

## **Project Report**

### **Detection of Parkinson's Disease using Machine Learning**

<b>Team ID</b>	PNT2022TMID18356
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<b>Project Name</b>	Detecting Parkinson's Disease using Machine Learning

#### **Parkinson's disease**

- Parkinson's disease is a brain disorder that causes unintended or uncontrollable movements, such as shaking, stiffness, and difficulty with balance and coordination.
- Symptoms usually begin gradually and worsen 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.
- While virtually anyone could be at risk for developing Parkinson's, some research studies suggest this disease affects more men than women. It's unclear why, but studies are underway to understand factors that may increase a person's risk.

#### **Project objective**

- To understand the problem for to classify if it is a regression or a classification kind of problem.
- To pre-process the image by using different data pre-processing techniques.
- To implement the algorithm by using OpenCV framework and machine learning to automatically detect Parkinson's disease in hand-drawn images of spirals and waves.
- To know how to find the accuracy of the model.
- To build web application using the Flask framework that features the detection of Parkinson's Disease.

## **Problem Statement**

Parkinson's disease is a brain disorder that causes unintended or uncontrollable movements, such as shaking, stiffness, and difficulty with balance and coordination. Symptoms usually begin gradually and worsen over time. As the disease progresses, people may have difficulty walking and talking.

## **Literature Survey**

### **1. Jie Mei, Christian Desrosiers, Johannes Frasnelli, "Machine Learning for the Diagnosis of Parkinson's Disease," 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. C K Gomathy, "The Parkinson's Disease Detection using Machine Learning Techniques." 2021.**

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". 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 database to check whether the person is affected by Parkinson's disease or not.

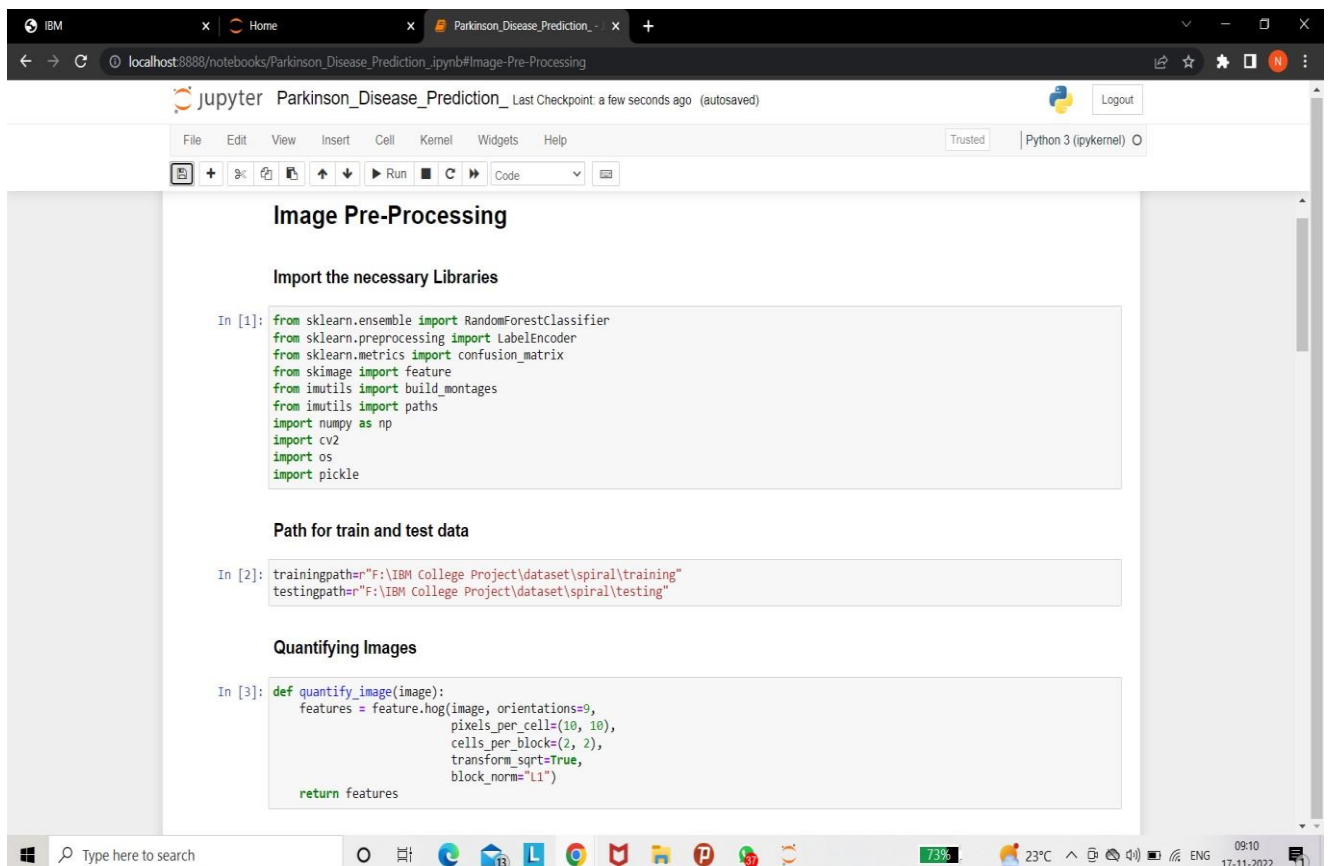
### 3. Iqra Nissar, Waseem Ahmad Mir, Izharuddin, Tawseef Ayoub Shaikh, "Machine Learning Approaches for Detection and Diagnosis of Parkinson's Disease," 2021.

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.

### Deployment of ML Model

The Machine Learning model which is developed using Random Forest Classifier Algorithm generates accuracy of 0.8666 approximately is deployed using IBM Watson which enhances scalability, reliability, security and performance of the ML model.

