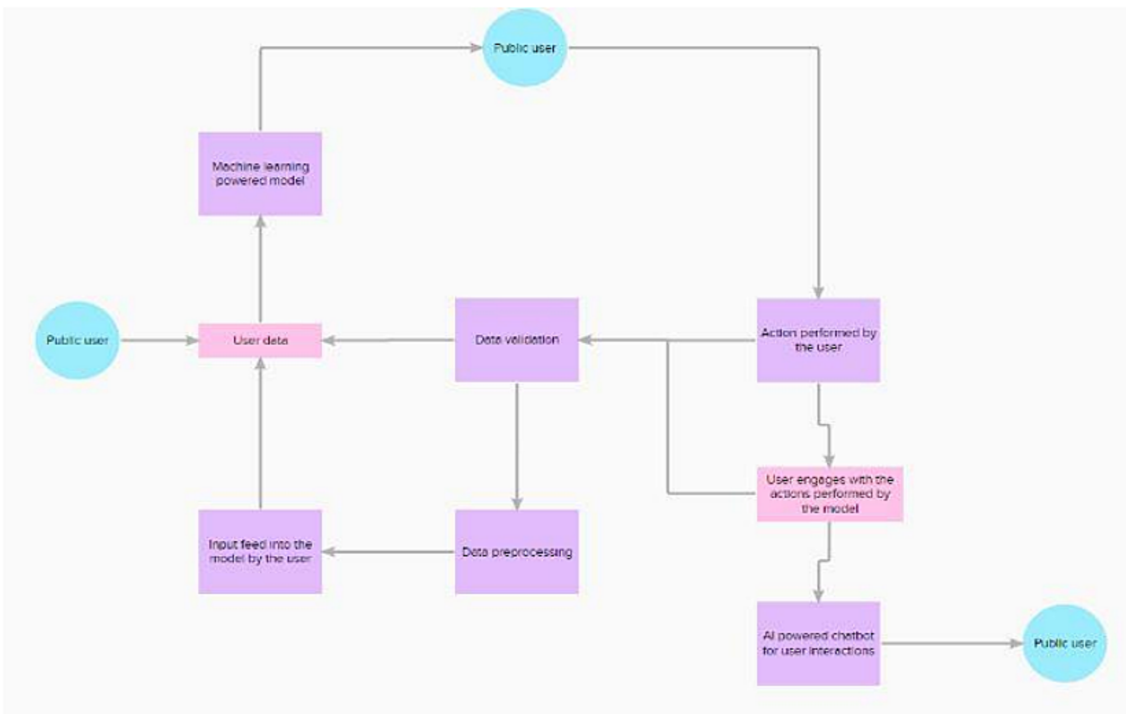
FR No.	**Non-Functional Requirement**	**Description**
NFR-1	Usability	The application can be used for accurate prediction and classifier of the true and fake input data sample.
NFR-2	Security	User's data is well encrypted using stable machine learning algorithms.
NFR-3	Reliability	The application is monitored periodically in terms of its constant prediction ability, quality, and availability towards the user.
NFR-4	Performance	It classifies the images and predicts the disease with careful accuracy output
NFR-5	Availability	The application is active throughout the day. While awaiting the prediction result, User can interact with the chatbot for knowing important details. If the application doesn't respond for the user, then the automated

		chatbot will forward the issue to our server then it can be resolved at that instance

