

# **Fertilizers Recommendation System for Disease Prediction**

**PROJECT REPORT**

*Submitted by*

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# **1. INTRODUCTION**

## **1.1. Project Overview**

In this project, two datasets name fruit dataset and vegetable dataset are collected. The collected datasets are trained and tested with deep learning neural network named Convolutional Neural Networks (CNN). First, the fruit dataset is trained and then tested with CNN. It has 6 classes and all the classes are trained and tested. Second, the vegetable dataset is trained and tested. The software used for training and testing of datasets is Python. All the Python codes are first written in Jupyter notebook supplied along with Anaconda Python and then the codes are tested in IBM cloud. Finally, a web-based framework is designed with help Flask a Python library. There are 2 html files are created in templates folder along with their associated files in static folder. The Python program 'app.py' used to interface with these two webpages is written in Spyder-Anaconda python and tested.

## **1.2. Purpose**

This project is used to test the fruits and vegetables samples and identify the different diseases. Also, this project recommends fertilizers for predicted diseases.

# **2. LITERATURE SURVEY**

## **2.1. Existing problem**

Indumathi proposed a method for leaf disease detection and suggest fertilizers to cure leaf diseases. But the method involves less number of train and test sets which results in poor accuracy. Pandi selvi proposed a simple prediction method for soil-based fertilizer recommendation system for predicted crop diseases. This method gives less accuracy and prediction. Shiva reddy proposed an IoT based system for leaf disease detection and fertilizer recommendation which is based on Machine Learning techniques yields less 80 percentage accuracies.

## **2.2. References**

- Leaf Disease Detection and Fertilizer Suggestion
- Plant Disease Detection and Classification using CNN Model with Optimized Activation Function
- Crop leaf disease detection using machine learning algorithm

## 2.3. Problem Statement Definition

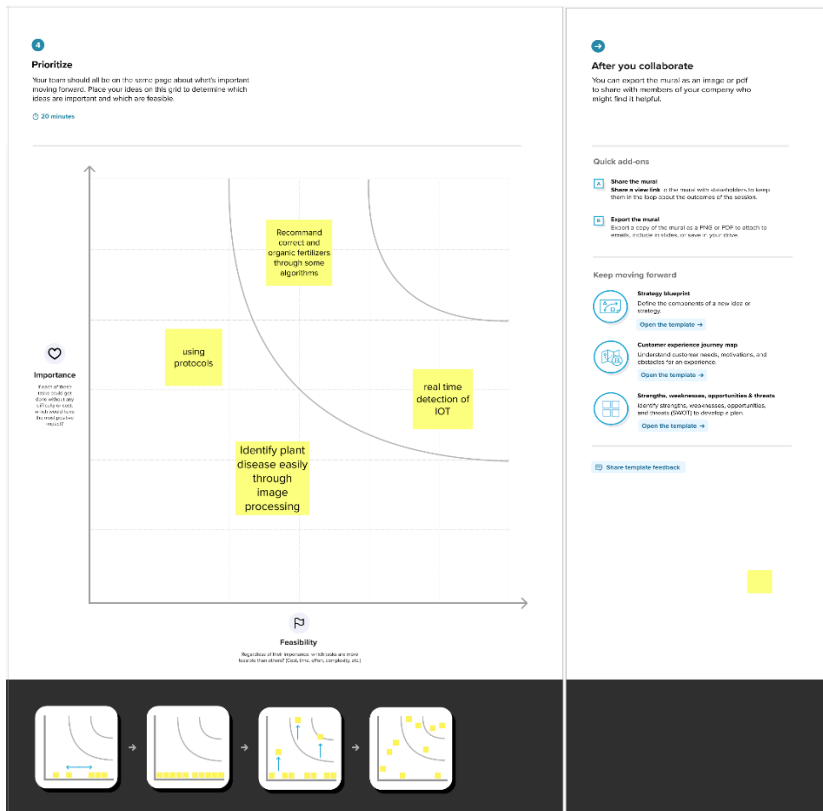
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Farmers	Cultivate healthy crops	It is not possible	It is affected by disease and insufficient fertilizer	Frustrated and Economically weak
PS-2	Local people	Buy healthy and organic vegetables at low cost	The price of food products are high and the quality is low	Crops are affected by disease	Frustrated

## 3. IDEATION & PROPOSED SOLUTION

### 3.1. Empathy Map Canvas







### 3.3. Proposed Solution

In this project work, a deep learning based neural network is used to train the collected datasets and test the same. The deep learning based neural network is CNN which gives more than 90% classification accuracies. By increasing the more number of dense layers and by modifying hyperparameters such as number of epochs, batch size, the accuracy rate can be increased to 95% to 98%.

### 3.4. Problem Solution Fit

Project Title: Fertilizers Recommendation System for Disease Prediction.  
Team ID: PNT2022TMID51209

Project Design Phase-I - Solution Fit Template

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> Farmer are the first customer for this application.Farmers can easily use this benefits and get uses of fertilizers crop.	<b>6. CUSTOMER CONSTRAINTS</b> Availability of good networks. Capturing the image in a required to Get a accurate prediction of disease in the plant.	<b>5. AVAILABLE SOLUTIONS</b> People can can identify the disease in plants through the Change of leaf quality.	Evolve AS, differentiate
	<b>2. JOBS-TO-BE-DONE/ PROBLEMS</b> The applications focuses it can helping for the farmer Who needs a better recommendation of fertilizer on the infected plants.	<b>9. PROBLEM ROOT CAUSE</b> Various disease on the plants can lead to reduce the quality and quantity of the crops production.	<b>7. BEHAVIOUR</b> DIRECTLY In offline, people can directly see the quality of the leaf. They dont need an extra knowledge on the disease prediction.	
	<b>3. TRIGGERS</b> Seeing their crops are being infected by disease and feeling huge loss in quality and quantity.	<b>10. YOUR SOLUTION</b> Using fertilizers is the one of the solution for the disease prediction in plants. In an image processing application it can identify the disease and notify the good fertilizer for the disease leaf.	<b>8. CHANNELS OF BEHAVIOUR</b> 8.1 ONLINE Basic knowledge of plant and fertilizer was helpful. 8.2 OFFLINE People try to identify the disease by the quality of leaf.	
Identify strong TR	<b>4. EMOTIONS: BEFORE / AFTER</b> BEFORE Losing self confidence and distress AFTER gaining self confidence and relief.			Identify strong TR

## 4. REQUIREMENT ANALYSIS

### 4.1. Functional requirement

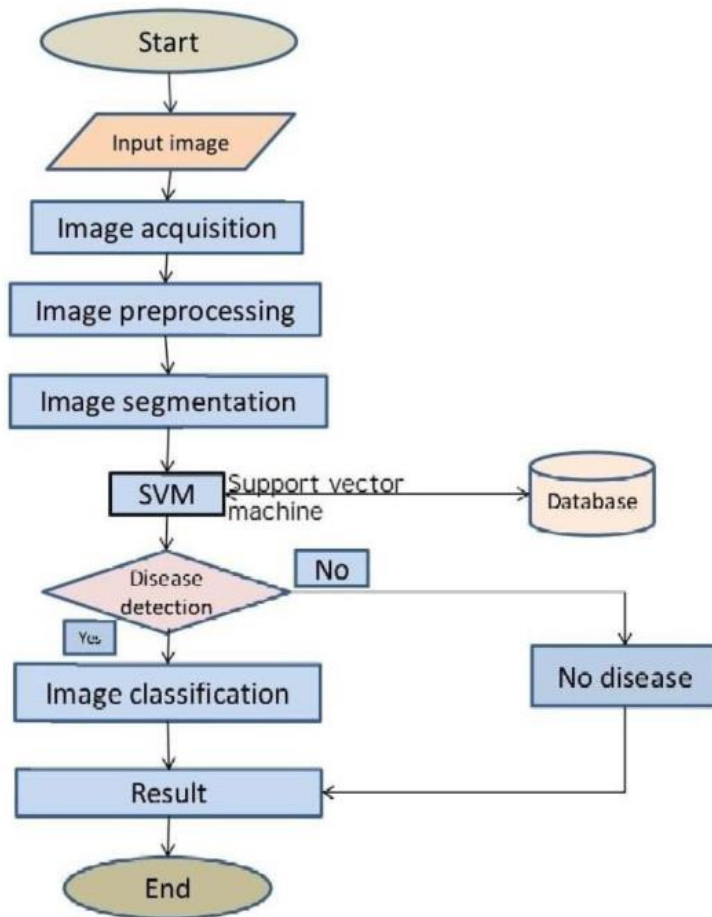
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Capturing image	Capture the image of the leaf and check the parameter of the captured image.
FR-4	Image processing	Upload the image for the prediction of the disease in the leaf.
Fr-5	Leaf identification	Identify the leaf and predict the disease in leaf.
Fr-6	Image description	Suggesting the best fertilizer for the disease.

## 4.2. Non -Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Datasets of all the leaf is used to detecting the disease that present in the leaf.
NFR-2	Security	The information belongs to the user and leaf are secured highly.
NFR-3	Reliability	The leaf quality is important for the predicting the disease in leaf.
NFR-4	Performance	The performance is based on the quality of the leaf used for disease prediction
NFR-5	Availability	It is available for all user to predict the disease in the plant.
NFR-6	Scalability	Increasing the prediction of the disease in the leaf.

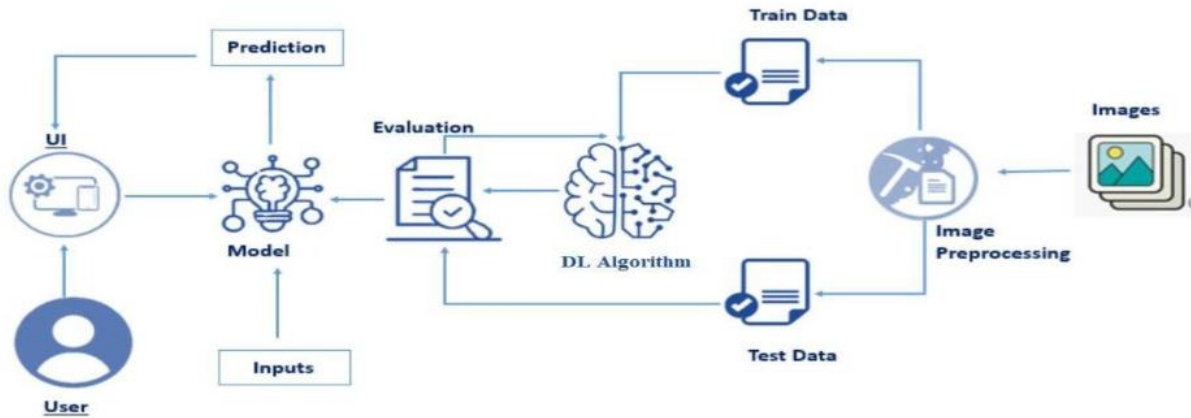
## 5. Project Design

### 5.1. Data Flow Diagrams





## 5.2. Solution & Technical Architecture



## 5.3. User Stories

Functional Requirement (Epic)	User Story Number	User Story / Task
Data collection	USN-1	Collect and create the data set related to the objective
Image processing	USN-2	Process the images
Model Building for fruit disease prediction	USN-3	Import libraries
Model Building for fruit disease prediction	USN-4	Initializing the model
Model Building for fruit disease prediction	USN-5	Adding layers
Model Building for fruit disease prediction	USN-6	Train and save the model for fruits
Model Building for vegetable disease prediction	USN-7	Train and save the model for vegetable
Test both model	USN-8	Testing the built model
Application building	USN-9	Build python code
Application building	USN-10	Build HTML code
Application building	USN-11	Run the code