### Codes:

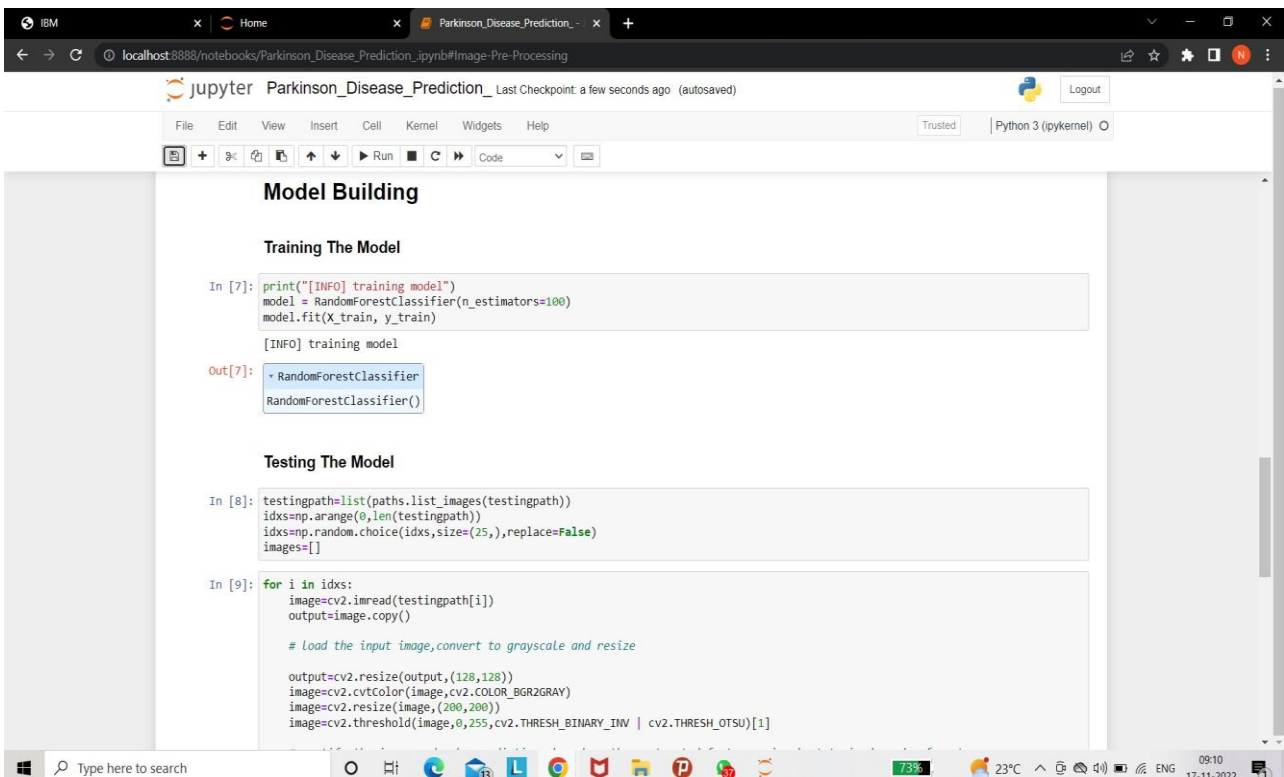
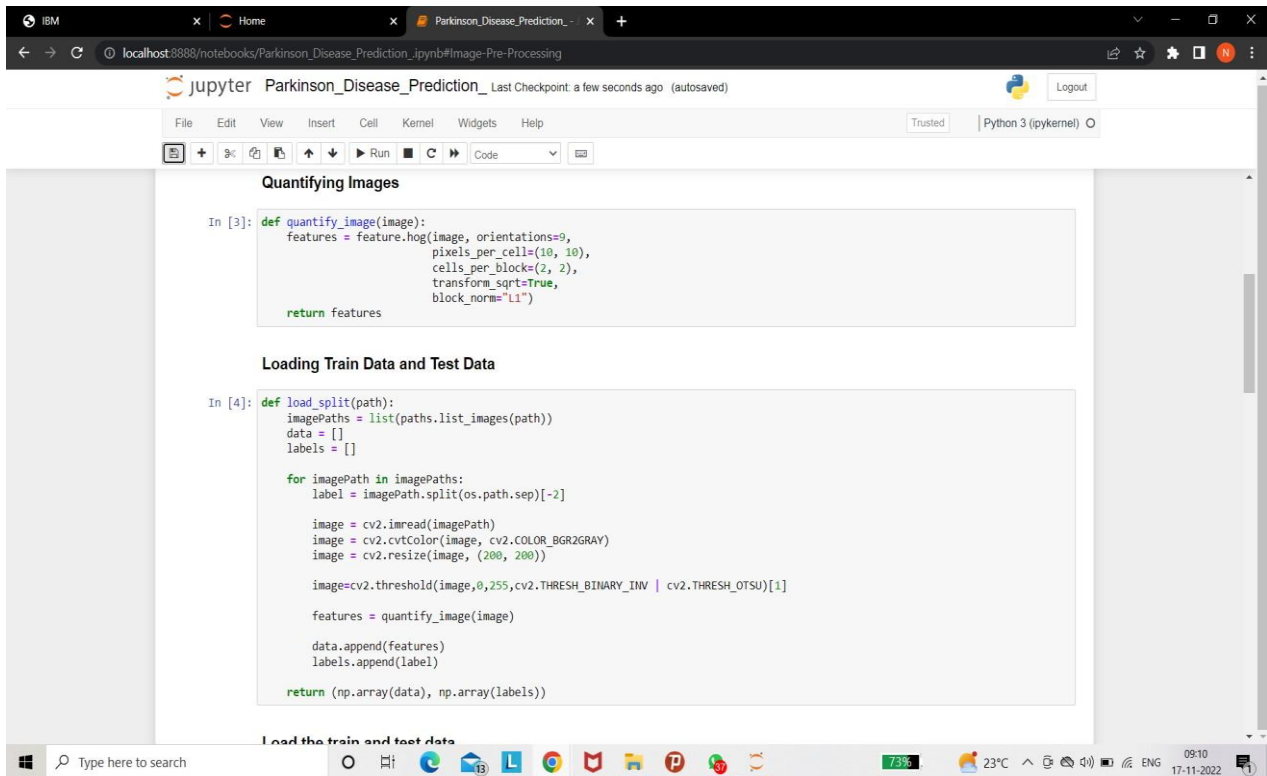