5. PROJECT DESIGN

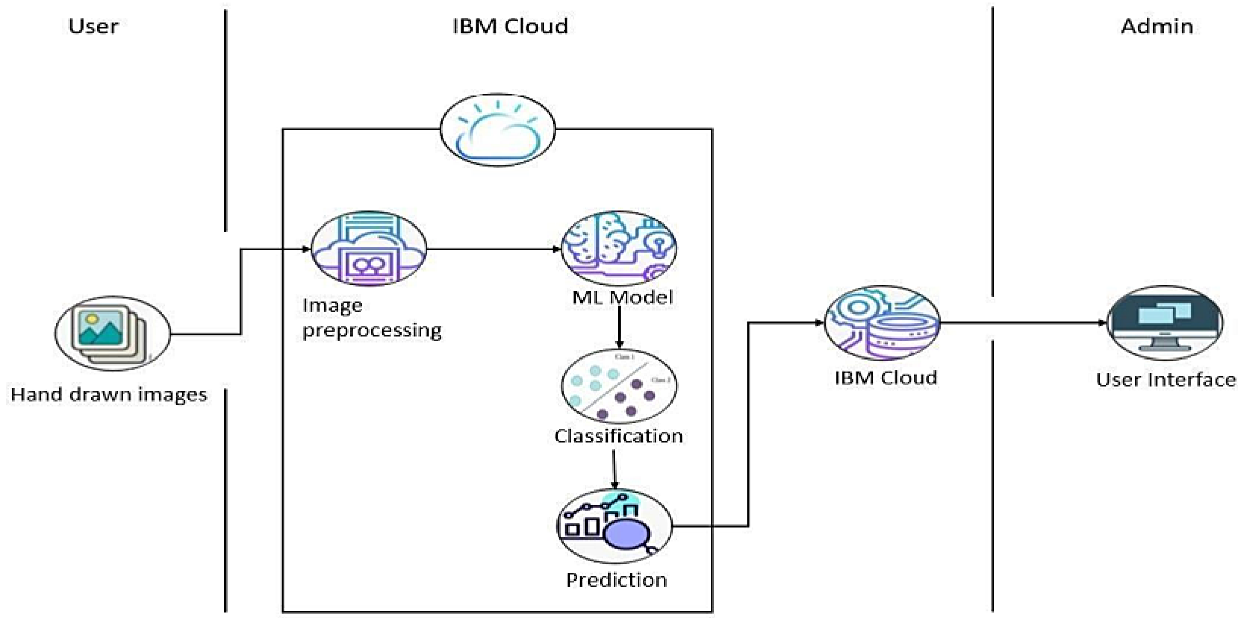
5.1Data Flow Diagram

Data flow diagram – Detecting Parkinson’s Disease using Machine Learning



5.2 Solution & Technical Architecture

Solution Architecture



Technical Architecture

Table-1 Components & technology

S.No	Components	Description	Technology
1	User Interface feature	How user interacts with application e.g.,Web UI	HTML, CSS, JavaScript, Firebase (Web techniques)
2	Application Logic-1	Logic for a process in the application	React and Firebase
3	Application Logic-2	Information visibility of the disease towards the user	IBM Watson Assistant (Cloud)
4	Cloud Database	Database Service on Cloud	IBM DB2
5	Data Analysis	Data preprocessing and machine learning	Data collection and preprocessing, Exploratory Data Analysis (EDA), Data

			visualization
6	Machine Learning	Important methods of Machine Learning	Data mining – Regression, Classification and Clustering
7	Machine learning methods	Data mining	Random Forest classifier (ML), Support Vector Machines(SVM), Label encoding and One-hot encoding, K Nearest Neighbor (KNN) algorithm, XG boost algorithm (Gradient boosting)
8	Artificial Intelligence	Computer vision to detect the Parkinson's disease C	Computer vision with OpenCV
9	Web application	Alternative to python flask	React and alternative web framework technique
10	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud	Cloud Server Configuration: IBM Watson (Cloud)

Table-2 Application Characteristics

S.NO	Characteristics	Description	Technology
1	Machine learning python Frameworks	List the open-source frameworks used	Numpy, Pandas, metrics, XG boost, Python Flask (Web), Scikit learn (Sklearn), Tensor flow
2	Security Implementations	List all the security / access controls implemented, use of	Encryptions, Decryptions

		firewalls etc.	
3	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Justify the scalability of architecture (3 – tier, Micro-services)
4	Availability	Justify the availability of application (e.g., use ofload balancers, distributed servers etc.)	IBM Watson – Can easily be accessed
5	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Web applications (React , JavaScript, Firebase)

5.3 User stories

Use the below template to list all the user stories for the product

User Type	**Functional Requirements(epic)**	**User Story Number**	**User Story/ Task**	**Acceptance criteria**	**Priority**	**Release**
Customer (public user)	Account creation	USN-1	As a user, I can connect my google into the application	As a user, I can retrieve the result data from the application for data storage for further medical research uses.	High	Sprint-1
Input data	Adding data	USN-2	As a user, I can feed my	I can cross verify the	High	Sprint-1

			data as the input into the application for it to classify the true fake data	data that entered in the initial step		
Data validation	Checking accuracy	USN-3	As a user, I can check the ability and accuracy of the model in obtaining the required information	I can log into my account and check the capability of the model	High	Sprint-2
Classification	Data classification	USN-4	As a user, I can view the real data	I can verify my data with the real data	High	Sprint-2
App work	Work flow	USN-5	As a user, I can examine the working action of the application model	I can view how the application works and responds to the actions imposed	High	Sprint-2
Image classification	Checking for the disease	USN-6	As a user, I can verify with the application that the image is identified with the actual disease with the	I can confirm that the data shows the accurate result	High	Sprint-3

			help of the trained and tested data’s			
User interaction	AI-powered chatbot	USN-7	As a user, I can interact with the automated chatbot to engage my time till the application processed the accurate result in a meanwhile	I can see the results from the interaction with the chatbot	High	Sprint-3
Medical assistance	Medical Suggestion	USN-8	As a user, I can get medical advises and recommendations for to boost the action of curing the disease	I can get enough assistance by getting the suggestions for curing the disease	High	Sprint-3
Data extraction	Obtaining the data	USN-9	As a user, I can retrieve the result data from the application for data storage for further medical research uses.	I can download the result in the form of data as a proof to show to medical teams	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint planning &Estimation

Sprint	Functional Requirements(Epic)	User story number	User story/task	Story points	Priority	Team Members
Sprint-1	Viewing Home Page for the web application	USN-1	As a user, I can research and know the sample disease images of Parkinson. Also collecting sample data to learn more about the disease.	4	Low	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-1	Sign Up Page	USN-2	I need to collect data (images of spirals and waves drawn by healthy people and Parkinson's patients).	4	High	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password after creation of the account	2	High	Priyankadevi Keerthana Swetha Lalithkamal