Train the model on IBM	USN-12	Register cloud account
Train the model on IBM	USN-13	Train the model on IBM

## 6. Project Planning & Scheduling

### 6.1. Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection	USN-1	Collect and create the data set related to the objective	10	High	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba, P.yamuna
Sprint-1	Image processing	USN-2	Process the images	10	High	J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba, P.yamuna
Sprint-2	Model Building for fruit disease prediction	USN-3	Import libraries	2	Low	S.Vijaya rama Lakshmi, B.Pradeeba, T.Gayathri
Sprint-2	Model Building for fruit disease prediction	USN-4	Initializing the model	2	Low	T.Gayathri,J.Flora, B.Pradeeba, P.yamuna
Sprint-2	Model Building for fruit disease prediction	USN-5	Adding layers	2	Low	J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba, P.yamuna
Sprint-2	Model Building for fruit disease prediction	USN-6	Train and save the model for fruits	7	High	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi,
Sprint-2	Model Building for vegetable disease prediction	USN-7	Train and save the model for vegetable	7	High	T.Gayathri,J.Flora, B.Pradeeba, P.yamuna

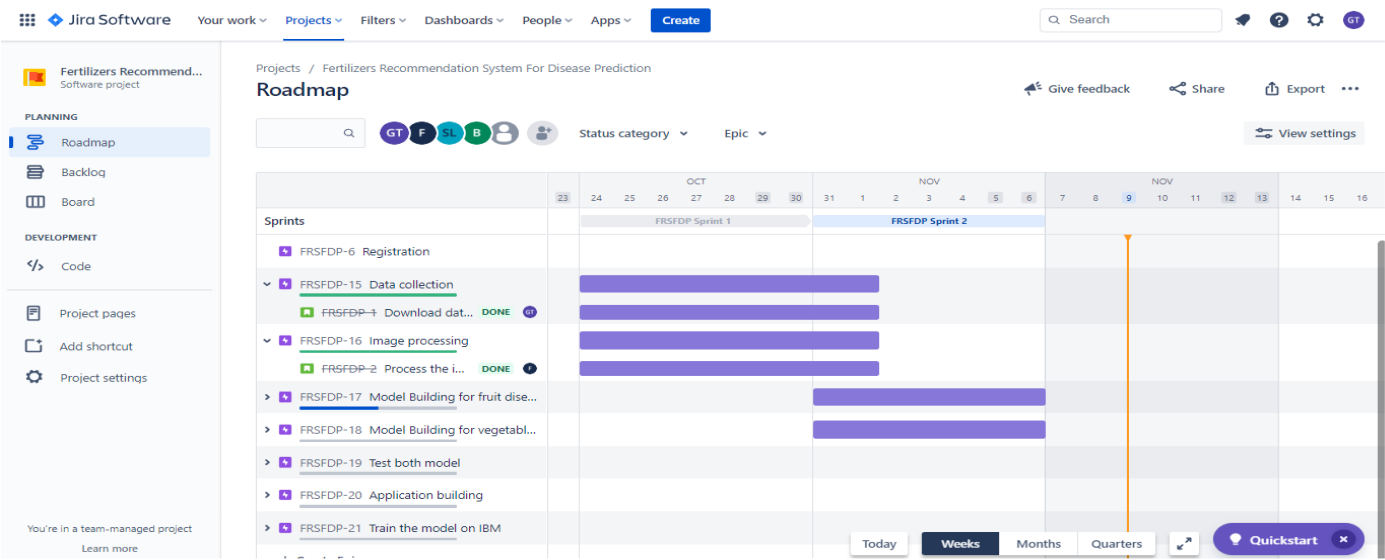
Sprint-3	Test both model	USN-8	Testing the built model	5	Medium	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi
Sprint-4	Application building	USN-9	Build python code	5	Medium	T.Gayathri,J.Flora, P.yamuna
Sprint-4	Application building	USN-10	Build HTML code	5	Medium	T.Gayathri,S.Vijaya rama Lakshmi, B.Pradeeba,
Sprint-4	Application building	USN-11	Run the code	10	High	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba,
Sprint-3	Train the model on IBM	USN-12	Register cloud account	5	Medium	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba, P.yamuna
Sprint-3	Train the model on IBM	USN-13	Train the model on IBM	10	High	T.Gayathri,J.Flora, S.Vijaya rama Lakshmi, B.Pradeeba

## 6.2. Sprint Delivery Schedule

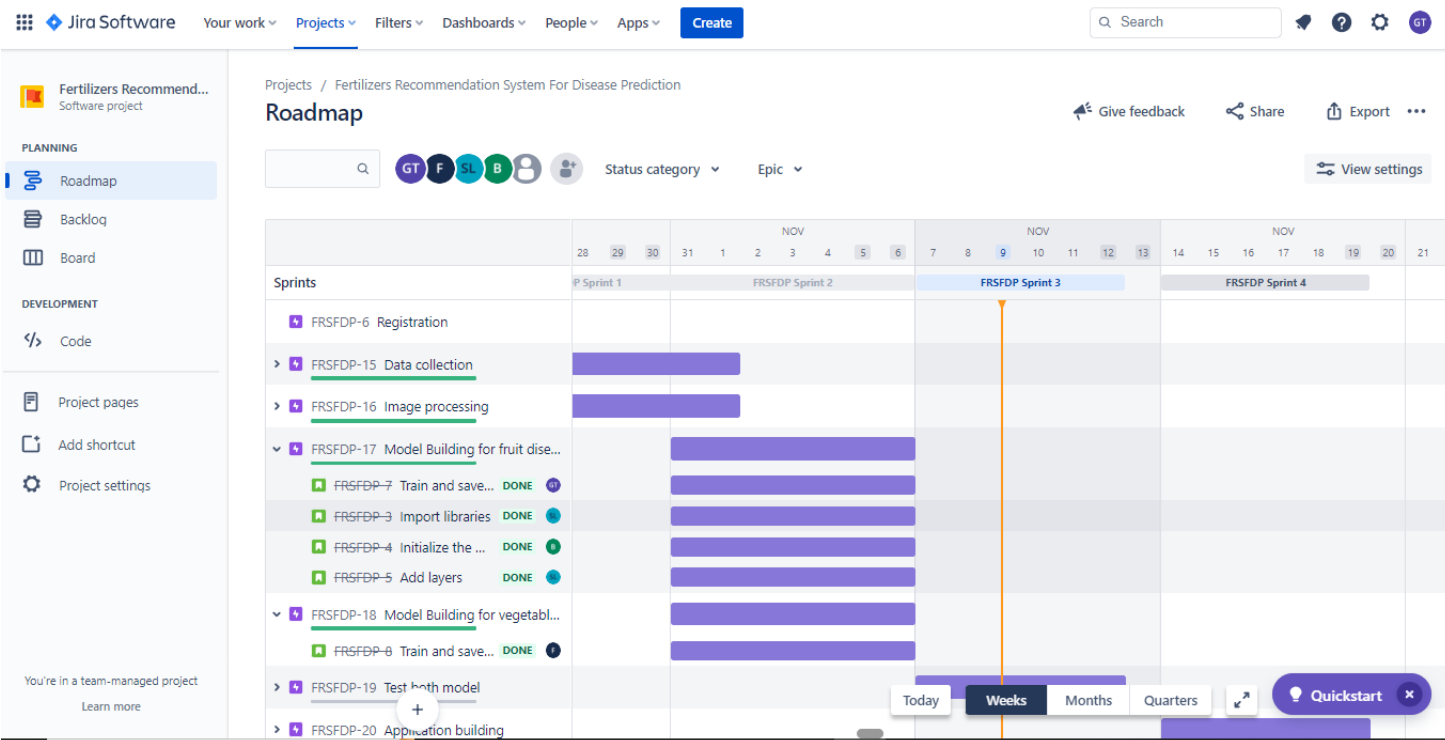
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

- SPRINT – 1



- SPRINT – 2



- **SPRINT – 3**

Jira Software
Your work v
Filters v
Dashboards v
People v
Apps v
Create

Fertilizers Recommend...  
Software project

Projects / Fertilizers Recommendation System For Disease Prediction

Give feedback
Share
Export
...

Roadmap

GT

F

SL

B

Status category v

Epic v

View settings

	NOV						NOV						NOV						NOV						
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Sprints	DP Sprint 2						FRSFDP Sprint 3						FRSFDP Sprint 4												
>  FRSFDP-16 Image processing																									
>  FRSFDP-17 Model Building for fruit dise...																									
>  FRSFDP-18 Model Building for vegetabl...																									
>  FRSFDP-19 Test both model																									
FRSFDP-9 Testing the built m... DONE																									
>  FRSFDP-20 Application building																									
>  FRSFDP-21 Train the model on IBM																									
FRSFDP-13 Register cloud ac... DONE																									
FRSFDP-14 Train the model o... DONE																									
+ Create Epic																									

You're in a team-managed project  
Learn more

Today

Weeks

Months

Quarters

Quickstart

- **SPRINT – 4**

The screenshot displays the Jira Roadmap interface for a project named "Fertilizers Recommendation System For Disease Prediction". The top navigation bar includes "Jira Software", "Your work", and various filters. The left sidebar lists navigation options: "PLANNING" (Roadmap, Backlog, Board), "DEVELOPMENT" (Code), "Project pages", "Add shortcut", and "Project settings". The main content area shows the "Roadmap" view with a search bar, status category filter, and epic filter. The roadmap grid is organized by month (NOV, DEC) and week. Sprints are listed on the left, and tasks are shown as horizontal bars across the timeline. A vertical orange line indicates the current date. The bottom of the screen shows a "Quickstart" button and a "You're in a team-managed project" message.