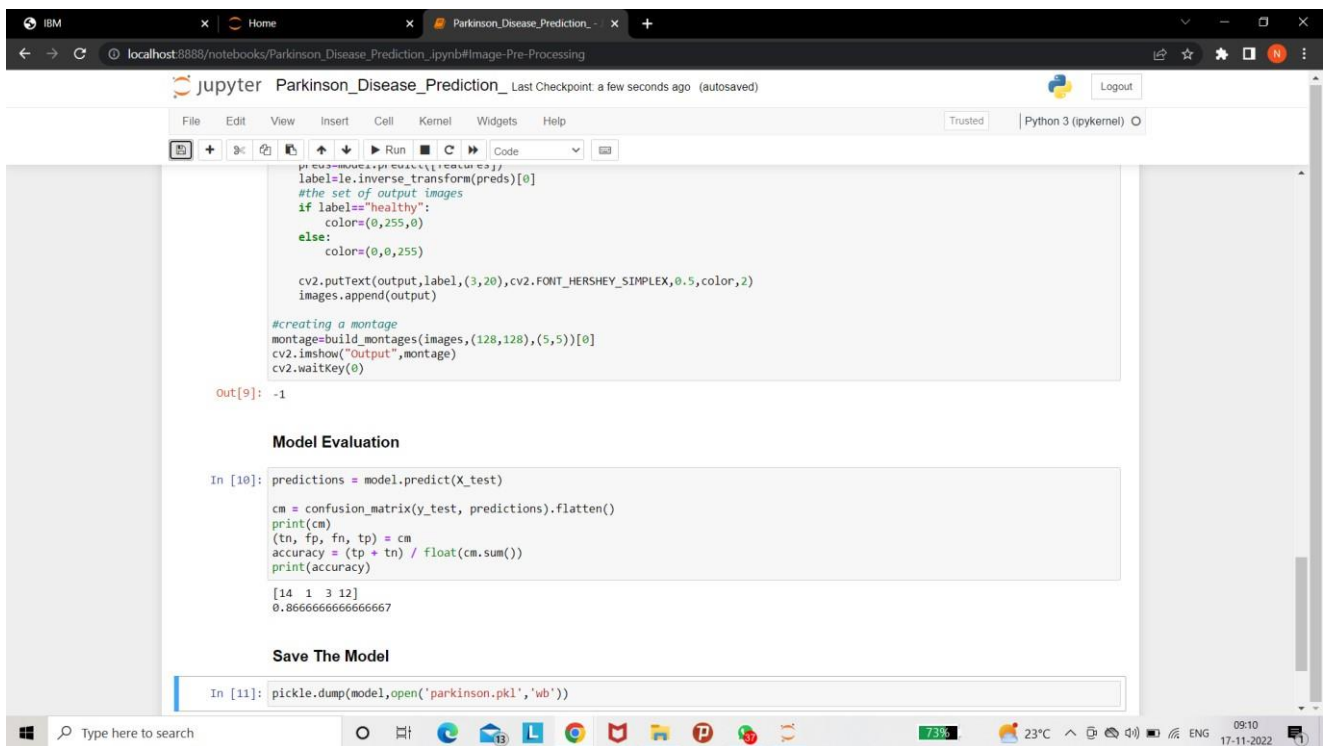
The screenshot shows a Jupyter Notebook interface with the title 'Parkinson\_Disease\_Prediction'. The notebook is running on a local host (localhost:8888) and is titled 'Parkinson\_Disease\_Prediction.ipynb#Image-Pre-Processing'. The code is organized into three sections: 'Import the necessary Libraries', 'Path for train and test data', and 'Quantifying Images'.

```
In [1]: from sklearn.ensemble import RandomForestClassifier
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import confusion_matrix
from skimage import feature
from imutils import build_montages
from imutils import paths
import numpy as np
import cv2
import os
import pickle

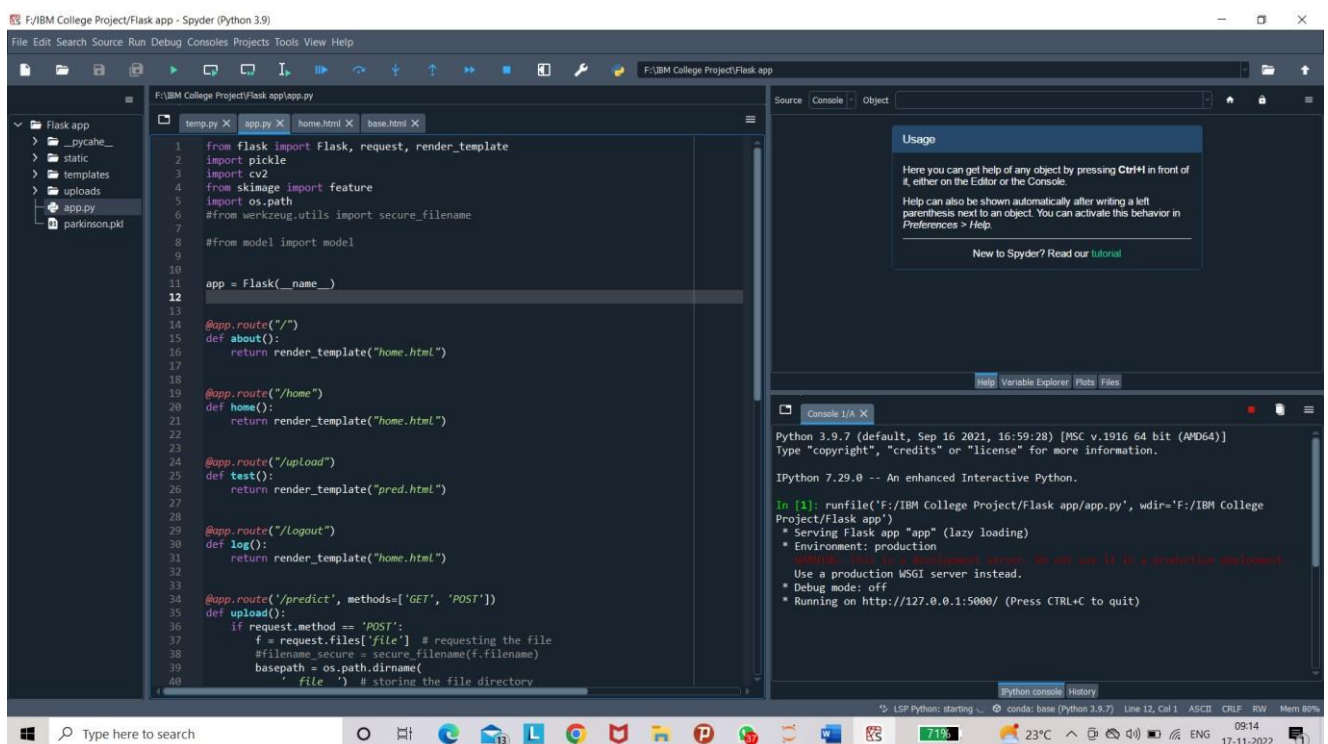
In [2]: trainingpath="F:\IBM College Project\dataset\spiral\training"
testingpath="F:\IBM College Project\dataset\spiral\testing"

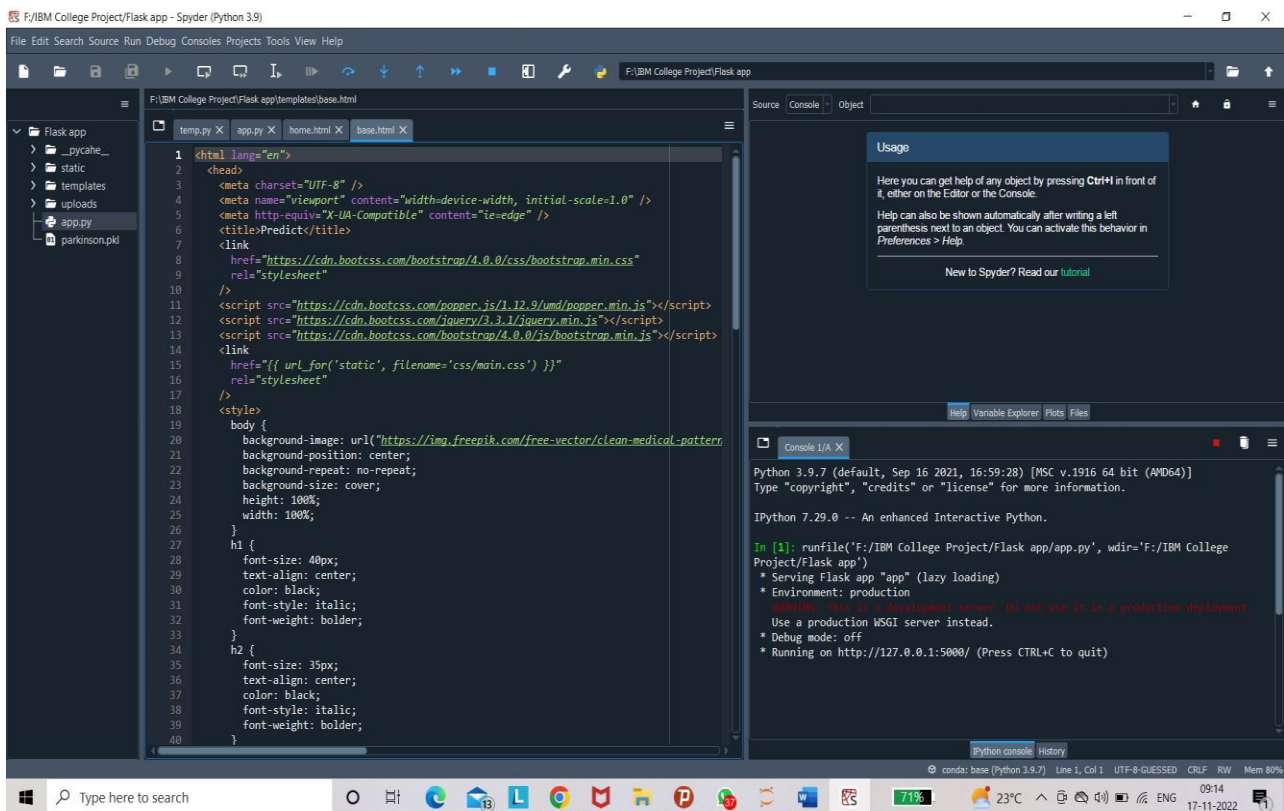
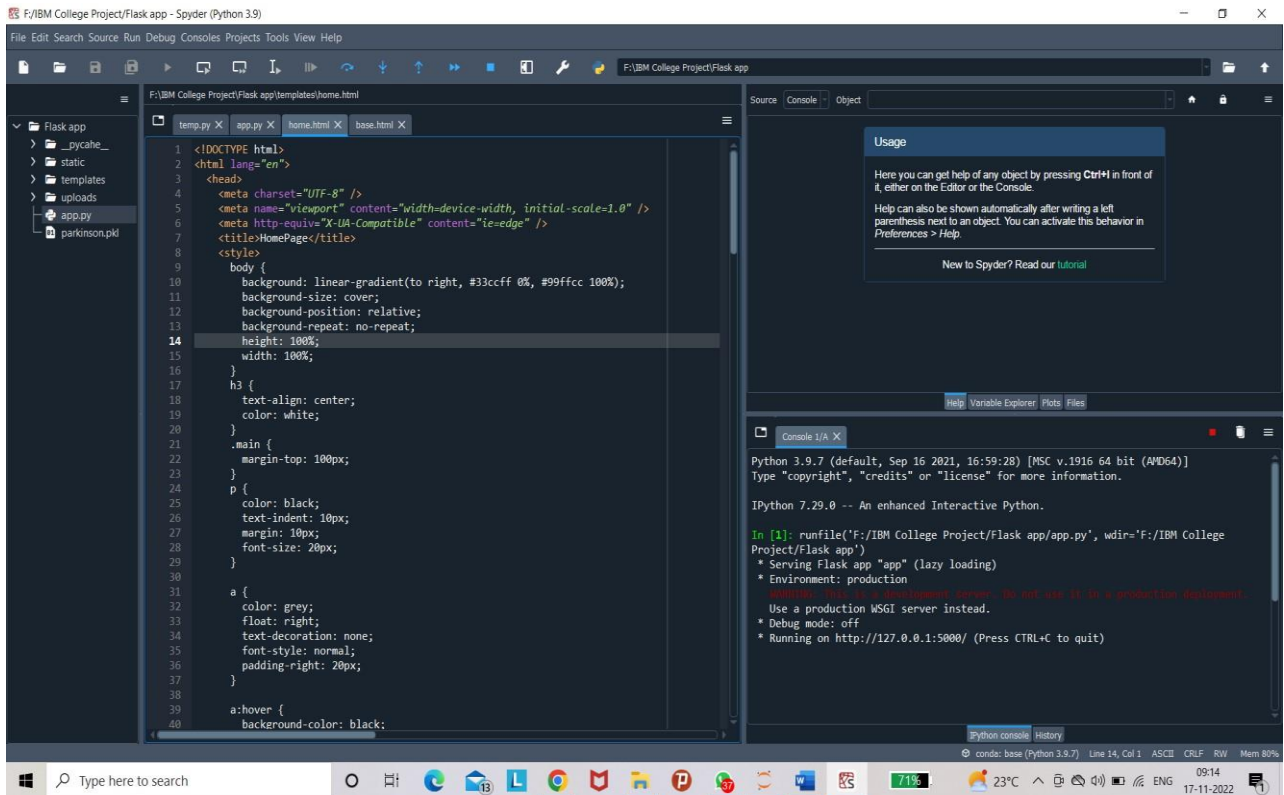
In [3]: def quantify_image(image):
features = feature.hog(image, orientations=9,
pixels_per_cell=(10, 10),
cells_per_block=(2, 2),
transform_sqrt=True,
block_norm="L1")
return features
```