Sprint-2	Authorization	USN-4	As a user, I will receive confirmation email once I have registered for the application.	6	High	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-2	Dashboard	USN-5	As a user, I can research and know the sample disease images of Parkinson. Also collecting sample data to learn more about the disease.	6	High	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-2	Data Collection (Dataset)	USN-6	I need to collect data (images of spirals and waves drawn by healthy people and Parkinson's patients).	6	Medium	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-2	Data checking	USN-7	I need to learn and understand the data	2	Medium	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-3	Data pre-processing and EDA	USN-8	I need to prepare, clean the data, and process the data for	4	High	Priyankadevi Keerthana Swetha Lalithkamal

			modelbuilding by doing preprocessing activities such as EDA and data visualization.			
Sprint-3	data visualization	USN-9	I need to visualize the data for to check for any outliers and processing the data accordingly	7	Medium	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-3	Model building (Training and testing)	USN-10	I need to build the model using Data mining processes such as Random ForestClassifier, K Nearest Neighbor (KNN) from regression, classification, and clustering techniques.	4	High	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-3	Assessing the model using metrics	USN-11	I need to measure the performance of the model using	5	Medium	Priyankadevi Keerthana Swetha Lalithkamal

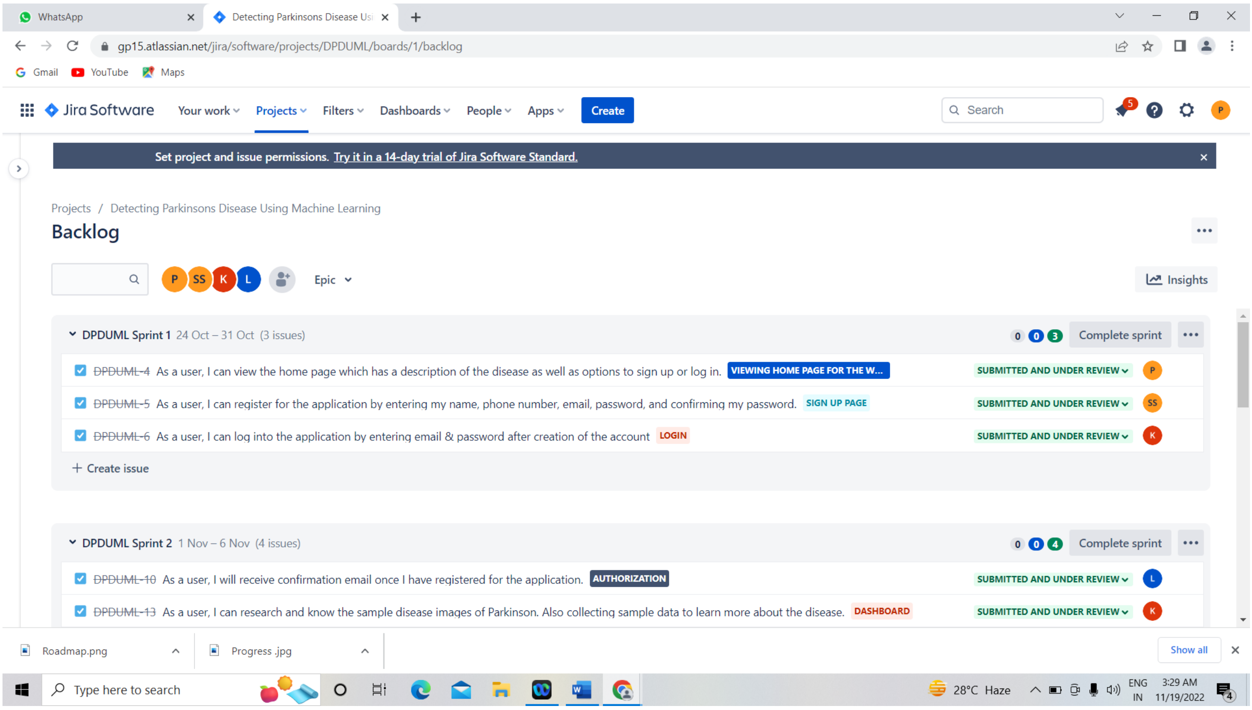
			regression metrics			
Sprint-4	Application Building	USN-12	I need to build the website for the model application using HTML, CSS, JavaScript etc followed by user sign up page creation in sprint 1. It is then completed by designing the application website.	4	Medium	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-4	Model Verification	USN-13	I need to check that model works fine in the application for the user.	6	High	Priyankadevi Keerthana Swetha Lalithkamal
Sprint-4	Model Deployment (IBM Cloud)	USN-14	I need to deploy the Machine Learning model iiithat was built using cloud environment from IBM. And configuring the data of the user in	5	Medium	Priyankadevi Keerthana Swetha Lalithkamal

			IBM warehouse service called as db2.			
Sprint-4	Results	USN-15	As a user, I can receive a diagnosis in addition to recommendations on what I should do now.	5	High	Priyankadevi Keerthana Swetha Lalithkamal

6.2 Sprint delivery schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	**10**	**6 Days**	24 Oct 2022	29 Oct 2022	**10**	29 Oct 2022
Sprint-2	**20**	**6 Days**	31 Oct 2022	05 Nov 2022	**20**	05 Nov 2022
Sprint-3	**20**	**6 Days**	07 Nov 2022	12 Nov 2022	**20**	12 Nov 2022
Sprint-4	**20**	**6 Days**	14 Nov 2022	19 Nov 2022	**20**	19 Nov 2022