### 7.1. Feature 1 (HTML Code)

```
<!DOCTYPE html>
```

[illegible]



```

<div class="container">

    
    <div class="card">
        <form>
            <h1>Drop in the image to get the Prediction </h1><br><br>
            <label><select name="Fruit" id="plant">
                <option value="fruit" id="fruit">Fruit</option>
                <option value="vagitabile" id="vig">vegitable</option>
            </select>
            </label><br><br><br>
            <input id="default-btn" type="file" name=""
onchange="document.getElementById('output').src=window.URL.createObjectURL(this.files[0])"><br><br><br>
            <img src="" id="output">

            <button id="button" onclick ="display()" >Predict!</button><br><br>

        </form>

    </div>

</div>
</body>
</html>

```

## 7.2. Feature 2 (Python code)

```

import os
from flask import Flask, redirect, render_template, request
from PIL import Image
import torchvision.transforms.functional as TF
import CNN
import numpy as np
import torch
import pandas as pd
import torch.nn as nn

disease_info = pd.read_csv('disease_info.csv' , encoding='cp1252')
supplement_info = pd.read_csv('supplement_info.csv',encoding='cp1252')

model = CNN.CNN(39)
model = nn.DataParallel(model)
model.load_state_dict(torch.load(r"../Model/model.pth", map_location=torch.device("cpu")))
model.eval()

def prediction(image_path):
    image = Image.open(image_path)
    image = image.resize((224, 224))
    input_data = TF.to_tensor(image)
    input_data = input_data.view((-1, 3, 224, 224))
    output = model(input_data)
    output = output.detach().numpy()
    index = np.argmax(output)

```



```

return index
app = Flask(__name__)

@app.route('/')
def home_page():
    return render_template('home.html')

@app.route('/index')
def ai_engine_page():
    return render_template('index.html')

@app.route('/mobile-device')
def mobile_device_detected_page():
    return render_template('mobile-device.html')

@app.route('/submit', methods=['GET', 'POST'])
def submit():
    if request.method == 'POST':
        image = request.files['image']
        filename = image.filename
        file_path = os.path.join('static/uploads', filename)
        image.save(file_path)

        print(file_path)
        pred = prediction(file_path)
        title = disease_info['disease_name'][pred]
        description = disease_info['description'][pred]
        prevent = disease_info['Possible Steps'][pred]
        image_url = disease_info['image_url'][pred]
        supplement_name = supplement_info['supplement name'][pred]
        supplement_image_url = supplement_info['supplement image'][pred]
        supplement_buy_link = supplement_info['buy link'][pred]
        return render_template('submit.html', title = title, desc = description, prevent = prevent,
                               image_url = image_url, pred = pred, sname = supplement_name, simage =
supplement_image_url, buy_link = supplement_buy_link)

@app.route('/market', methods=['GET', 'POST'])
def market():
    return render_template('market.html', supplement_image = list(supplement_info['supplement image']),
                           supplement_name = list(supplement_info['supplement name']), disease =
list(disease_info['disease_name']), buy = list(supplement_info['buy link']))

if __name__ == '__main__':
    app.run(debug=True)

```

## 8.1. Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps to Execute	Test Data	Expected Result	Actual Result	Status	CAPSULE	TC For Automation (Y/N)	BDD/G	Executed By
HomePage_TC_0001	Functional	Home Page	Verify user is able to view the home page or not.		1. Enter URL and click go 2. Verify whether the user is able to see the home page.	Enter URL and click go	User able to see the home page	Working as expected	Pass	NAI	N	-	Salaf M
HomePage_TC_0003	UI	Home Page	Verify the UI elements in Home Page		1. Enter URL and click go 2. Verify the UI elements in Home Page.	Enter URL and click go	Application should show below UI elements: Home link is visible	Working as expected	Pass	NAI	N	-	Pradeep V
5	Functional	Predict page	Verify user is able to redirect to predict page or not.		1. Enter URL and click go 2. Click on Predict button 3. Verify whether the user is redirected to predict page or not.	Click the predict button in home page	User should navigate to Predict page	Working as expected	Pass	NAI	N	-	Mohamed Farooq C
6	UI	Predict page	Verify the UI elements in Predict page		1. Enter URL and click go 2. Verify the UI elements in Predict Page.	Click the predict button and redirect to predict page	Application should show below UI elements: Diagnosis List , Upload file button, Predict button	Working as expected	Pass	NAI	N	-	Saeed A, Pradeep V
7	Functional	Predict page	Verify user is able to select the diagnosis value or not.		1. Enter URL and click go 2. Click on Predict button 3. Verify whether the user is redirected to predict page or not. 4. Verify user is able to select the diagnosis value or not.	Not applicable	Application should show user to choose fruit or vegetable option in diagnosis list	Working as expected	Pass	NAI	N	-	Saeed A, Mohamed Farooq C
8	Functional	Predict page	Verify user is able to upload the image or not.		1. Enter URL and click go 2. Click on Predict button 3. Verify whether the user is redirected to predict page or not. 4. Verify user is able to select the diagnosis value or not. 5. Verify user is able to upload the image or not	Images to be uploaded	Application should show the uploaded image	Working as expected	Pass	NAI	N	-	Saeed A, Rajul M
9	Functional	Predict page	Verify whether the integer is predicted correctly or not		1. Enter URL and click go 2. Click on Predict button 3. Verify whether the user is redirected to predict page or not. 4. Verify user is able to select the diagnosis value or not. 5. Verify user is able to upload the image or not 6. Verify whether the integer predicted correctly or not	Click the Predict Button	Application shows the predicted input	Working as expected	Pass	NAI	N	-	Saeed A

## 8.2. User Acceptance Testing

- **Defect Analysis**

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	0	1	0	1
Duplicate	1	3	2	2	8
External	2	3	0	0	5
Fixed	4	4	4	4	16
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	7	10	7	7	31

- **Test Case Analysis**

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	1	0	0	1

## 9. Results

### 9.1. Performance Metrics

## Model Summary

Total params: 5,084,552

Trainable params: 5,084,552

**Non-trainable params: 0**

```
In [41]: model.summary()
```

Model: "sequential\_2"

Layer (type)	Output Shape	Param #
conv2d_5 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_2 (MaxPooling2D)	(None, 63, 63, 32)	0
flatten_2 (Flatten)	(None, 127008)	0
dense_6 (Dense)	(None, 40)	5080360
dense_7 (Dense)	(None, 70)	2870
dense_8 (Dense)	(None, 6)	426

=====  
Total params: 5,084,552  
Trainable params: 5,084,552  
Non-trainable params: 0

## Accuracy

Training Accuracy – 96.55

Validation Accuracy – 97.45

```
model.fit_generator(x_train, steps_per_epoch=len(x_train), validation_data=x_test, validation_steps=len(x_test), epochs=10)
```

C:\Users\Sree Ram\AppData\Local\Temp\ipykernel\_13228\1582812018.py:1: UserWarning: `Model.fit\_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.

```
model.fit_generator(x_train, steps_per_epoch=len(x_train), validation_data=x_test, validation_steps=len(x_test), epochs=10)
```

```
Epoch 1/10
225/225 [=====] - 96s 425ms/step - loss: 1.1095 - accuracy: 0.7829 - val_loss: 0.3157 - val_accuracy: 0.8861
Epoch 2/10
225/225 [=====] - 88s 393ms/step - loss: 0.2825 - accuracy: 0.9042 - val_loss: 0.3015 - val_accuracy: 0.9075
Epoch 3/10
225/225 [=====] - 85s 375ms/step - loss: 0.2032 - accuracy: 0.9303 - val_loss: 0.2203 - val_accuracy: 0.9288
Epoch 4/10
225/225 [=====] - 84s 374ms/step - loss: 0.1576 - accuracy: 0.9463 - val_loss: 0.2424 - val_accuracy: 0.9164
Epoch 5/10
225/225 [=====] - 84s 372ms/step - loss: 0.1719 - accuracy: 0.9389 - val_loss: 0.1330 - val_accuracy: 0.9632
Epoch 6/10
225/225 [=====] - 85s 376ms/step - loss: 0.1240 - accuracy: 0.9580 - val_loss: 0.1340 - val_accuracy: 0.9573
Epoch 7/10
225/225 [=====] - 87s 388ms/step - loss: 0.1235 - accuracy: 0.9591 - val_loss: 0.1638 - val_accuracy: 0.9478
Epoch 8/10
225/225 [=====] - 83s 371ms/step - loss: 0.1012 - accuracy: 0.9643 - val_loss: 0.1468 - val_accuracy: 0.9561
Epoch 9/10
225/225 [=====] - 83s 367ms/step - loss: 0.0967 - accuracy: 0.9655 - val_loss: 0.1412 - val_accuracy: 0.9531
Epoch 10/10
225/225 [=====] - 83s 369ms/step - loss: 0.0954 - accuracy: 0.9655 - val_loss: 0.0905 - val_accuracy: 0.9745
```

## 10. ADVANTAGES & DISADVANTAGES

### List of advantages

- The proposed model here produces very high accuracy of classification.
- Very large datasets can also be trained and tested.

- Images of very high can be resized within the proposed itself.

#### List of disadvantages

- For training and testing, the proposed model requires very high computational time.
- The neural network architecture used in this project work has high complexity.

## **11. CONCLUSION**

The model proposed here involves image classification of fruit datasets and vegetable datasets. The following points are observed during model testing and training:

- The accuracy of classification increased by increasing the number of epochs.
- For different batch sizes, different classification accuracies are obtained.
- The accuracies are increased by increasing more convolution layers.
- The accuracy of classification also increased by varying dense layers.
- Different accuracies are obtained by varying the size of kernel used in the convolution layer output.
- Accuracies are different while varying the size of the train and test datasets.

## **12. FUTURE SCOPE**

The proposed model in this project work can be extended to image recognition. The entire model can be converted to application software using python to exe software. The real time image classification, image recognition and video processing are possible with help OpenCV python library. This project work can be extended for security applications such as figure print recognition, iris recognition and face recognition.

## 13. Appendix

### 13.1. Source Code

## Model Building For Fruit Disease Prediction

```
jupyter Model Building for Fruit disease prediction Last Checkpoint: 2 hours ago (autosaved) Python 3 (ipykernel) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

In [23]: #Image Agumentation

In [24]: from keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.2, horizontal_flip=True)
test_datagen=ImageDataGenerator(rescale=1)

In [25]: x_train=train_datagen.flow_from_directory('C:\Users\ELCOT\Desktop\IBM\Dataset Plant Disease\fruit-dataset\fruit-dataset\train', target_size=(180, 180))
x_test=test_datagen.flow_from_directory('C:\Users\ELCOT\Desktop\IBM\Dataset Plant Disease\fruit-dataset\fruit-dataset\test', target_size=(180, 180))

Found 5384 images belonging to 6 classes.
Found 1686 images belonging to 6 classes.

In [26]: #Import required Libraries

In [27]: from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Convolution2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten

In [28]: #Initializing Sequential model

In [29]: model=Sequential()

In [30]: #Adding Layers

In [31]: model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))# convolution Layer

In [32]: model.add(MaxPooling2D(pool_size=(2,2))) # Max pooling Layer

In [33]: model.add(Flatten())# Flatten Layer

In [34]: model.add(Dense(units=40,kernel_initializer='uniform',activation='relu'))# Hidden Layer 1
model.add(Dense(units=70,kernel_initializer='random_uniform',activation='relu'))# Hidden Layer 2
model.add(Dense(units=6,kernel_initializer='random_uniform',activation='softmax')) # Output Layer


In [35]: # Compiling the model

In [36]: model.compile(optimizer='adam',loss='categorical_crossentropy',metrics=['accuracy'])

In [37]: #Train the model

In [38]: model.fit(x_train,steps_per_epoch=168,epochs=3,validation_data=x_test,validation_steps=52)

Epoch 1/3
168/168 [=====] - 51s 266ms/step - loss: 1.5775 - accuracy: 0.3601 - val_loss: 133.8710 - val_accuracy: 0.4038
Epoch 2/3
168/168 [=====] - 57s 342ms/step - loss: 1.1549 - accuracy: 0.5625 - val_loss: 93.9611 - val_accuracy: 0.6442
Epoch 3/3
168/168 [=====] - 42s 249ms/step - loss: 0.9021 - accuracy: 0.6280 - val_loss: 48.2599 - val_accuracy: 0.7308
```

jupyter Model Building for Fruit disease prediction Last Checkpoint: 2 hours ago (autosaved)  Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

```
Out[38]: <keras.callbacks.History at 0x1d85a6c3790>
```

```
In [39]: #Save the model
```

```
In [40]: model.save(r'C:\Users\Elcot\project\flask\uploads\fruit.h5')
```


```
In [41]: model.summary()
```

```
Model: "sequential_2"
```

Layer (type)	Output Shape	Param #
conv2d_5 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_2 (MaxPooling 2D)	(None, 63, 63, 32)	0
flatten_2 (Flatten)	(None, 127008)	0
dense_6 (Dense)	(None, 40)	5080360
dense_7 (Dense)	(None, 70)	2870
dense_8 (Dense)	(None, 6)	426

```
-----  
Total params: 5,084,552  
Trainable params: 5,084,552  
Non-trainable params: 0
```