## Flask Application Codes







# IBM Deployment Code

```
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file Edit View Insert Cell Kernel Help  Not Connected Trusted Python 3.9

In [5]: # Training Datasets
train_datagen = ImageDataGenerator(rescale=1/255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)
# Testing Datasets
test_datagen = ImageDataGenerator(rescale=1/255)

In [11]:
import os, types
import pandas as pd
from boto3.client import Config
import boto3

def __iter__(self): return 0

#@hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = boto3.client(service_name='s3',
    iam_api_key_id='Jq6uF5-esFIYN7Mip7GEmubTf6ErV07fe5T3B5k47iI1',
    iam_auth_endpoint='https://iam.cloud.ibm.com/oidc/token',
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'detectingparkinsonsdisease-donotdelete-pr-kopghnknwugkrd'
object_key = 'dataset.zip'

streaming_body_1 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']

# Your data file was loaded into a boto3.response.StreamingBody object.
# Please read the documentation of boto3 and pandas to learn more about the possibilities to load the data.
# The boto3 documentation: https://boto3.amazonaws.com/v1/documentation/api/latest/guide/quickstart.html
```

```
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In [50]: from ibm_watson_machine_learning import APIClient
wml_credentials = {
    "url": "https://us-south.ml.cloud.ibm.com",
    "apikey": "Dr6GxZazRE05mq0GFC-bP2Ug0ZShyyI-6u4UVIV0C50p"
}
client = APIClient(wml_credentials)

In [51]: def guid_from_space_name(client, space_name):
space = client.spaces.get_details()
return (next(item for item in space['resources'] if item['entity']['name'] == space_name)['metadata']['id'])

In [53]: space_uid = guid_from_space_name(client, 'Detecting Parkinson's Disease')
space_uid

Out[53]: '95caff3e-81b1-4833-9f0b-aa6d834227a9'

In [54]: client.set.default_space(space_uid)

Out[54]: 'SUCCESS'

In [55]: client.software_specifications.list()

NAME ASSET_ID TYPE
default_py3.6 0062b8c9-8b7d-44a0-a9b9-46c416adcbd9 base
kernel-spark3.2-scala2.12 020d69ce-7ac1-5e68-ac1a-31189867356a base
pytorch-onnx-1.3-py3.7-edt 069ea134-3346-5748-b513-49120e15d288 base
```