6.3 Reports from JIRA



7.Coding & Solutioning

7.1 Feature 1

We have performed Data preprocessing & Exploratory Data Analysis (EDA), Data visualization, Data mining (model building) and Performance metrics. Finally, we have saved the mode

Machine Learning Algorithm for Parkinson Disease

Importing libaries

In [5]:

```
import warnings
warnings.filterwarnings("ignore") #Not to display the warnings

import numpy as np
import pandas as pd
import os, sys
from sklearn.preprocessing import MinMaxScaler
from xgboost import XGBClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score #Modelmetrics
```

Data preprocessing and Exploratory Data Analysis(EDA)

In [10]:
```
parkinson_data = pd.read_csv('parkinsons.data')
print(parkinson_data)
```

```
               name  MDVP:Fo(Hz)  MDVP:Fhi(Hz)  MDVP:Flo(Hz)  MDVP:Jitter(%)  \
0    phon_R01_S01_1      119.992       157.302        74.997         0.00784
1    phon_R01_S01_2      122.400       148.650       113.819         0.00968
2    phon_R01_S01_3      116.682       131.111       111.555         0.01050
3    phon_R01_S01_4      116.676       137.871       111.366         0.00997
4    phon_R01_S01_5      116.014       141.781       110.655         0.01284
..              ...          ...           ...           ...             ...
190  phon_R01_S50_2      174.188       230.978        94.261         0.00459
191  phon_R01_S50_3      209.516       253.017        89.488         0.00564
192  phon_R01_S50_4      174.688       240.005        74.287         0.01360
193  phon_R01_S50_5      198.764       396.961        74.904         0.00740
194  phon_R01_S50_6      214.289       260.277        77.973         0.00567

     MDVP:Jitter(Abs)  MDVP:RAP  MDVP:PPQ  Jitter:DDP  MDVP:Shimmer  ...  \
0             0.00007   0.00370   0.00554     0.01109       0.04374  ...
1             0.00008   0.00465   0.00696     0.01394       0.06134  ...
2             0.00009   0.00544   0.00781     0.01633       0.05233  ...
3             0.00009   0.00502   0.00698     0.01505       0.05492  ...
4             0.00011   0.00655   0.00908     0.01966       0.06425  ...
..                ...       ...       ...         ...           ...  ...
190           0.00003   0.00263   0.00259     0.00790       0.04087  ...
191           0.00003   0.00331   0.00292     0.00994       0.02751  ...
192           0.00008   0.00624   0.00564     0.01873       0.02308  ...
193           0.00004   0.00370   0.00390     0.01109       0.02296  ...
194           0.00003   0.00295   0.00317     0.00885       0.01884  ...
```

MDVH denotes Maximum or Minimum Vocal Fundamental Frequency

In [11]:
```
parkinson_data
```

```
Button(description='Toggle Pandas/Lux', layout=Layout(top='5px', width='140px'), style=ButtonStyle())
Output()
```

In [12]:
```
parkinson_data.head(n=20)
```

```
Button(description='Toggle Pandas/Lux', layout=Layout(top='5px', width='140px'), style=ButtonStyle())
Output()
```

In [14]:
```
parkinson_data.tail(50)
```

```
Button(description='Toggle Pandas/Lux', layout=Layout(top='5px', width='140px'), style=ButtonStyle())
Output()
```

In [15]:
```
parkinson_data.shape
#(rows,columns)
```

Out[15]: `(195, 24)`

In [17]:
```
#Capturing for null values if any of it is available
parkinson_data.isnull().sum()
```

```
Button(description='Toggle Pandas/Lux', layout=Layout(top='5px', width='140px'), style=ButtonStyle())
Output()
```

No null values are present in the data

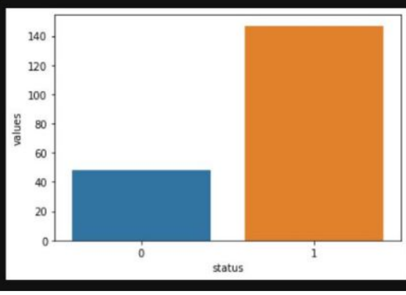
In [23]:
```
variable=parkinson_data['status'].value_counts()
variable_data=pd.DataFrame({'status':variable.index,'values':variable.values})
variable_data
```

```
Button(description='Toggle Pandas/Lux', layout=Layout(top='5px', width='140px'), style=ButtonStyle())
Output()
```

Data visualization

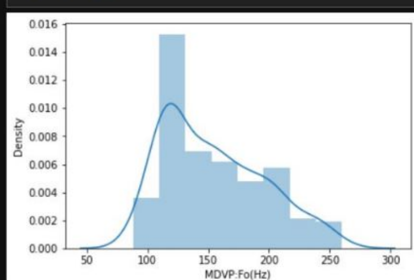
In [24]:
```
#Data visualization
import seaborn as sns
import matplotlib.pyplot as plt
variable = parkinson_data["status"].value_counts()
variable_data = pd.DataFrame({'status':variable.index,'values':variable.values})
sns.barplot(x='status',y='values',data=variable_data)
```