## Model Building for Vegetable disease Prediction

jupyter Model Building for vegetable disease prediction Last Checkpoint: 2 minutes ago (autosaved)  Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

```
In [1]: #Image Agumentation  
from keras.preprocessing.image import ImageDataGenerator  
train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)  
test_datagen=ImageDataGenerator(rescale=1)
```

```
In [2]: x_train=train_datagen.flow_from_directory(r'C:\Users\ELCOT\Desktop\IBM\Dataset Plant Disease\Veg-dataset\Veg-dataset\train_set',target_size=(224,224))  
x_test=test_datagen.flow_from_directory(r'C:\Users\ELCOT\Desktop\IBM\Dataset Plant Disease\Veg-dataset\Veg-dataset\test_set',target_size=(224,224))
```

```
Found 11386 images belonging to 9 classes.  
Found 3416 images belonging to 9 classes.
```

```
In [3]: #Import Library Files  
from keras.models import Sequential  
from keras.layers import Dense  
from keras.layers import Convolution2D  
from keras.layers import MaxPooling2D  
from keras.layers import Flatten
```

```
In [4]: #Initialize the sequential model  
model=Sequential()
```

```
In [5]: # Add the convolution layer  
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

```
In [6]: # Add the max pooling layer  
model.add(MaxPooling2D(pool_size=(2,2)))
```

```
In [7]: # Add the Flatten Layer
model.add(Flatten())

In [8]: # Add the Hidden Layer 1
model.add(Dense(units=300, kernel_initializer='uniform', activation='relu'))

In [9]: # Add the Hidden Layer 2
model.add(Dense(units=150, kernel_initializer='uniform', activation='relu'))

In [10]: # Add the Hidden Layer 3
model.add(Dense(units=75, kernel_initializer='uniform', activation='relu'))

In [11]: # Add the Output Layer
model.add(Dense(units=9, kernel_initializer='uniform', activation='softmax'))

In [12]: # Compiling the model
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

In [13]: # Train model
model.fit(x_train, steps_per_epoch=89, epochs=20, validation_data=x_test, validation_steps=27)

Epoch 1/20
89/89 [=====] - 66s 690ms/step - loss: 2.1881 - accuracy: 0.1685 - val_loss: 194.3618 - val_accuracy:
0.1296
Epoch 2/20
89/89 [=====] - 59s 663ms/step - loss: 2.1182 - accuracy: 0.1236 - val_loss: 109.5233 - val_accuracy:
0.1296
Epoch 3/20
89/89 [=====] - 67s 755ms/step - loss: 2.0954 - accuracy: 0.1180 - val_loss: 80.7805 - val_accuracy:
0.1296
```

```
Epoch 4/20
89/89 [=====] - 73s 817ms/step - loss: 2.1350 - accuracy: 0.1854 - val_loss: 164.9028 - val_accuracy:
0.1111
Epoch 5/20
89/89 [=====] - 69s 776ms/step - loss: 2.1272 - accuracy: 0.1798 - val_loss: 74.0293 - val_accuracy:
0.1296
Epoch 6/20
89/89 [=====] - 65s 729ms/step - loss: 2.0987 - accuracy: 0.2079 - val_loss: 94.8363 - val_accuracy:
0.2037
Epoch 7/20
89/89 [=====] - 57s 643ms/step - loss: 2.0832 - accuracy: 0.2079 - val_loss: 32.7240 - val_accuracy:
0.0926
Epoch 8/20
89/89 [=====] - 56s 628ms/step - loss: 2.0565 - accuracy: 0.2584 - val_loss: 134.1384 - val_accuracy:
0.2963
Epoch 9/20
89/89 [=====] - 56s 628ms/step - loss: 2.1103 - accuracy: 0.1517 - val_loss: 61.7429 - val_accuracy:
0.1481
Epoch 10/20
89/89 [=====] - 55s 622ms/step - loss: 2.0565 - accuracy: 0.2416 - val_loss: 121.7573 - val_accuracy:
0.1481
Epoch 11/20
89/89 [=====] - 53s 598ms/step - loss: 2.1168 - accuracy: 0.1854 - val_loss: 30.3666 - val_accuracy:
0.1667
Epoch 12/20
89/89 [=====] - 57s 635ms/step - loss: 2.0713 - accuracy: 0.2079 - val_loss: 56.4360 - val_accuracy:
0.2778
Epoch 13/20
89/89 [=====] - 59s 665ms/step - loss: 1.9673 - accuracy: 0.2416 - val_loss: 66.7629 - val_accuracy:
0.3333
Epoch 14/20
89/89 [=====] - 55s 612ms/step - loss: 1.9854 - accuracy: 0.3202 - val_loss: 95.1238 - val_accuracy:
0.3148
```

```
Epoch 15/20
89/89 [=====] - 55s 614ms/step - loss: 1.7150 - accuracy: 0.3933 - val_loss: 148.8870 - val_accuracy: 0.2037
Epoch 16/20
89/89 [=====] - 56s 624ms/step - loss: 1.6605 - accuracy: 0.3708 - val_loss: 292.1395 - val_accuracy: 0.2222
Epoch 17/20
89/89 [=====] - 55s 611ms/step - loss: 1.8242 - accuracy: 0.3427 - val_loss: 156.9938 - val_accuracy: 0.3704
Epoch 18/20
89/89 [=====] - 56s 628ms/step - loss: 1.7093 - accuracy: 0.3876 - val_loss: 161.5939 - val_accuracy: 0.2778
Epoch 19/20
89/89 [=====] - 66s 745ms/step - loss: 1.6356 - accuracy: 0.3933 - val_loss: 143.6697 - val_accuracy: 0.3704
Epoch 20/20
89/89 [=====] - 64s 714ms/step - loss: 1.8686 - accuracy: 0.3427 - val_loss: 70.6791 - val_accuracy: 0.4259
```

Out[13]: <keras.callbacks.History at 0x259831a6be0>

```
In [16]: # Save model
model.save(r'C:\Users\Elcot\project\flask\uploads\vegetable.h5')
```

```
In [16]: # Save model
model.save(r'C:\Users\Elcot\project\flask\uploads\vegetable.h5')
```

```
In [17]: model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d (MaxPooling2D)	(None, 63, 63, 32)	0
flatten (Flatten)	(None, 127008)	0
dense (Dense)	(None, 300)	38102700
dense_1 (Dense)	(None, 150)	45150
dense_2 (Dense)	(None, 75)	11325
dense_3 (Dense)	(None, 9)	684

```

Total params: 38,160,755
Trainable params: 38,160,755
Non-trainable params: 0
```