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In [56]:

```
software_spec_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1-py3.9")
software_spec_uid
```

Out[56]: 'acd9c798-6974-5d2f-a657-ce06e986dfad'

In [57]:

```
model_details = client.repository.store_model(model='IBM_TrainedModel.tgz', meta_props={
    client.repository.ModelMetaNames.NAME: "CNN",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID: software_spec_uid,
    client.repository.ModelMetaNames.TYPE: "tensorflow_2.7"})
model_id = client.repository.get_model_uid(model_details)
```

This method is deprecated, please use get\_model\_id()

/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/ibm\_watson\_machine\_learning/repository.py:1453: UserWarning: This method is deprecated, please use get\_model\_id()
warn("This method is deprecated, please use get\_model\_id()")

In [58]:

```
model_id
```

Out[58]: '75236d5b-f232-4617-87e2-27975d06824a'

In [59]:

```
DEPLOYMENT_NAME = "Detecting Parkinson's Disease"
deployment_props = {
    client.deployments.ConfigurationMetaNames.NAME: DEPLOYMENT_NAME,
    client.deployments.ConfigurationMetaNames.ONLINE: {}
}
```

In [60]:

```
deployment = client.deployments.create(
    artifact_uid = model_id,
```

Detecting\_Parkin...ipynb

Show all

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In [59]:

```
DEPLOYMENT_NAME = "Detecting Parkinson's Disease"
deployment_props = {
    client.deployments.ConfigurationMetaNames.NAME: DEPLOYMENT_NAME,
    client.deployments.ConfigurationMetaNames.ONLINE: {}
}
```

In [60]:

```
deployment = client.deployments.create(
    artifact_uid = model_id,
    meta_props = deployment_props
)
```

#####

Synchronous deployment creation for uid: '75236d5b-f232-4617-87e2-27975d06824a' started

#####

initializing  
Note: online\_url is deprecated and will be removed in a future release. Use serving\_urls instead.  
...  
ready

-----

Successfully finished deployment creation, deployment\_uid='0787eb40-1e89-4f84-ab3b-42d6975ec032'

Detecting\_Parkin...ipynb

Show all



Deployments /



## Detecting Parkinson's Disease

Overview Assets **Deployments** Jobs Manage

Search

Name	Type	Status	Asset	Last modified	
Detecting Parkinson's Disease	Online	Deployed	CNN	50 minutes ago Nallajonnala Ramanaidu (You)	

Items per page: 20 1-1 of 1 items

1 of 1 pages

Drop files here or browse for files to upload.

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Incomplete uploads are cancelled.

Deployments /



## Detecting Parkinson's Disease

**Overview** Assets Deployments Jobs Manage

### Assets

CNN  
53 minutes ago

[View all \(1\)](#)

### Deployments

All

**1** **0**  
 Deployed Failed

[View deployments](#)

### Job runs

**0** **0**  
 Active Failed last hour

[View jobs](#)

### Space activity

**Online deployment deleted**  
You deleted the online deployment "Detecting Parkinson's Disease" from space [Detecting Parkinson's Disease](#).  
Today at 08:17 PM

**Online deployment deleted**  
You deleted the online deployment "Detecting Parkinson's Disease" from space [Detecting Parkinson's Disease](#).  
Today at 08:17 PM

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Stay on the page until upload completes.  
Incomplete uploads are cancelled.

## Detection of Parkinson's Disease using ML

Parkinson disease (PD) is a progressive neuro degenerative disorder that impacts more than 6 million people around the world. Parkinson's disease is non-communicable, early-stage detection of Parkinson's can prevent further damages in humans suffering from it. However, Nonetheless, non-specialist physicians still do not have a definitive test for PD, similarly in the early stage of the diseased person where the signs may be intermittent and badly characterized. It resulted in a high rate of misdiagnosis (up to 25% among non-specialists) and many years before treatment, patients can have the disorder. A more accurate, unbiased means of early detection is required, preferably one that individuals can use in their home setting. However, it has been observed that PD's presence in a human is related to its hand-writing as well as hand-drawn subjects. From that perspective, several techniques have been proposed by researchers to detect Parkinson's disease from hand-drawn images of suspected people. But the previous methods have their constraints.

## Causes and Symptoms of Parkinson's Disease

### PARKINSON'S DISEASE

A disease that affects nerve cells in the brain and causes tremors, poor coordination and problems walking and moving

### CAUSES & RISK FACTORS

- Both men & women are affected
- Parkinson's commonly develops after age 50
- Scientists have identified several genes that may lead to Parkinson's in some people but there is no solid proof to show it is always inherited.
- Men are more likely to develop Parkinson's disease because they're more likely to experience head injury or exposure to toxins.

### SYMPTOMS OF PARKINSON'S

- Slow thinking
- No facial expression
- Shaking
- Difficulty swallowing
- Shaking tremors
- Loss of smell or the handwriting
- Memory loss, depression
- Anxiety, depression
- Hallucinations
- Sloped posture
- Stiff neck and joints
- Constipation
- Problems with sleep

### Parkinson's Disease Symptoms

### Stages of Parkinson's Disease

Stage 1: Developing mild symptoms but able to go about day-to-day life

Stage 2: Symptoms such as tremors and stiffness begin to worsen, may develop poor posture or have trouble walking

Stage 3: Movement begins to slow down, loss of balance

Stage 4: Symptoms are severe and cause significant issues with day-to-day living, unable to live

Stage 5: Walking or standing may be impossible at this point, people at this stage are often confined to a wheelchair