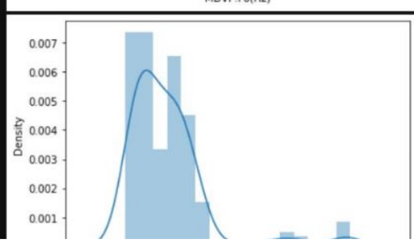
Out[24]:



In [25]:
```
#Analyzing the distribution of the data using distplot
def distplots(col):
  sns.distplot(parkinson_data[col])
  plt.show()

for i in list(parkinson_data.columns)[1:]:
  distplots(i)
```



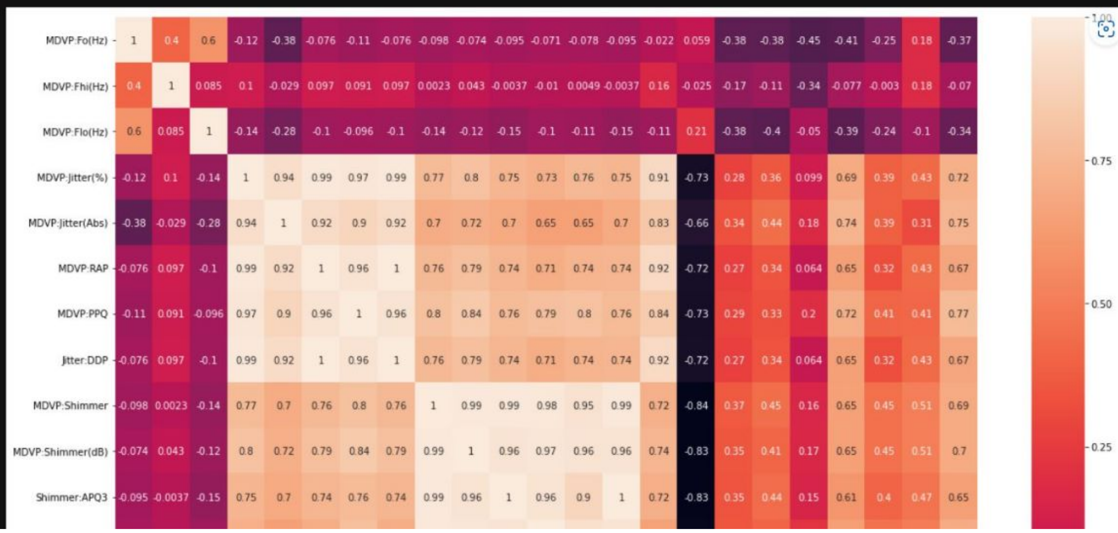


In [29]:

```
#Figuring out the correlations using heatmap to visualize between the features and patterns in the data used for this project

plt.figure(figsize=(20,20))
correlation_data=parkinson_data.corr()
sns.heatmap(correlation_data,annot=True)
```

Out[29]:



Converging the above classification algorithms and performance metric using Voting Classifier.

In [37]:

```
from sklearn.ensemble import VotingClassifier
VC = VotingClassifier(estimators=[('Classification_model',Classification_model),('Classification_tree',Classification_tree),('Classification_random',C
Model_VC = VC.fit(x_train, y_train)
Model_prediction = VC.predict(x_test)
Model_accuracy = accuracy_score(y_test,pred_gnb)
print(Model_accuracy)
```

0.8813559322033898

XGBClassification - Supervised Machine Learning

In [38]:

```
Model_XG = XGBClassifier(random_state=0)
Model_XG.fit(x_train,y_train)
```

Out[38]: XGBClassifier()

Converging the above classification algorithms and performance metric using Voting Classifier.

In [37]:

```
from sklearn.ensemble import VotingClassifier
VC = VotingClassifier(estimators=[('Classification_model',Classification_model),('Classification_tree',Classification_tree),('Classification_random',C
Model_VC = VC.fit(x_train, y_train)
Model_prediction = VC.predict(x_test)
Model_accuracy = accuracy_score(y_test,pred_gnb)
print(Model_accuracy)
```

0.8813559322033898

XGBClassification - Supervised Machine Learning

In [38]:

```
Model_XG = XGBClassifier(random_state=0)
Model_XG.fit(x_train,y_train)
```

Out[38]: XGBClassifier()

Saving the model

In [44]:

```
import pickle

with open( 'Parkinson_MLmodel.sav', 'wb') as f:
    pickle.dump(Model_XG,f)

with open('standardScalar.sav', 'wb') as f:
    pickle.dump(Scaler_data,f)
```