# Train the Vegetable model on IBM

```
train the vegetable model.ipynb
File Edit View Insert Runtime Tools Help All changes saved
+ Code + Text
RAM 100% Disk 100% Editing
!tar -zxvf vegetable-classification.tgz vegetable.h5
vegetable.h5
!pip install watson-machine-learning-client
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (4.64.1)
Collecting lomond
  Downloading lomond-0.3.3-py2.py3-none-any.whl (35 kB)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.24.3)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2022.9.24)
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.3.5)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (0.8.10)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2.23.0)
Collecting boto3
  Downloading boto3-1.29.8-py3-none-any.whl (9.9 MB)
  9.9 MB 44.0 MB/s
Collecting s3transfer<0.7.0,>=0.6.0
  Downloading s3transfer-0.6.0-py3-none-any.whl (79 kB)
  79 kB 5.9 MB/s
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from boto3->watson-machine-learning-client) (2.8.2)
Collecting urllib3
  Downloading urllib3-1.26.12-py2.py3-none-any.whl (140 kB)
  140 kB 49.8 MB/s
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->boto3->watson-machine-learning-client) (1.16.0)
Collecting ibm-cos-sdk-core==2.12.0
  Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)
  956 kB 51.1 MB/s
Collecting ibm-cos-sdk-s3transfer==2.12.0
  Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
  135 kB 41.9 MB/s
Collecting jmespath<2.0.0,>=0.7.1
9s completed at 4:50 PM

train the vegetable model.ipynb
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RAM 100% Disk 100% Editing
Collecting ibm-cos-sdk-core==2.12.0
  Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)
  956 kB 51.1 MB/s
Collecting ibm-cos-sdk-s3transfer==2.12.0
  Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
  135 kB 41.9 MB/s
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-0.10.0-py2.py3-none-any.whl (24 kB)
Collecting requests
  Downloading requests-2.28.1-py3-none-any.whl (62 kB)
  62 kB 1.4 MB/s
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->watson-machine-learning-client) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests->watson-machine-learning-client) (2.1.1)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas->watson-machine-learning-client) (2022.6)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas->watson-machine-learning-client) (1.21.6)
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer
  Building wheel for ibm-cos-sdk (setup.py) ... done
  Created wheel for ibm-cos-sdk: filename=ibm_cos_sdk-2.12.0-py3-none-any.whl size=73931 sha256=9dc8bc595283dd512bdba6518aac95fea85f7b427b6fc466f622face6c4ff099
  Stored in directory: /root/.cache/pip/wheels/ec/94/29/2b57327cf00664b6614304f7958abd29d77ea0e5bbece2ea57
  Building wheel for ibm-cos-sdk-core (setup.py) ... done
  Created wheel for ibm-cos-sdk-core: filename=ibm_cos_sdk_core-2.12.0-py3-none-any.whl size=562962 sha256=a2e50525cdf2fb7a30956d24ed0eb8339e105797ad40e660eb7b2bfb10e87fde
  Stored in directory: /root/.cache/pip/wheels/64/56/fb/5cd6f4f40406c828a5289b95b2752a4d142a9afb359244ed8d
  Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done
  Created wheel for ibm-cos-sdk-s3transfer: filename=ibm_cos_sdk_s3transfer-2.12.0-py3-none-any.whl size=89778 sha256=257cdc4ff7f9e9cbe0a5fa35ab4f8ad4c888e7b049eb00c1f81d3fedaff
  Stored in directory: /root/.cache/pip/wheels/57/79/6a/ffe3370ed7ebc00604f9f76766e1e0348dcdcad2b2e32dff9e1
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
Installing collected packages: urllib3, requests, jmespath, ibm-cos-sdk-core, boto3, s3transfer, ibm-cos-sdk-s3transfer, lomond, ibm-cos-sdk, boto3, watson-machine-learning-cl
  Attempting uninstall: urllib3
    Found existing installation: urllib3 1.24.3
    Uninstalling urllib3-1.24.3:
      Successfully uninstalled urllib3-1.24.3
  Attempting uninstall: requests
    Found existing installation: requests 2.23.0
    Uninstalling requests-2.23.0:
      Successfully uninstalled requests-2.23.0
Successfully installed boto3-1.26.8 boto3-1.29.8 ibm-cos-sdk-2.12.0 ibm-cos-sdk-core-2.12.0 ibm-cos-sdk-s3transfer-2.12.0 jmespath-0.10.0 lomond-0.3.3 requests-2.28.1 s3transfe
9s completed at 4:50 PM
```

```
train the vegetable model.ipynb
File Edit View Insert Runtime Tools Help All changes saved

+ Code + Text

!pip install ibm_watson_machine_learning

Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting ibm_watson_machine_learning
  Downloading ibm_watson_machine_learning-1.0.257-py3-none-any.whl (1.8 MB)
    |#####| 1.8 MB 9.4 MB/s
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (1.3.5)
Requirement already satisfied: lxml in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (0.3.3)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (1.26.12)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (2.28.1)
Collecting ibm-cos-sdk==2.7.*
  Downloading ibm-cos-sdk-2.7.0.tar.gz (51 kB)
    |#####| 51 kB 708 kB/s
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (21.3)
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (4.13.0)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (2022.9.24)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (0.8.10)
Collecting ibm-cos-sdk-core==2.7.0
  Downloading ibm-cos-sdk-core-2.7.0.tar.gz (824 kB)
    |#####| 824 kB 52.1 MB/s
Collecting ibm-cos-sdk-s3transfer==2.7.0
  Downloading ibm-cos-sdk-s3transfer-2.7.0.tar.gz (133 kB)
    |#####| 133 kB 51.2 MB/s
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk==2.7.*->ibm_watson_machine_learning) (0.10.0)
Collecting docutils<0.16,>=0.10
  Downloading docutils-0.15.2-py3-none-any.whl (547 kB)
    |#####| 547 kB 49.4 MB/s
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk-core==2.7.0->ibm_watson_machine_learning) (2.8.1)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (2022.6)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (1.21.6)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-core==2.7.0->ibm_watson_machine_learning) (1.16.0)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests->ibm_watson_machine_learning) (2.1.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->ibm_watson_machine_learning) (2.10)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm_watson_machine_learning) (3.10.0)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm_watson_machine_learning) (4.1.1)
Requirement already satisfied: ovsarsine<3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->ibm_watson_machine_learning) (3.0.9)
9s completed at 4:50 PM
```

```
train the vegetable model.ipynb
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Requirement already satisfied: pyparsing<3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->ibm_watson_machine_learning) (3.0.9)
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer
  Building wheel for ibm-cos-sdk (setup.py) ... done
  Created wheel for ibm-cos-sdk: filename=ibm_cos_sdk-2.7.0-py2.py3-none-any.whl size=72563 sha256=c40613ff61488741dd9bde985e8c9561c1a2ae2743ed568b200a974f8715
  Stored in directory: /root/.cache/pip/wheels/47/22/bf/e1154ff0f5de93cc477ac0ca9abfbb8b799c5b28a66b44c2
  Building wheel for ibm-cos-sdk-core (setup.py) ... done
  Created wheel for ibm-cos-sdk-core: filename=ibm_cos_sdk_core-2.7.0-py2.py3-none-any.whl size=501013 sha256=f44c9b5718819e778367a0873bec7ea10d05f84b04b8381378e42f2accfc
  Stored in directory: /root/.cache/pip/wheels/6c/a2/e4/cl6d02f809a3ea998e17cf02c1369281f3d232aa5f902c19
  Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done
  Created wheel for ibm-cos-sdk-s3transfer: filename=ibm_cos_sdk_s3transfer-2.7.0-py2.py3-none-any.whl size=88622 sha256=8328123a45bd1abb82b1298bf27c0d4e3ccc067064611a3c0449fab16
  Stored in directory: /root/.cache/pip/wheels/5f/b7/14/fbe02bc1efaf890650c7e51743d1c83890852e598d164b9da
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
Installing collected packages: docutils, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer, ibm-cos-sdk, ibm-watson-machine-learning
Attempting uninstall: docutils
  Found existing installation: docutils 0.17.1
  Uninstalling docutils-0.17.1:
    Successfully uninstalled docutils-0.17.1
Attempting uninstall: ibm-cos-sdk-core
  Found existing installation: ibm-cos-sdk-core 2.12.0
  Uninstalling ibm-cos-sdk-core-2.12.0:
    Successfully uninstalled ibm-cos-sdk-core-2.12.0
Attempting uninstall: ibm-cos-sdk-s3transfer
  Found existing installation: ibm-cos-sdk-s3transfer 2.12.0
  Uninstalling ibm-cos-sdk-s3transfer-2.12.0:
    Successfully uninstalled ibm-cos-sdk-s3transfer-2.12.0
Attempting uninstall: ibm-cos-sdk
  Found existing installation: ibm-cos-sdk 2.12.0
  Uninstalling ibm-cos-sdk-2.12.0:
    Successfully uninstalled ibm-cos-sdk-2.12.0
Successfully installed docutils-0.15.2 ibm-cos-sdk-2.7.0 ibm-cos-sdk-core-2.7.0 ibm-cos-sdk-s3transfer-2.7.0 ibm-watson-machine-learning-1.0.257
```

```
train the vegetable model.ipynb
File Edit View Insert Runtime Tools Help All changes saved

+ Code + Text

[5] from ibm_watson_machine_learning import APIClient
    wml_credentials = {
        "url": "https://eu-gb.ml.cloud.ibm.com",
        "apikey": "wHv1Gg2JmwaTSL5IOX_1IRsFEITms97bQQIT3FFv1WGXc"
    }
    client = APIClient(wml_credentials)

Python 3.7 and 3.8 frameworks are deprecated and will be removed in a future release. Use Python 3.9 framework instead.

[6] client

<ibm_watson_machine_learning.client.APIClient at 0x7f35d3cc750>

client.spaces.get_details()

[{'resources': [{'entity': {'compute': [{'crn': 'crn:v1:bluemix:public:pm-20:eu-gb:a/d2a512c7590048cfaf7f28cd26438f49:f78a826e-3c47-40ec-9ced-ab40e6d544d3':,
'guid': 'f78a826e-3c47-40ec-9ced-ab40e6d544d3',
'name': 'Watson Machine Learning-ak',
'type': 'machine_learning'}],
'description': '',
'name': 'v1_Deploy',
'scope': {'bss_account_id': 'd2a512c7590048cfaf7f28cd26438f49'},
'stage': {'production': False},
'status': {'state': 'active'},
'storage': {'properties': {'bucket_name': 'a90b4771-730e-49cc-b5e5-1758dc2fb7c1',
'bucket_region': 'eu-gb-standard',
'credentials': {'admin': {'access_key_id': 'e827a1d463054462be58c11d21f4a342',
'api_key': 'hIKmNx80Wj461q3pDfSL2-lNveCtZ7cnqsm8c0lQe4LG3',
'secret_access_key': '73985104727fed75860de0d65b713b701909a93da86a73',
'service_id': 'ServiceId-a30f82e7-316e-46bd-b229-331030406a23'},
'editor': {'access_key_id': '004f08bd143c4550b2516a8f5271771',
'api_key': '9Ysax1Y9-XojQa56GwvJ2Kf64HyTcfwxf67nCd-jrXau',
'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49:',
'secret_access_key': '7chh5e540375876c10f85a86b0ad6e6f4a42cra4338f7'}
```

train the vegetable model.ipynb

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```
def create_space(self, stage, status, storage, bucket_region, credentials, api_key, secret_access_key, service_id, editor, resource_key_crn, secret_access_key, service_id, viewer, api_key, resource_key_crn, secret_access_key, service_id, endpoint_url, guid, resource_crn, type, metadata):
    'stage': {'production': False},
    'status': {'state': 'active'},
    'storage': {'properties': {'bucket_name': 'a90b4771-730e-49cc-b5e5-1758dc2fb7c1',
                              'bucket_region': 'eu-gb-standard',
                              'credentials': {'admin': {'access_key_id': 'e827a1d463954462be58c11d21f4a342',
                                                         'api_key': 'hikmhu80uj461a3p0DF5LC-nvefc7cng5m8e9l0e4Lg3',
                                                         'secret_access_key': 'e730510472c7fed75868de0d65b713b70109a93da86a73',
                                                         'service_id': 'ServiceId-a30f82e7-315e-46bd-b229-331030406a23'},
                                                         'editor': {'access_key_id': '004f08db143c4550b25166a8f5271771',
                                                         'api_key': '9Ysax1Y9-XojQeS6WvJ2Kf64HyFtwcxf67ncD-jrXqu',
                                                         'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
                                                         'secret_access_key': '7cbb5e54037e5876c10f85a86b0acd6e6fba4b2caa4338f7',
                                                         'service_id': 'ServiceId-68abd7ca-11d3-4e3e-b8dd-da61d9c93eae'},
                                                         'viewer': {'access_key_id': '08ec080406014223b26317ff7d844345',
                                                         'api_key': 'amCm5-G8gCOF66caRf1118Pz5kIVU8SF1TPFL284uMP',
                                                         'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
                                                         'secret_access_key': 'e7c659f9ebf2790368703f11b8a0f28082cf7256833fd2d',
                                                         'service_id': 'ServiceId-ea9f16f2-4120-4ae0-b248-f5bc5605c424'}},
                                                         'endpoint_url': 'https://s3.eu-gb.cloud-object-storage.appdomain.cloud',
                                                         'guid': '0e43b750-15aa-4634-9c02-9954d7f0be49',
                                                         'resource_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
                                                         'type': 'bmcos_object_storage'}},
                                                         'metadata': {'created_at': '2022-11-13T10:24:33.382Z',
                                                         'creator_id': 'IBH1d-6640043b38',
                                                         'id': 'c77baaef-a816-44c5-95eb-9d2bf178dc6f',
                                                         'updated_at': '2022-11-13T10:24:47.901Z',
                                                         'url': '/v2/spaces/c77baaef-a816-44c5-95eb-9d2bf178dc6f'}}]]]

[8] client.spaces.list()

Note: 'limit' is not provided. Only first 50 records will be displayed if the number of records exceed 50
-----
ID          NAME          CREATED
c77baaef-a816-44c5-95eb-9d2bf178dc6f  v1_Deploy  2022-11-13T10:24:33.382Z
-----
```

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```
[9] space_uid = "c77baaef-a816-44c5-95eb-9d2bf178dc6f"
space_uid

'c77baaef-a816-44c5-95eb-9d2bf178dc6f'

[10] client.set_default_space(space_uid)

'SUCCESS'

client.software_specifications.list()

-----
NAME          ASSET_ID          TYPE
default_py3.6  0062b8c9-8b7d-44a0-a9b9-46c416adcbd9  base
kernel-spark3.2-scala2.12  020d659ce-7ac1-5e68-ac1a-11189867356a  base
pytorch-onnx_1.3-py3.7-edt  069ea134-3346-5748-b513-49120e154288  base
scikit-learn_0.20-py3.6  09c5a1d0-9c1e-4473-a344-eb7b665ff687  base
spark-mllib_3.0-scala_2.12  09f4cff0-90a7-5899-b9ed-1ef348aebdee  base
pytorch-onnx_rt22.1-py3.9  0b848dd4-e681-5599-be41-b5f6fccc6471  base
ai-function_0.1-py3.6  0cdd0f1e-5376-4f4d-92dd-da3b69aa9bda  base
shiny-r3.6  0e6e79df-875e-4f24-8ae9-62dccc2148306  base
tensorflow_2.4-py3.7-horovod  1092590a-307d-563d-9b62-4eb7d64b3f22  base
pytorch_1.1-py3.6  10ac12d6-6b30-4ccd-8392-3e922c096a92  base
tensorflow_1.15-py3.6-ddl  111e41b3-de2d-5422-84d6-bf776828c4b7  base
autoai-hb_rt22.2-py3.10  125b6d9a-5b1f-5e8d-972a-b251688c-cf40  base
runtime_22.1-py3.9  12b83a17-24d8-5082-900f-0ab31fbfd3cb  base
scikit-learn_0.22-py3.6  154010fa-5b3b-4ac1-82af-4d5ee5abbcb5  base
default_r3.6  1b70aec3-ab34-4b87-8aa0-a4a3c8296a36  base
pytorch-onnx_1.3-py3.6  1bc6029a-c97f-56da-b0e0-39c3880dbb7  base
kernel-spark3.3-r3.6  1c9e5454-f216-59dd-a20e-474a5cdf5988  base
pytorch-onnx_rt22.1-py3.9-edt  1d362186-7ad5-5b59-8b6c-9d0880bde37f  base
tensorflow_2.1-py3.6  1eb25b84-daed-5dde-b6a5-3fbdf1665666  base
spark-mllib_3.2  2004f772-0a98-58c7-9ff5-a77b012eb0f5  base
tensorflow_2.4-py3.8-horovod  217c16f6-178f-56bf-824a-b19f20564c49  base
-----
```