### (A) Normal

### (B) Parkinson's disease

### Brain Regions Affected by Parkinson's Disease

### Treatment of Motor Symptoms of Parkinson's Disease

## Treatment for parkinson disease

### Rehabilitate

Example: LSVT-LOUD

### Therapy

Example: Deep Brain Stimulation

### Dopaminergics

### Muscarinic Antagonists

### Others

### Advanced Parkinson's Treatment and Coping Strategies

## Treatment for parkinson disease



## How brains looks during PD?

## How brains looks during PD?



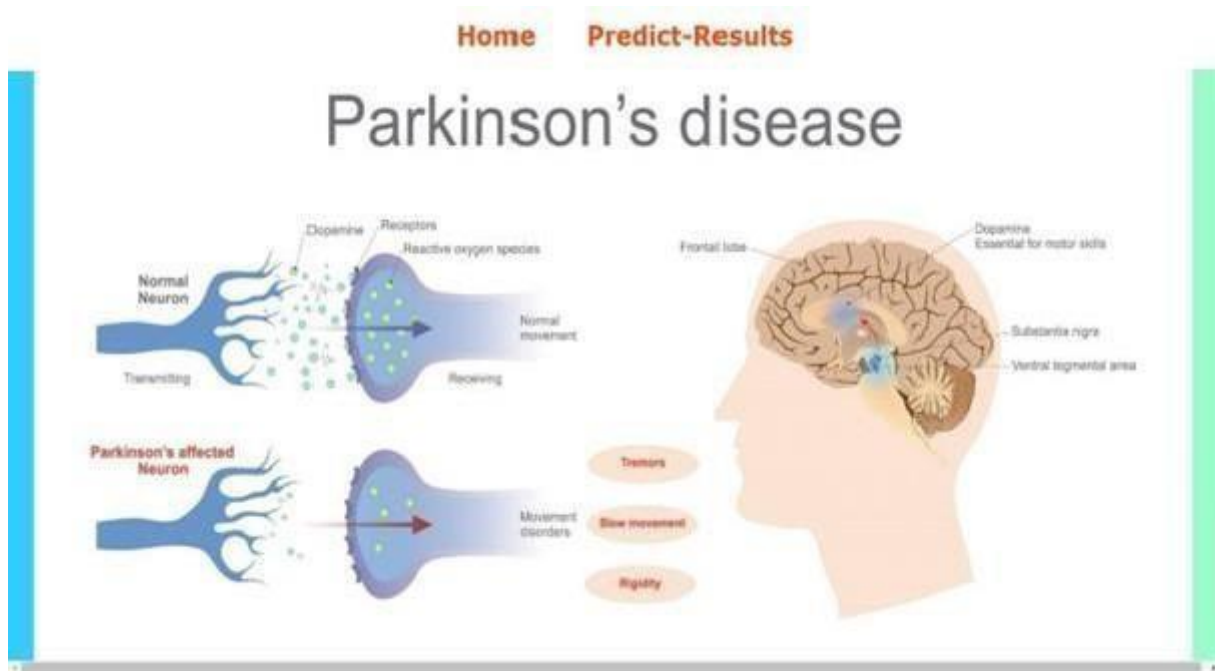
Healthy



Parkinson's Disease  
before symptoms



Parkinson's Disease  
after symptoms

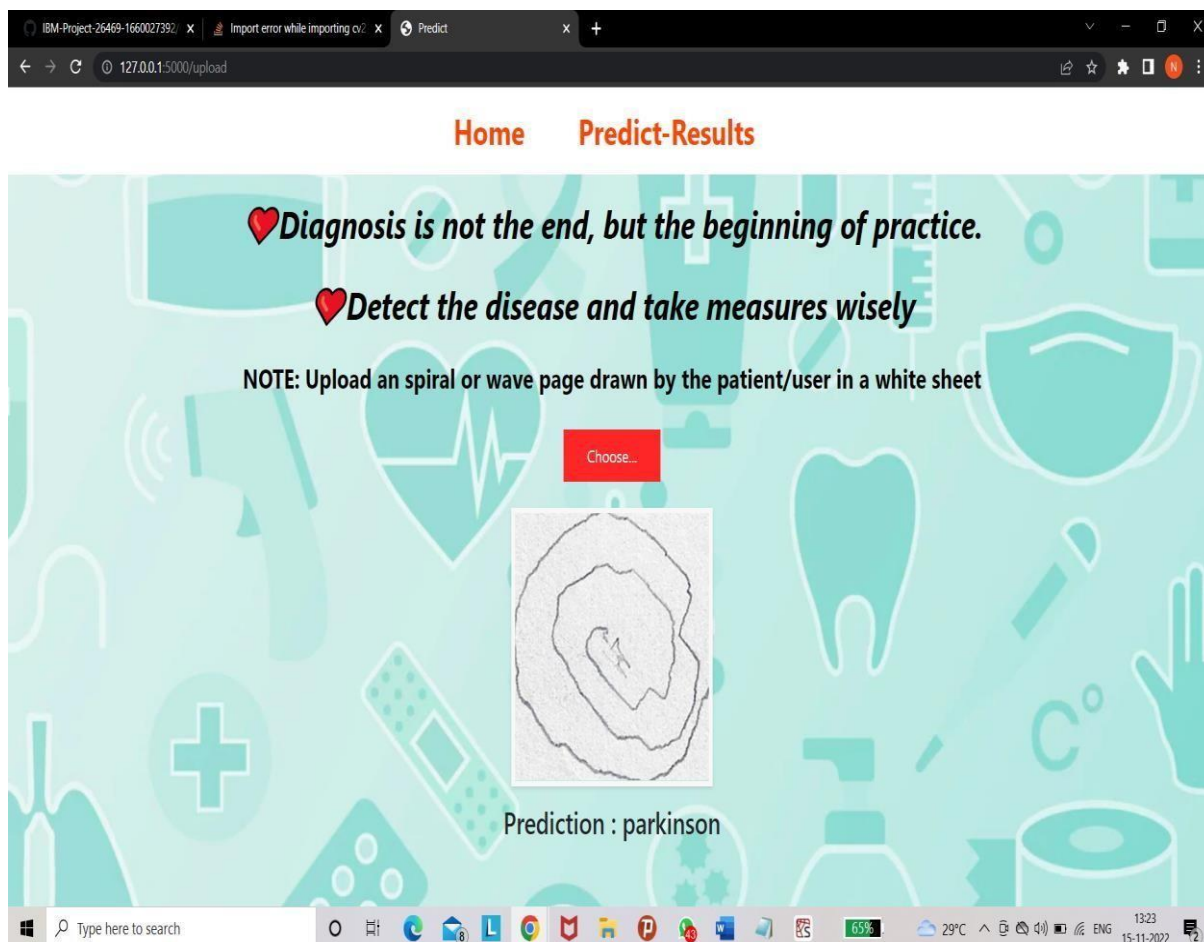
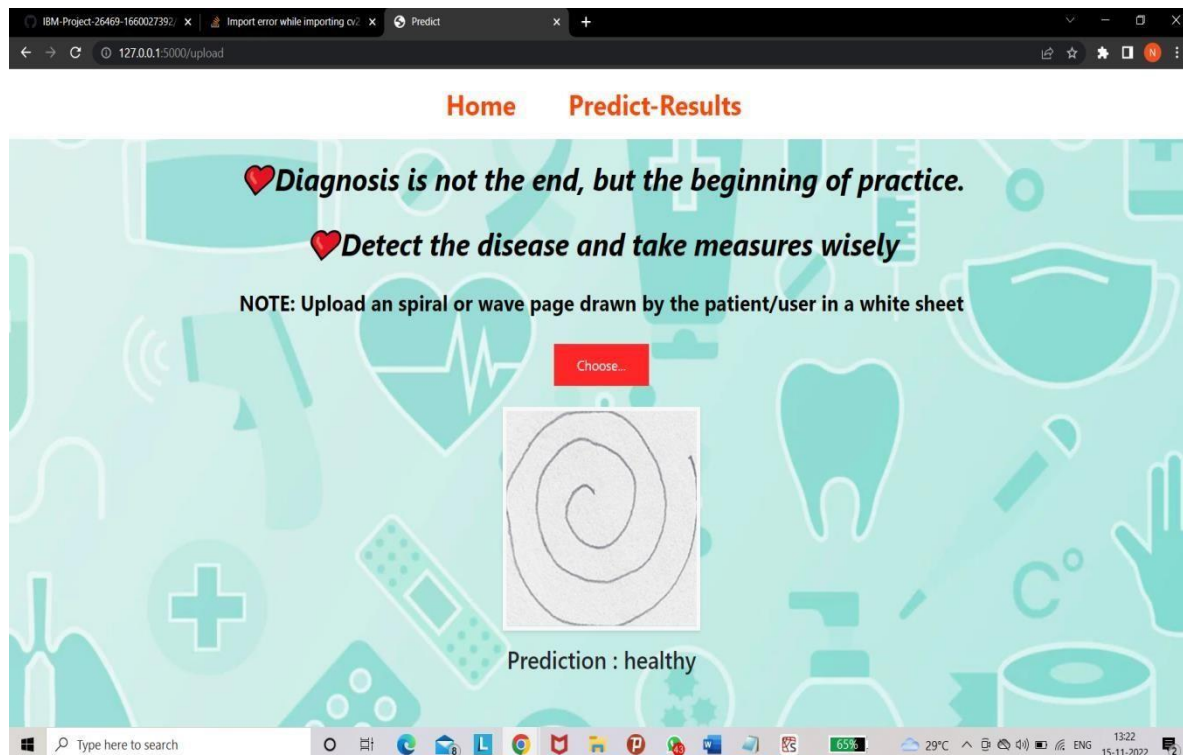