7.2 Feature 2

We have created an Application with Home Page (After logging in by the user), Layout and Predict Page.

```
<!DOCTYPE html>
<!--
This is a starter template page. Use this page to start your new project from
scratch. This page gets rid of all links and provides the needed markup only.
-->
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <title>Parkinson Detection</title>

    <!-- Google Font: Source Sans Pro -->
    <link
      rel="stylesheet"
      href="https://fonts.googleapis.com/css?family=Source+Sans+Pro:300,400,400i,700&display=fallback"
    />
    <!-- Font Awesome Icons -->
    <link
      rel="stylesheet"
      href="../static/plugins/fontawesome-free/css/all.min.css"
    />
    <!-- Theme style -->
    <link rel="stylesheet" href="../static/dist/css/adminlte.min.css" />
    <link
      rel="stylesheet"
      href="https://cdn.jsdelivr.net/npm/admin-lte@3.1/dist/css/adminlte.min.css"
    />
  </head>
  <body
    class="hold-transition layout-top-nav layout-footer-fixed layout-navbar-fixed"
  >
    <div class="wrapper">
      <!-- Navbar -->
      <nav
```

```
          <li class="nav-item">
            <a class="nav-link" href="{{url_for('Home_page')}}"><b>Home</b></a>
          </li>
          <li class="nav-item">
            <a class="nav-link" href="{{url_for('info_page')}}"><b>Info</b></a>
          </li>
          <li class="nav-item">
            <a class="nav-link" href="{{url_for('Predict_page')}}"><b>Predict</b></a>
          </li>
        </ul>
    </div>
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Fo(Hz)” /> MDVP:Fo(Hz)
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Fhi(Hz)” /> MDVP:Fhi(Hz)
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Flo(Hz)” /> MDVP:Flo(Hz)
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Jitter(%)” /> MDVP:Jitter(%)
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Jitter(Abs)” /> MDVP:Jitter(Abs)
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:RAP” /> MDVP:RAP
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:PPQ” /> MDVP:PPQ
Value : <input type=”radio” name=”parkinsons.data” value=”Jitter:DDP” /> Jitter:DDP
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Shimmer” /> MDVP:Shimmer
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Shimmer(dB)” /> ”MDVP:Shimmer(dB)
Value : <input type=”radio” name=”parkinsons.data” value=”Shimmer:APQ3” /> Shimmer:APQ3
Value : <input type=”radio” name=”parkinsons.data” value=”Shimmer:APQ5” /> Shimmer:APQ5
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:APQ” /> MDVP:APQ
Value : <input type=”radio” name=”parkinsons.data” value=”Shimmer:DDA” /> Shimmer:DDA
Value : <input type=”radio” name=”parkinsons.data” value=”NHR” /> NHR
Value : <input type=”radio” name=”parkinsons.data” value=”HNR” /> HNR
Value : <input type=”radio” name=”parkinsons.data” value=”status” /> status
Value : <input type=”radio” name=”parkinsons.data” value=”RPDE” /> RPDE
Value : <input type=”radio” name=”parkinsons.data” value=”MDVP:Fo(Hz) /> MDVP:Fo(Hz)
Value : <input type=”radio” name=”parkinsons.data” value=”DFA” /> DFA
Value : <input type=”radio” name=”parkinsons.data” value=”spread1” /> spread1
Value : <input type=”radio” name=”parkinsons.data” value=”spread2” /> spread2
Value : <input type=”radio” name=”parkinsons.data” value=”D2” /> D2
Value : <input type=”radio” name=”parkinsons.data” value=”PPE” /> PPE
<button type="PREDICT">Send your prediction data</button>
```

```
<script src="../static/plugins/jquery/jquery.min.js"></script>
<!-- Bootstrap 4 -->
<script src="../static/plugins/bootstrap/js/bootstrap.bundle.min.js"></script>
<!-- AdminLTE App -->
<script src="../static/dist/js/adminlte.min.js"></script>
<!-- AdminLTE for demo purposes -->
<script src="../static/dist/js/demo.js"></script>
<script src="https://cdn.jsdelivr.net/npm/admin-lte@3.1/dist/js/adminlte.min.js"></script>
<script>
  var currentTheme = sessionStorage.getItem("theme");
  var mainHeader = document.querySelector(".main-header");

  if (currentTheme) {
    if (currentTheme === "dark") {
      if (!document.body.classList.contains("dark-mode")) {
        document.body.classList.add("dark-mode");
      }
      if (mainHeader.classList.contains("navbar-light")) {
        mainHeader.classList.add("navbar-dark");
        mainHeader.classList.remove("navbar-light");
      }
      toggleSwitch.checked = true;
    }
  }
```

```html
<!DOCTYPE html>
<!--
This is a starter template page. Use this page to start your new project from
scratch. This page gets rid of all links and provides the needed markup only.
-->
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <title>Parkinson Detection</title>

    <!-- Google Font: Source Sans Pro -->
    <link
      rel="stylesheet"
      href="https://fonts.googleapis.com/css?family=Source+Sans+Pro:300,400,400i,700&display=fallback"
    />
    <!-- Font Awesome Icons -->
    <link
      rel="stylesheet"
      href="../static/plugins/fontawesome-free/css/all.min.css"
    />
    <!-- Theme style -->
    <link rel="stylesheet" href="../static/dist/css/adminlte.min.css" />
    <!-- dropzonejs -->
    <link
      rel="stylesheet"
      href="../static/plugins/dropzone/min/dropzone.min.css"
    />
  </head>
  <body
    class="hold-transition layout-top-nav layout-footer-fixed layout-navbar-fixed"
  >
    <div class="wrapper">
```

```
<div class="collapse navbar-collapse order-3" id="navbarCollapse">
  <!-- Left navbar links -->
  <ul class="navbar-nav">
    <li class="nav-item">
      <a href="/" class="nav-link">Home</a>
    </li>
    <li class="nav-item">
      <a href="/info" class="nav-link">Info</a>
    </li>
    <li class="nav-item">
      <a href="/test" class="nav-link">Predict</a>
    </li>
  </ul>
</div>

<!-- Right navbar links -->
<ul class="order-1 order-md-3 navbar-nav navbar-no-expand ml-auto">
  <li class="nav-item">
    <button
      type="button"
      onclick="switchTheme()"
      class="btn btn-primary btn-block btn-sm"
    >
      <i class="fa fa-bell"></i> Switch Theme
```

```javascript
var previewNode = document.querySelector("#template");
previewNode.id = "";
var previewTemplate = previewNode.parentNode.innerHTML;
previewNode.parentNode.removeChild(previewNode);

var myDropzone = new Dropzone(document.body, {
  // Make the whole body a dropzone
  url: "/predict", // Set the url
  thumbnailWidth: 80,
  thumbnailHeight: 80,
  parallelUploads: 20,
  previewTemplate: previewTemplate,
  autoQueue: false, // Make sure the files aren't queued until manually added
  previewsContainer: "#previews", // Define the container to display the previews
  clickable: ".fileinput-button", // Define the element that should be used as click trigger to select files.
  success: function (file, response) {
    if (response === "healthy") {
      $("#successModel").click();
    } else {
      $("#dangerModel").click();
    }
  },
});

myDropzone.on("addedfile", function (file) {
  // Hookup the start button
  file.previewElement.querySelector(".start").onclick = function () {
    myDropzone.enqueueFile(file);
  };
});
```