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runtime-22.1-py3.9 12b83a17-24d8-5082-900f-0ab31bfbd3cb base

scikit-learn\_0.22-py3.6 154010fa-5b3b-4ac1-82af-4d5ee5abbc85 base

default\_r3.6 1b70aec3-ab34-4b87-8aa0-a4a3c8296a36 base

pytorch-onnx\_1.3-py3.6 1bc6029a-c937-56da-b0e0-39c380d0bb67 base

kernel-spark3.3-r3.6 1c9e5454-f216-59dd-a20e-474a5cdf5908 base

pytorch-onnx\_rt22.1-py3.9-edt 1d362186-7ad5-5b59-8b6c-9d0808bde37f base

tensorflow\_2.1-py3.6 1eb25b84-d6ed-5dde-b6a5-3fbd1f665666 base

spark-mllib\_3.2 20047f72-0a98-58c7-9ff5-a77b012eb8f5 base

tensorflow\_2.4-py3.8-horovod 217c16f6-178f-56bf-824a-b19f20564c49 base

runtime-22.1-py3.9-cuda 26215f05-08c3-5a41-a1b0-da66306ce658 base

do\_py3.8 295addb5-9ef9-547e-9bf4-92ae3563e720 base

autoai-ts\_3.8-py3.8 2aa0c932-798f-5ae9-abd6-15e0c2402fb5 base

tensorflow\_1.15-py3.6 2b73a275-7cbf-420b-a912-eae7f436e0bc base

kernel-spark3.3-py3.9 2b7951e2-e3b1-5a6c-a491-a02c8360b39a base

pytorch\_1.2-py3.6 2c8ef57d-2687-4b7d-acce-01f94976dac1 base

spark-mllib\_2.3 2e517900-bca0-4b0d-88dc-5c6791338875 base

pytorch-onnx\_1.1-py3.6-edt 32983cea-3f32-4400-8965-dde874a8d67e base

spark-mllib\_3.0-py37 36507ebe-8770-55ba-ab2a-eafe787600e9 base

spark-mllib\_2.4 390d21f8-e58b-4fac-9c55-d7ceda621326 base

autoai-ts\_rt22.2-py3.10 396b2e83-0953-5b86-9a55-7ce1628a406f base

xgboost\_0.82-py3.6 39e31acd-5f30-41dc-ae44-60233c80306e base

pytorch-onnx\_1.2-py3.6-edt 40589d0e-7019-4e28-8daa-fb03b6f4fe12 base

pytorch-onnx\_rt22.2-py3.10 40e73f55-783a-5335-b3fa-0c8b94291431 base

default\_r36py38 41c47d33-45f8-5a71-b065-8580229facf0 base

autoai-ts\_rt22.1-py3.9 4269d26e-07ba-5d40-8f66-2d495b0c71f7 base

autoai-om\_3.0 42b92e18-d9ab-567f-988a-4240ba1ed5f7 base

pmml-3.0\_4.3 493bcb95-16f1-5bc5-bee8-81b8af80e9c7 base

spark-mlib\_2.4-r\_3.6 49403dff-92e9-4c87-a3d7-a42d0021c095 base

xgboost\_0.90-py3.6 4ff8d6c2-1343-4c18-05e1-689c965304d3 base

pytorch-onnx\_1.1-py3.6 50f95b2a-bc16-43bb-bc94-b0bed208c60b base

autoai-ts\_3.9-py3.8 52c57136-80fa-572e-8728-a5e7cbb42cde base

spark-mlib\_2.4-scala\_2.11 55a70f99-7320-40e5-9fb9-9ed05a443af5 base

spark-mlib\_3.0 5c1b0ca2-4977-5c2e-9439-ff044ea8ff69 base

autoai-om\_2.0 5c2e37fa-80b8-5e77-840f-d912469614ee base

spss-modeler\_18.1 5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b base

cuda-py3.8 5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e base

autoai-kb\_3.1-py3.7 632d4b22-10aa-5180-88f0-f52dfb6444d7 base

634d3cdc-b562-5bf9-a2d4-ea90a478456b base

Note: Only first 50 records were displayed. To display more use 'limit' parameter.

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train the vegetable model.ipynb

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[11] autoai-om\_2.0 5c2e37fa-80b8-5e77-840f-d912469614ee base

spss-modeler\_18.1 5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b base

cuda-py3.8 5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e base

autoai-kb\_3.1-py3.7 632d4b22-10aa-5180-88f0-f52dfb6444d7 base

pytorch-onnx\_1.7-py3.8 634d3cdc-b562-5bf9-a2d4-ea90a478456b base

[12] software\_space\_uid = client.software\_specifications.get\_uid\_by\_name("tensorflow\_rt22.1-py3.9")

software\_space\_uid

'acd9c798-6974-5d2f-a657-ce06e986df4d'

[14] model\_details = client.repository.store\_model(model="vegetable-classification.tgz", meta\_props={

client.repository.ModelMetaNames.NAME: "vegetable",

client.repository.ModelMetaNames.TYPE: "tensorflow\_rt22.1",

client.repository.ModelMetaNames.SOFTWARE\_SPEC\_UID: software\_space\_uid

})

[15] model\_details

{'entity': {'hybrid\_pipeline\_software\_specs': [],

'software\_spec': {'id': 'acd9c798-6974-5d2f-a657-ce06e986df4d',

'name': 'tensorflow\_rt22.1-py3.9',

'type': 'tensorflow\_rt22.1',

'metadata': {'created\_at': '2022-11-13T11:19:55.723Z',

'id': '15968ed0-bd94-472d-bd56-f0f05496bc24',

'modified\_at': '2022-11-13T11:20:07.139Z',

'name': 'vegetable',

'owner': 'I0Hid-6640043H30',

'resource\_key': 'eae28117-3bc8-4000-bc5c-7d06944a26c5',

'space\_id': 'c77baeef-a816-44c5-95eb-9d2bf178dc6f',

'system': {'warnings': []}}

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train the vegetable model.ipynb

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```
[14] model_details = client.repository.store_model(model="vegetable-classification.tgz", meta_props={
    client.repository.ModelMetaNames.NAME:"vegetable",
    client.repository.ModelMetaNames.TYPE:"tensorflow_rt22.1",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid
})

[15] model_details

{'entity': {'hybrid_pipeline_software_specs': [],
'software_spec': {'id': 'acd9c798-6974-5d2f-a657-ce06e986df4d',
'name': 'tensorflow_rt22.1-py3.9'},
'type': 'tensorflow_rt22.1'},
'metadatas': {'created_at': '2022-11-13T11:19:55.723Z',
'id': '1596bedb-bd94-472d-bd56-f0f05496bc24',
'modified_at': '2022-11-13T11:20:07.139Z',
'name': 'vegetable',
'owner': 'IBMid-6640043H3B',
'resource_key': 'eae28117-3bc8-4000-bc5c-7d06944a26c5',
'space_id': 'c77baaef-a816-44c5-95eb-9d2bf178dc6f'},
'system': {'warnings': []}}

model_id = client.repository.get_model_id(model_details)
model_id

'1596bedb-bd94-472d-bd56-f0f05496bc24'

[17] client.repository.download(model_id, 'vegetable_IBM_Model.tgz')

Successfully saved model content to file: 'vegetable_IBM_Model.tgz'
'/content/vegetable_IBM_Model.tgz'
```

9s completed at 4:50 PM

## TRAIN THE FRUIT MODEL ON IBM

train the fruit model.pynb

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```
[1] !tar -zxvf fruit-classification.tgz fruit.h5

fruit.h5

!pip install watson-machine-learning-client

Collecting lomond
  Downloading lomond-0.3.3-py2.py3-none-any.whl (35 kB)
Collecting boto3
  Downloading boto3-1.26.0-py3-none-any.whl (132 kB)
Collecting ibm-cos-sdk
  Downloading ibm-cos-sdk-2.12.0.tar.gz (55 kB)
Collecting botocore<1.30.0,>=1.29.8
  Downloading botocore-1.29.8-py3-none-any.whl (9.9 MB)
Collecting s3transfer<0.7.0,>=0.6.0
  Downloading s3transfer-0.6.0-py3-none-any.whl (79 kB)
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from botocore<1.30.0,>=1.29.8->boto3->watson-machine-learning-client) (2.8.2)
Collecting urllib3
  Downloading urllib3-1.26.12-py2.py3-none-any.whl (140 kB)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.30.0,>=1.29.8->boto3->watson-machine-learning-client) (1.16.0)
Collecting ibm-cos-sdk-core==2.12.0
  Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)
Collecting ibm-cos-sdk-s3transfer==2.12.0
  Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
```

3s completed at 5:23 PM

train the fruit model.pynb

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Collecting ibm-cos-sdk-core==2.12.0  
Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)  
[REDACTED] 956 kB 62.2 MB/s  
Collecting ibm-cos-sdk-s3transfer==2.12.0  
Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)  
[REDACTED] 135 kB 53.8 MB/s  
Collecting jmespath<2.0.0,>=0.7.1  
Downloading jmespath-0.10.0-py2.py3-none-any.whl (24 kB)  
Collecting requests  
Downloading requests-2.28.1-py3-none-any.whl (62 kB)  
[REDACTED] 62 kB 1.6 MB/s  
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->watson-machine-learning-client) (2.10)  
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests->watson-machine-learning-client) (2.1.1)  
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas->watson-machine-learning-client) (2022.6)  
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas->watson-machine-learning-client) (1.21.6)  
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer  
Building wheel for ibm-cos-sdk (setup.py) ... done  
Created wheel for ibm-cos-sdk: filename=ibm\_cos\_sdk-2.12.0-py3-none-any.whl size=73951 sha256=9c62751312ee10ea1732629c42c49bbe2b77edc96b4ae74cacb52e850d27c29  
Stored in directory: /root/.cache/pip/wheels/ec/94/29/2b5732cf08664b6614304f7958abd29d77ea0e5bbce2eae57  
Building wheel for ibm-cos-sdk-core (setup.py) ... done  
Created wheel for ibm-cos-sdk-core: filename=ibm\_cos\_sdk\_core-2.12.0-py3-none-any.whl size=562962 sha256=5c67652ec16dc076f3b57b354585e1df76e4765e18b1000fed77ced4c22d82be  
Stored in directory: /root/.cache/pip/wheels/64/56/fb/5cd6f4f40406c828a5289b95b2752a4d142a9afb359244ed8d  
Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done  
Created wheel for ibm-cos-sdk-s3transfer: filename=ibm\_cos\_sdk\_s3transfer-2.12.0-py3-none-any.whl size=89778 sha256=bc9798b18f7e6f806a5413f23f9869bb3677e22028f593806800981e713  
Stored in directory: /root/.cache/pip/wheels/57/79/6a/ffe3370ed7ebc00604f9f76766e1e0348dcad2b2e32df9e1  
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer  
Installing collected packages: urllib3, requests, jmespath, ibm-cos-sdk-core, botocore, s3transfer, ibm-cos-sdk-s3transfer, lomond, ibm-cos-sdk, boto3, watson-machine-learning-cl  
Attempting uninstall: urllib3  
Found existing installation: urllib3 1.24.3  
Uninstalling urllib3-1.24.3:  
Successfully uninstalled urllib3-1.24.3  
Attempting uninstall: requests  
Found existing installation: requests 2.23.0  
Uninstalling requests-2.23.0:  
Successfully uninstalled requests-2.23.0  
Successfully installed boto3-1.26.8 botocore-1.29.8 ibm-cos-sdk-2.12.0 ibm-cos-sdk-core-2.12.0 ibm-cos-sdk-s3transfer-2.12.0 jmespath-0.10.0 lomond-0.3.3 requests-2.28.1 s3transfe