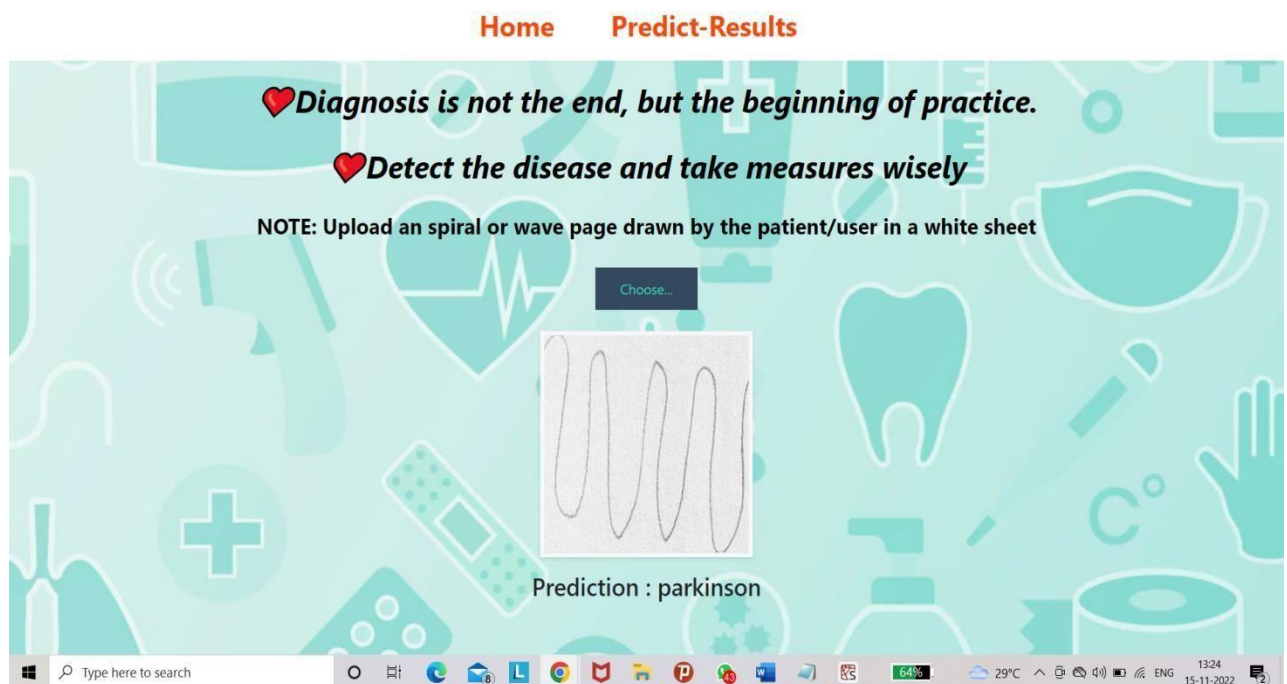
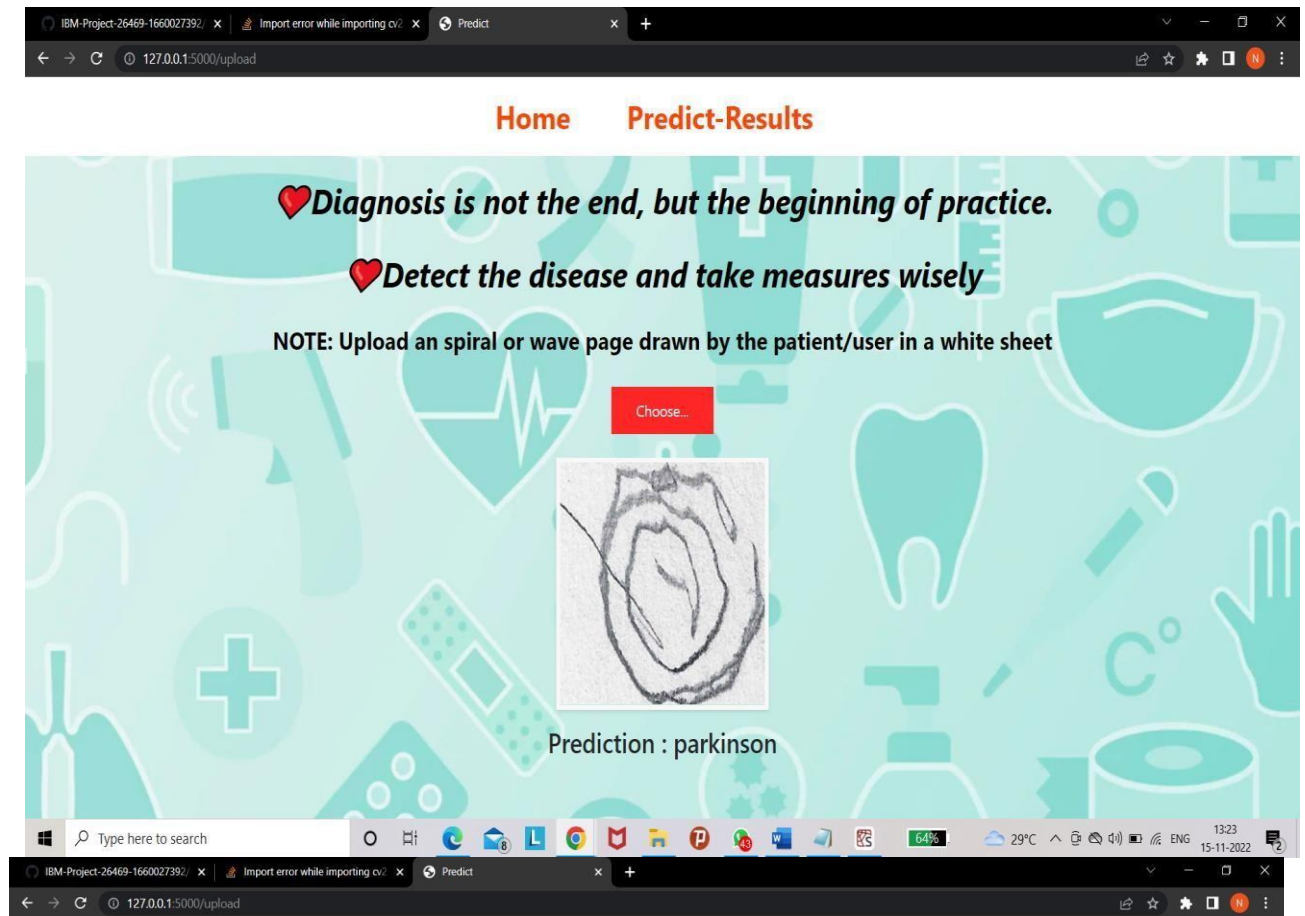
## Test-Vital Page