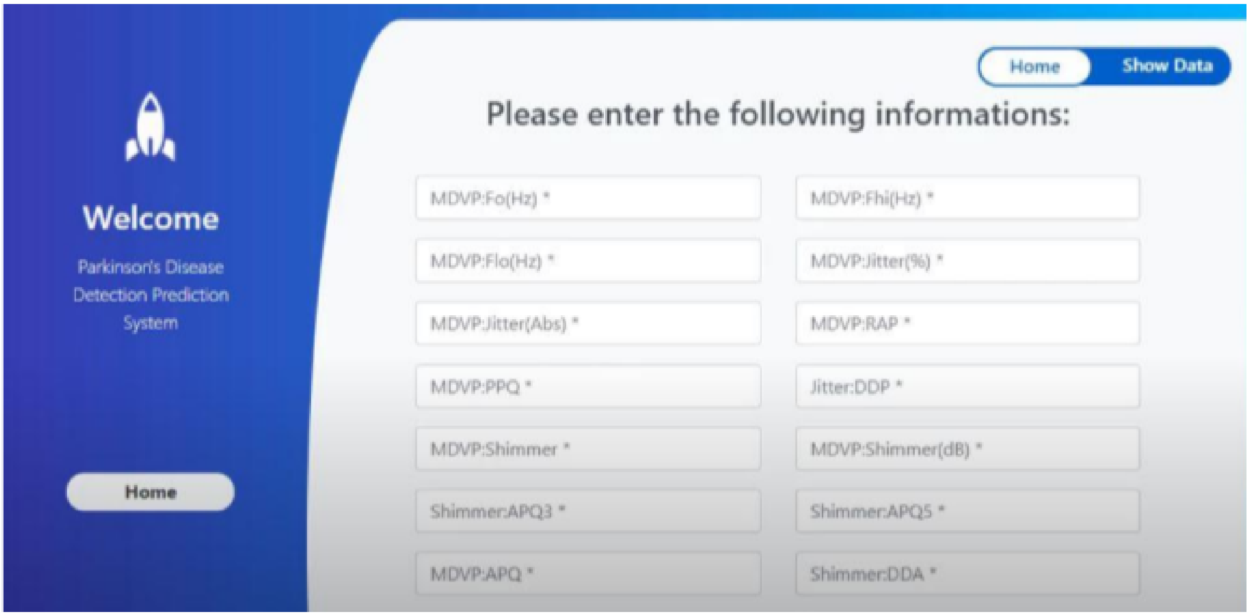
```
  var predict = function(input) {
    if (window.model) {
      window.model.predict([tf.tensor(input).reshape([1, 28, 28, 1])]).array().then(function(scores){
        scores = scores[0];
        predicted = scores.indexOf(Math.max(...scores));
        $('#number').html(predicted);
      });
    } else {
      // The model takes a bit to load, if we are too fast, wait
      setTimeout(function(){predict(input)}, 50);
    }
  }

  $('#clear').click(function(){
    context.clearRect(0, 0, canvas.width, canvas.height);
    $('#number').html('');
  });
  </script>
 </body>
</html>
```

```
!pip install tensorflowjs
!tensorflowjs_converter --input_format keras
    ‘/content/Parkinson_MLmodel.sav’ ‘/content/standardScaler.sav'
```

Login Page

Disease input data by registering in this Page:



Predict result side:

Predict Page:

8.Testing

8.1 Test Cases

Date	17-Nov-22
Team ID	PNT2022TMID38399
Project Name	Project - Detecting Parkinson's
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Expected Result	Actual Result	Status
TC_OO1	Functional	Home Page	Verify user is able to visit home	PC or Laptop & URL	1. Login and enter the input data	User able to visit home page	Working as	Pass
TC_OO2	Functional	Home Page	Verify user is able to enter the input	PC or Laptop, URL & Hand-	1. Enter the input data and click	User is able to enter the input data	Working as	Pass
TC_OO3	Functional	Home page	Verify user is able to get the result	PC or Laptop, URL & Hand-	1. Enter input data 2. Click the get	Verify user is able to get the result	Working as	Pass
TC_OO4	UI	Home page	Verify user is able to identify	PC or Laptop & URL	1.Enter input data and click go	User is able to identify the correct	Working as	Pass
TC_OO5	UI	Home page	Verify user is able to see the get the	PC or Laptop, URL & Hand-	1. Know about the disease in the	User is able to see the get the correct	Working as	Pass

17-Nov-22
PNT2022TMID38399
Project - Detecting Parkinson's
4 marks

Steps To Execute	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	Executed By
1. Login and enter the input data	User able to visit home page	Working as	Pass	Easy to access	N	Priyankadevi R
1. Enter the input data and click	User is able to enter the input data	Working as	Pass	Less time taken	N	Swetha R
1. Enter input data 2. Click the get	Verify user is able to get the result	Working as	Pass	Accurate result	N	Keerthana K
1.Enter input data and click go	User is able to identify the correct	Working as	Pass	Easy to identify the upload	N	Priyankadevi R
1. Know about the disease in the	User is able to see the get the correct	Working as	Pass	Easy to identify the get result	N	All team members

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT)

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	1	1	0	2
Duplicate	0	0	0	0	0
External	2	2	0	1	5
Fixed	1	0	0	0	1
Not Reproduced	0	0	0	0	1
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	3	3	1	1	8

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Login / Register	8	0	0	8
Home page	1	0	0	1
Logout page	2	0	1	1
Prediction	10	0	0	10
Version control	2	0	0	2

9. RESULTS

9.1 Performance Metrics

Classification Model: Confusion Matrix, Accuracy Score & Classification Report

XGBClassification - Supervised Machine Learning

In [38]:

```
Model_XG = XGBClassifier(random_state=0)
Model_XG.fit(x_train,y_train)
```

Out[38]: `XGBClassifier()`

Assessing the model using metrics

In [39]:

```
y_predict = Model_XG.predict(x_test)
print(accuracy_score(y_test,y_predict)*100)
```

```
96.61016949152543
```

Hence by reducing the overfitting using XGBoost Classifier, we are getting accuracy_score of **98.30%** for the model

Confusion metrics

In [40]:

```
from sklearn.metrics import confusion_matrix
ypre = Classification_model.predict(x_test)
ypre = (ypre>0.5)
confusion_matrix(y_test,ypre)
```

Out[40]:

```
array([[20,  4],
       [ 7, 28]])
```

F1 score

In [41]:

```
from sklearn.metrics import f1_score
Variation_score = f1_score(y_test, Model_XG.predict(x_test), average='binary')
print(Variation_score/0.01)
```

```
97.14285714285714
```

10. ADVANTAGES & DISADVANTAGES

10.1 Advantages

- We developed a model using the XG Boost Classifier using sklearn module of python to detect if an individual has Parkinson's Disease or not. We got the machine learning model with 96.61% accuracy, which is good as our dataset contains good labels and values.
- More accuracy in the model
- The data of any person can be entered in db to check whether the person is affected by Parkinson's disease or not.

10.2 Disadvantages

- Packages to be installed
- It produces fake results if the input data is entered wrong

11. CONCLUSION

It is possible to detect Parkinson`s disease using the drawings alone instead of measuring the speed and pressure of the pen on paper. Here, we presented included studies in a high-level summary, providing access to information including machine learning methods that have been used in the diagnosis of PD and associated outcomes, types of clinical, behavioral, and biometric data that could be used for rendering more accurate diagnoses, potential biomarkers for assisting clinical decision making, and other highly relevant information, including databases that could be used to enlarge and enrich smaller datasets. In summary, realization of machine learning-assisted diagnosis of PD yields high potential for a more systematic clinical decision-making system, while adaptation of novel biomarkers may give rise to easier access to PD diagnosis at an earlier stage.

12. FUTURE SCOPE

Following years of minimal progress in the treatment of Parkinson's disease, pioneering pipeline therapies such as those previously discussed offer hope to those affected by this devastating condition.

13. APPENDIX

13.1 Source Code

Machine Learning code : https://github.com/IBM-EPBL/IBM-Project-43936-1660720716/tree/main/Project%20Development%20Phase/Sprint%203/Machine%20Learning%20Algorithm

Web development code : https://github.com/IBM-EPBL/IBM-Project-43936-1660720716/tree/main/Project%20Development%20Phase/Sprint%204

13.2 Github Link:

Repository link: https://github.com/IBM-EPBL/IBM-Project-43936-166072071**6**

13.3 Project Demo :

Link: https://drive.google.com/file/d/1d97lm4RKxtEp6x6vPnyfZAYhIImBG3Rp/view