3s completed at 5:23 PM

train the fruit model.pynb

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!pip install ibm\_watson\_machine\_learning  
[REDACTED] 51 kB 622 kB/s  
Requirement already satisfied: lomond in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (0.3.3)  
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (21.3)  
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (2.28.1)  
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (4.13.0)  
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (0.8.10)  
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (1.3.5)  
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (2022.9.24)  
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from ibm\_watson\_machine\_learning) (1.26.12)  
Collecting ibm-cos-sdk-core==2.7.0  
Downloading ibm-cos-sdk-core-2.7.0.tar.gz (824 kB)  
[REDACTED] 824 kB 19.0 MB/s  
Collecting ibm-cos-sdk-s3transfer==2.7.0  
Downloading ibm-cos-sdk-s3transfer-2.7.0.tar.gz (133 kB)  
[REDACTED] 133 kB 61.8 MB/s  
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk==2.7.\*->ibm\_watson\_machine\_learning) (0.10.0)  
Collecting docutils<0.16,>=0.10  
Downloading docutils-0.15.2-py3-none-any.whl (547 kB)  
[REDACTED] 547 kB 62.9 MB/s  
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk-core==2.7.0->ibm\_watson\_machine\_learning) (2.8.1)  
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm\_watson\_machine\_learning) (1.21.6)  
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm\_watson\_machine\_learning) (2022.6)  
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-core==2.7.0->ibm\_watson\_machine\_learning) (1.16.0)  
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests->ibm\_watson\_machine\_learning) (2.1.1)  
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->ibm\_watson\_machine\_learning) (2.10)  
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm\_watson\_machine\_learning) (4.1.1)  
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm\_watson\_machine\_learning) (3.10.0)  
Requirement already satisfied: pyparsing<3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->ibm\_watson\_machine\_learning) (3.0.9)  
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer  
Building wheel for ibm-cos-sdk (setup.py) ... done  
Created wheel for ibm-cos-sdk: filename=ibm\_cos\_sdk-2.7.0-py2.py3-none-any.whl size=72563 sha256=fa8c58715e9ddf8350537fcfbf2acbd45d7a6b69eae3a282aeb718abe8e56577  
Stored in directory: /root/.cache/pip/wheels/47/22/bf/e1154ff0f5de93cc477acdc0ca69abfbb8b799c5b28a66b44c2  
Building wheel for ibm-cos-sdk-core (setup.py) ... done  
Created wheel for ibm-cos-sdk-core: filename=ibm\_cos\_sdk\_core-2.7.0-py2.py3-none-any.whl size=501013 sha256=3fc3c0f924895c68b671b029e8383b69c72ca3a5c5c132c3127a0d208bfff9d7b  
Stored in directory: /root/.cache/pip/wheels/6c/a2/e4/c16d02f809a3ea998e17cfd02c13369281f3d232aaf5902c19

3s completed at 5:23 PM

```
[18] from ibm_watson_machine_learning import APIClient
wml_credentials = {
    "url": "https://eu-gb.ml.cloud.ibm.com",
    "apikey": "AQ_xc5cv7Q5JrYnfPbfmSyac6Vn25fPhUu-V8mdF1P"
}
client = APIClient(wml_credentials)
```

Python 3.7 and 3.8 frameworks are deprecated and will be removed in a future release. Use Python 3.9 framework instead.

```
[19] client

<ibm_watson_machine_learning.client.APIClient at 0x7fb57312f350>
```

```
client.spaces.get_details()

{'bucket_region': 'eu-gb-standard',
 'credentials': {'admin': {'access_key_id': 'e827a1d463054462be58c11d21f4a342',
 'api_key': 'Hikntw8Q0j461a3pDP5L2-lvveCFz7mg5m8e0lQe4LG3',
 'secret_access_key': 'e730510472c7fed75868de0d665b713b701909a93da86a73',
 'service_id': 'ServiceId-a30f82e7-315e-46bd-b229-331030406a23'},
 'editor': {'access_key_id': '004f08db143c4550b2516ea8f5271771',
 'api_key': '9Ysax1Y9-XoJQa56wvJ2KF64HyFtwcxf67ncD-jrXqu',
 'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'secret_access_key': '7cbb5e54037e5876c10f85a86b0acde6fba4b2caa4338f7',
 'service_id': 'ServiceId-68abd7ca-11d3-4e3e-b8dd-da61d9c93eae'},
 'viewer': {'access_key_id': '08ec080406014223b26317ff7d844345',
 'api_key': 'amC0S-0gGCOF6e-mR11l8p-z5IVU85f1TPP1284uMp',
 'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'secret_access_key': 'e7c659f9ebf2790368703f119b8a0f28082cf7256833fd2d',
 'service_id': 'ServiceId-ea9f16f2-4120-4ae0-b248-f5bc5605c424'}},
 'endpoint_url': 'https://s3.eu-gb.cloud-object-storage.appdomain.cloud',
 'guid': '0e43b750-15aa-4634-9c02-9954d7f0be49',
 'resource_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'type': 'bmcos_object_storage'}}
```

```
{'url': '/v2/spaces/c77baaef-a816-44c5-95eb-9d2bf178dc6f'},
 'entity': {'compute': [{'crn': 'crn:v1:bluemix:public:pm-20:eu-gb:a/d2a512c7590048cfaf7f28cd26438f49:f78a826e-3c47-40ec-9ced-ab40e6d544d3',
 'guid': 'f78a826e-3c47-40ec-9ced-ab40e6d544d3',
 'name': 'Watson Machine Learning-ak',
 'type': 'machine_learning'}],
 'description': '',
 'name': 'f1',
 'scope': {'bss_account_id': 'd2a512c7590048cfaf7f28cd26438f49'},
 'stage': {'production': False},
 'status': {'state': 'active'},
 'storage': {'properties': {'bucket_name': 'f4356370-41d7-4406-9b54-9eaddfb02d12',
 'bucket_region': 'eu-gb-standard',
 'credentials': {'admin': {'access_key_id': '0345751f31684f7d988cf9bd2d9a633c',
 'api_key': 'fIndfb_Ks1jgr-XfOUA030FqYvvsz-c_Ogu4y3rpVcQ',
 'secret_access_key': '0bb6e5186f2aee7525776c876cd74f9dcec8c50f0dea71c',
 'service_id': 'ServiceId-560fac55-10b4-494d-983d-15821b101c02'},
 'editor': {'access_key_id': 'f016e464721b4db2a0fbaa1879de673a',
 'api_key': 'H80TzyMdi0vHdgdcnT9NYZnQENRbJbQqkibaUYA9KF',
 'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'secret_access_key': '921110b4f02600f7b655f740b7de3af0b5620bd3f88b2108',
 'service_id': 'ServiceId-c6333f38-a775-4ffe-8461-f9451f8ce259'},
 'viewer': {'access_key_id': '2ae1637c88ce48bfa3e80cdd8b161ad',
 'api_key': 'U853PKFKa12F08yFp8hFwJnZC4u8F_vTGzORLnJKU',
 'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'secret_access_key': '348290e05e1c239db638225fd69349dee370472db875bb8',
 'service_id': 'ServiceId-16fbfab2-dfd6-4c87-9219-03d0470377db'}},
 'endpoint_url': 'https://s3.eu-gb.cloud-object-storage.appdomain.cloud',
 'guid': '0e43b750-15aa-4634-9c02-9954d7f0be49',
 'resource_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/d2a512c7590048cfaf7f28cd26438f49:0e43b750-15aa-4634-9c02-9954d7f0be49::',
 'type': 'bmcos_object_storage'}},
 'metadata': {'created_at': '2022-11-13T11:47:24.278Z',
 'creator_id': 'IBMId-6640043b38',
 'id': '4ad0fa56-67ce-4b1a-b30f-e8035c8149b8',
 'updated_at': '2022-11-13T11:47:37.954Z',
 'url': '/v2/spaces/4ad0fa56-67ce-4b1a-b30f-e8035c8149b8'}}}]
```



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[21] client.spaces.list()

Note: 'limit' is not provided. Only first 50 records will be displayed if the number of records exceed 50

ID	NAME	CREATED
4ad0fa56-67ce-4b1a-b30f-e8035c8149b8	F1	2022-11-13T11:47:24.278Z
c77baaef-a816-44c5-95eb-9d2bf178dc6f	v1_Deploy	2022-11-13T10:24:33.382Z

[22] space\_uid = "4ad0fa56-67ce-4b1a-b30f-e8035c8149b8"

space\_uid

'4ad0fa56-67ce-4b1a-b30f-e8035c8149b8'

[23] client.set\_default\_space(space\_uid)

'SUCCESS'

[24] client.software\_specifications.list()

NAME	ASSET_ID	TYPE
default_py3.6	0062b8c9-bb7d-44a0-a9b9-46c416adcbd9	base
kernel-spark3.2-scala2.12	02b0d9ce-79c1-5e68-ac1a-31189867356a	base
pytorch-onnx_1.3-py3.7-edt	069ea134-3346-5748-b513-49120e15d288	base
scikit-learn_0.20-py3.6	09c5a1d0-9c1e-4473-a344-eb7b665ff687	base
spark-mllib_3.0-scala_2.12	09f4cff0-90a7-5899-b9ed-1ef348aebdee	base
pytorch-onnx_rt22.1-py3.9	0b848dd4-e681-5599-be41-b5f6fccc6471	base
ai-function_0.1-py3.6	0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda	base
shiny-r3.6	0e6e79df-875e-4f24-8ae9-62dcd2148306	base
tensorflow_2.4-py3.7-horovod	1092590a-307d-563d-9b62-4eb7d64b3f22	base
pytorch_1.1-py3.6	10ac12d6-6b30-4ccd-8392-3e922c096a92	base
tensorflow_1.15-py3.6-dl1	111e41b3-de2d-5422-a4d6-bf776828c467	base