## Predicted Result of Spiral/Wave Images







IBM-Project-26469-1660027392 x Import error while importing a/ x Predict x +

127.0.0.1:5000/upload

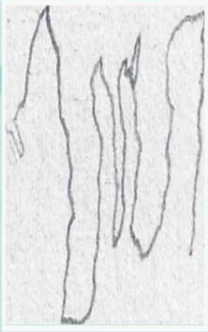
[Home](#) [Predict-Results](#)

♥ *Diagnosis is not the end, but the beginning of practice.*

♥ *Detect the disease and take measures wisely*

NOTE: Upload an spiral or wave page drawn by the patient/user in a white sheet

Choose...



Prediction : parkinson

Type here to search

64% 29°C 13:24 15-11-2022



IBM-Project-26469-1660027392 x Import error while importing cv2 x Predict x +

127.0.0.1:5000/upload

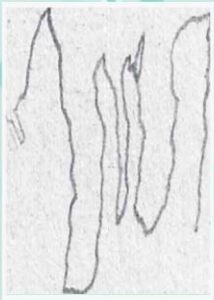
**Home Predict-Results**

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NOTE: Upload an spiral or wave page drawn by the patient/user in a white sheet

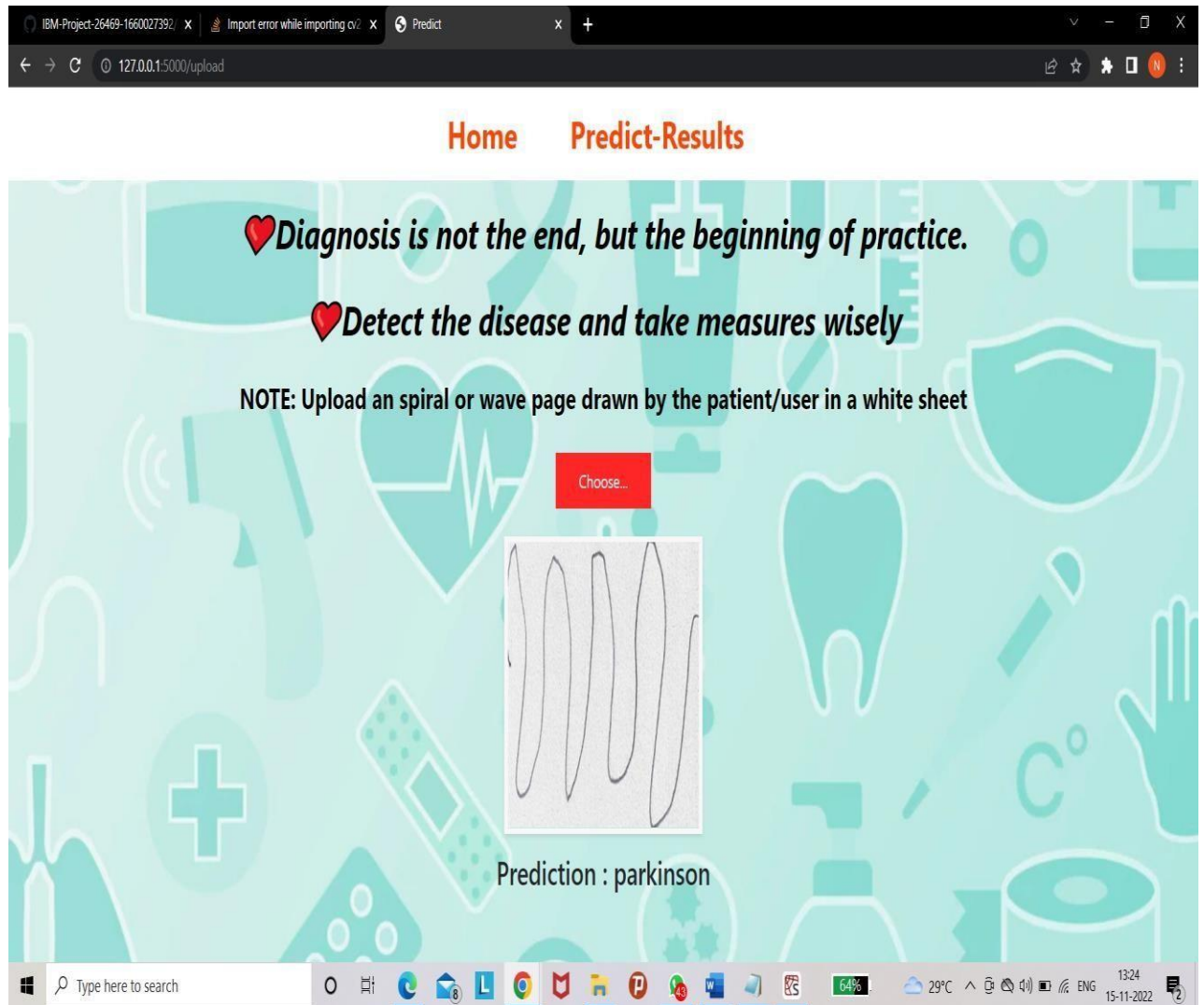
Choose...



Prediction : parkinson

Type here to search

64% 29°C 13:24 15-11-2022



## Conclusion

Parkinson's disease affects the CNS of the brain and has yet no treatment unless it's detected early. Late detection leads to no treatment and loss of life. Thus, its early detection is significant. Machine Learning techniques is used to improve the accuracy of early diagnosis significantly. So, our Machine Learning model can help doctors and assist

them in detecting Parkinson's disease at an earlier stage and increase the chances of survival.