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[24]

kernel-spark3.3-r3.6	1c9e5454-f216-59dd-a20e-474a5cdf5988	base
pytorch-onnx_rt22.1-py3.9-edt	1d362186-7ad5-5b59-8b6c-9d0880bde37f	base
tensorflow_2.1-py3.6	1eb25b84-d6ed-5dde-b6a5-3fbd1665666	base
spark-mllib_3.2	20047f72-0a98-58c7-9ff5-a77b012eb8f5	base
tensorflow_2.4-py3.8-horovod	217c16f6-178f-56bf-824a-b19f20564c49	base
runtime-22.1-py3.9-cuda	26215f05-08c3-5a41-a1b0-da66306ce658	base
do_py3.8	295addb5-9ef9-547e-9bf4-92ae3563e720	base
autoai-ts_3.8-py3.8	2a00c932-798f-5ae9-abd6-15e0c2402fb5	base
tensorflow_1.15-py3.6	2b73a275-7c0f-a20b-a912-ee7f436a00c	base
kernel-spark3.3-py3.9	2b7961e2-e3b1-5a8c-a491-482c8368839a	base
pytorch_1.2-py3.6	2c8ef57d-2687-4b7d-acc6-01f94976dac1	base
spark-mllib_2.3	2e5f700-bca0-4b0d-88dc-5c6791338875	base
pytorch-onnx_1.1-py3.6-edt	32983cea-3f32-4400-0965-dde874a8d67e	base
spark-mllib_3.0-py37	36507ebe-8770-55ba-ab2a-eafe787600e9	base
spark-mllib_2.4	390d21f8-e58b-4fac-9c55-d7ceda621326	base
autoai-ts_rt22.2-py3.10	396b2e83-0953-5b86-9a55-7ce1628a406f	base
xgboost_0.82-py3.6	39e31acd-5f30-41dc-ae44-60233c80306e	base
pytorch-onnx_1.2-py3.6-edt	40589d0e-7019-4e28-8daa-fb03b6f4fe12	base
pytorch-onnx_rt22.2-py3.10	40e73f55-783a-5535-b3fa-0c8b94291431	base
default_r36py38	41c247d3-45f8-5a71-b065-8580229facf0	base
autoai-ts_rt22.1-py3.9	4269d26e-07ba-5d40-8f66-2d495b0c71f7	base
autoai-obm_3.0	42b92e18-d9ab-567f-988a-4240ba1ed5f7	base
pmml-3.0_4.3	493bcb95-16f1-5bc5-bee8-81b8af80e9c7	base
spark-mllib_2.4-r_3.6	49403dff-92e9-4c87-a3d7-a42d0021c095	base
xgboost_0.90-py3.6	4ff8d6c2-1343-4c18-85e1-689c965304d3	base
pytorch-onnx_1.1-py3.6	50f95b2a-bc16-43bb-bc94-b0bed208c60b	base
autoai-ts_3.9-py3.8	52c57136-80fa-572e-8728-a5e7cbb42cde	base
spark-mllib_2.4-scala_2.11	55a70f99-7320-4be5-9fb9-9ed65a443af5	base
spark-mllib_3.0	5c1b0ca2-4977-5c2e-9439-ff44ae8ffe9	base
autoai-obm_2.0	5c2e37fa-80b8-5e77-840f-d912469614ee	base
spss-modeler_18.1	5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b	base
cuda-py3.8	5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e	base
autoai-kb_3.1-py3.7	632d4b22-10aa-5180-88f0-f52dfb6444d7	base
pytorch-onnx_1.7-py3.8	634d3cdc-b562-5bf9-a2d4-ea90a478456b	base

Note: Only first 50 records were displayed. To display more use 'limit' parameter.

3s completed at 5:23 PM



train the fruit model.pynb

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```
[25] software_space_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1-py3.9")
software_space_uid

'acd9c798-6974-5d2f-a657-ce06e986df4d'

model_details = client.repository.store_model(model="fruit-classification.tgz", meta_props={
    client.repository.ModelMetaNames.NAME:"fruit",
    client.repository.ModelMetaNames.TYPE:"tensorflow_rt22.1",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid
})

[27] model_details

{'entity': {'hybrid_pipeline_software_specs': [],
'software_spec': {'id': 'acd9c798-6974-5d2f-a657-ce06e986df4d',
'name': 'tensorflow_rt22.1-py3.9'},
'type': 'tensorflow_rt22.1'},
'metadata': {'created_at': '2022-11-13T11:52:22.919Z',
'id': '7656b11c-b4d6-4c77-83aa-bce9052215df',
'modified_at': '2022-11-13T11:52:27.272Z',
'name': 'fruit',
'owner': 'IBMId-6640043H3B',
'resource_key': 'a1e6d912-974d-477f-8809-2ab9871afe44',
'space_id': '4ad0fa56-67ce-4b1a-b30f-e8035c8149b8'},
'system': {'warnings': []}}

[28] model_id = client.repository.get_model_id(model_details)
model_id

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```

fruit\_IBM\_Model.tgz

train the fruit model.pynb

File Edit View Insert Runtime Tools Help All changes saved

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RAM Disk

Editing

```
[26] })

model_details

{'entity': {'hybrid_pipeline_software_specs': [],
'software_spec': {'id': 'acd9c798-6974-5d2f-a657-ce06e986df4d',
'name': 'tensorflow_rt22.1-py3.9'},
'type': 'tensorflow_rt22.1'},
'metadata': {'created_at': '2022-11-13T11:52:22.919Z',
'id': '7656b11c-b4d6-4c77-83aa-bce9052215df',
'modified_at': '2022-11-13T11:52:27.272Z',
'name': 'fruit',
'owner': 'IBMId-6640043H3B',
'resource_key': 'a1e6d912-974d-477f-8809-2ab9871afe44',
'space_id': '4ad0fa56-67ce-4b1a-b30f-e8035c8149b8'},
'system': {'warnings': []}}

[28] model_id = client.repository.get_model_id(model_details)
model_id

'7656b11c-b4d6-4c77-83aa-bce9052215df'


[30] client.repository.download(model_id, 'fruit_IBM_Model.tgz')

Successfully saved model content to file: 'fruit_IBM_Model.tgz'
'/content/fruit_IBM_Model.tgz'

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```

## Test both the models

### Test the Fruit disease prediction model


jupyter fruit model building and testing Last Checkpoint: 30 minutes ago (autosaved)  Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

In [22]: `# Testing the model`

In [23]: `from tensorflow.keras.preprocessing import image  
import numpy as np`

In [29]: `img=image.load_img(r'C:\Users\Elcot\project\flask\sample_images\Healthy corn.jpg',grayscale=False,target_size=(128,128))  
img`


Out[29]: 

In [30]: `x = image.img_to_array(img) # Converting image into array  
x = np.expand_dims(x,axis=0) # expanding Dimensions  
pred = np.argmax(model.predict(x)) # Predicting the higher probablity index  
op = ['Apple__Black_rot','Apple__healthy','Corn_(maize)__healthy','Corn_(maize)__Northern_Leaf_Blight',''] # Creating List  
op[pred] # List indexing with output`


1/1 [=====] - 0s 63ms/step

Out[30]: `'Corn_(maize)__Northern_Leaf_Blight'`

In [31]: `img=image.load_img(r'C:\Users\ELCOT\project\flask\Sample_images\apple.jpg',grayscale=False,target_size=(128,128))  
img`

jupyter fruit model building and testing Last Checkpoint: 31 minutes ago (autosaved)  Logout

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Out[31]: 

In [32]: `x = image.img_to_array(img) # Converting image into array  
x = np.expand_dims(x,axis=0) # expanding Dimensions  
pred = np.argmax(model.predict(x)) # Predicting the higher probablity index  
op = ['Apple__Black_rot','Apple__healthy','Corn_(maize)__healthy','Corn_(maize)__Northern_Leaf_Blight',''] # Creating List  
op[pred] # List indexing with output`

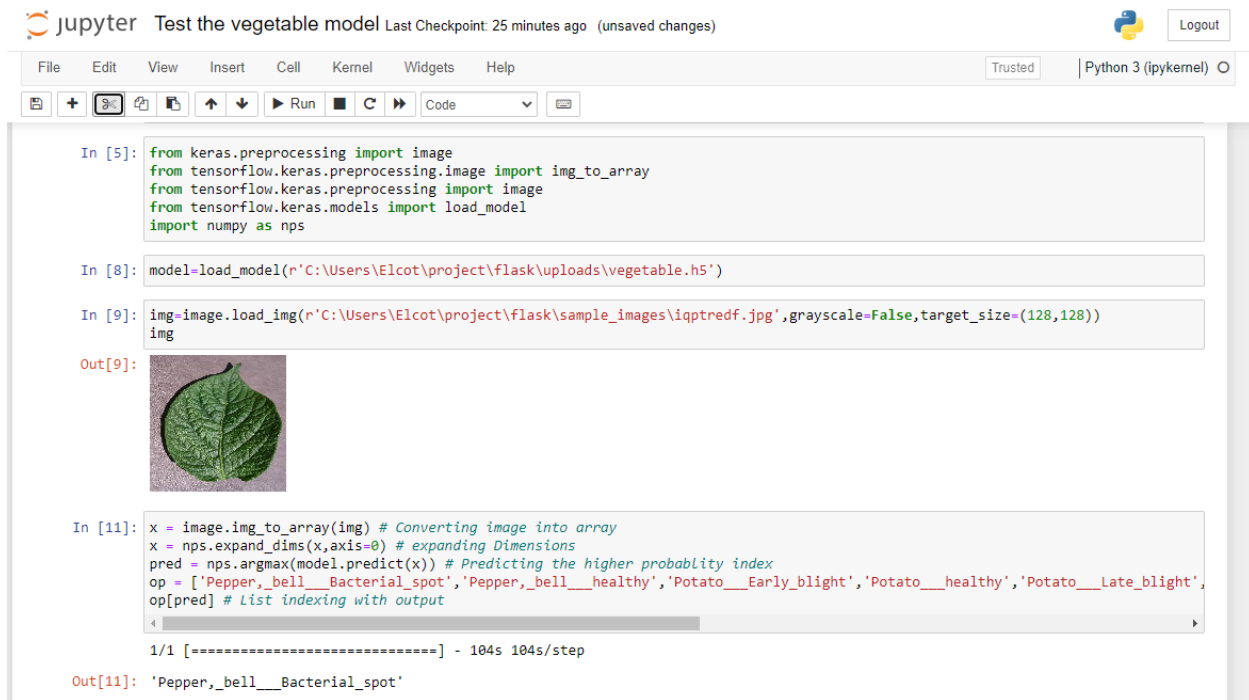
1/1 [=====] - 0s 128ms/step

Out[32]: `'Apple__healthy'`

In [34]: `x_train.class_indices`

Out[34]: `{'Apple__Black_rot': 0,  
'Apple__healthy': 1,  
'Corn_(maize)__Northern_Leaf_Blight': 2,  
'Corn_(maize)__healthy': 3,  
'Peach__Bacterial_spot': 4,  
'Peach__healthy': 5}`


## Test the Vegetable disease prediction model



```
In [5]: from keras.preprocessing import image
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.preprocessing import image
from tensorflow.keras.models import load_model
import numpy as nps

In [8]: model=load_model(r'C:\Users\Elcot\project\flask\uploads\vegetable.h5')

In [9]: img=image.load_img(r'C:\Users\Elcot\project\flask\sample_images\iqptredf.jpg',grayscale=False,target_size=(128,128))
img

Out[9]: 

In [11]: x = image.img_to_array(img) # Converting image into array
x = nps.expand_dims(x,axis=0) # expanding Dimensions
pred = nps.argmax(model.predict(x)) # Predicting the higher probability index
op = ['Pepper, bell__Bacterial_spot', 'Pepper, bell__healthy', 'Potato__Early_blight', 'Potato__healthy', 'Potato__Late_blight',
op[pred] # List indexing with output

1/1 [=====] - 104s 104s/step

Out[11]: 'Pepper, bell__Bacterial_spot'
```

### 13.2. GitHub & Project Demo Link

#### GitHub Link

<https://github.com/IBM-EPBL/IBM-Project-30021-1660138394>

#### Demo Video Link

#### Drive Link

[https://drive.google.com/file/d/1PouAjsqQyVhmNAVkH0wIT31I0pBxFwjI/view?usp=share\\_link](https://drive.google.com/file/d/1PouAjsqQyVhmNAVkH0wIT31I0pBxFwjI/view?usp=share_link)

#### Youtube Link

<https://youtu.be/BxBk9Or6gg0>

