FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

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TEAM ID: PNT2022TMID46442

Submitted by

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Project Report Format

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1.1 Project Overview
Fertilizer Recommendation System For Disease Prediction

Team id : PNT2022TMID46442
Date: 19 October 2022

Objective :

In today's world agriculture is very important for life and helps to save the natural resources around us. Doing agriculture is very hard in current scenario because many natural disasters are happening every day.

Most of the plants are affected by many diseases due to pollution in water, air, and soil.

Identifying the disease is one of the huge hurdles in agriculture. Most plants are affected by leaf disease, and it's hard to find correct fertilizer to cure it.

The main objective of this project is to identify the disease in the plants and cure it in the early stage of the infection. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques.

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

1.2 Purpose

Agriculture is the main aspect of country development. Many people lead their life from agriculture field, which gives fully related to agricultural products. Plant disease, especially on leaves, is one of the major factors of reductions in both quality and quantity of the food crops. In agricultural aspects, if the plant is affected by leaf disease then it reduces the growth of the agricultural level. Finding the leaf disease is an important role of agriculture preservation. After pre-processing using a median filter, segmentation is done by Guided Active Contour method and finally, the leaf disease is identified by using Support Vector Machine. The disease-based similarity measure is used for fertilizer recommendation**.**

2. Literature Survey

2.1 Existing Problems

Project Title	Algorithms used	Advantages	Disadvantages
Plant Infection Detection Using Image Processing	Infections are detected based on K-means clustering which uses hue estimation method for dividing and clustering the image and GLCM techniques that is used for texture analysis.	This system was capable of identifying the infection and classifies them accordingly with 98.27% of accuracy. This automated system reduces time of detection and labor cost	The farmers must afford mobile phones or digital camera to take images of infected leaves of different plants.
Prediction of crop yield and fertilizer recommendation using machine learning algorithms	Random Forest and Support Vector Machine algorithms are used for the classification of the soil to classify, display confusion matrix, Precision, Recall, predict crop based on the given inputs, etc.	It recommends fertilizer suitable for every particular crop.	Requires Third Party applications to display information on weather, temperature, humidity, atmospheric pressure, etc.
Plant Disease Detection Using Image	Random Forest classifier, a combination of	Accuracy scores were 93% which is nearly equal to f1	The proposed system is able to detect 20 different diseases

Processing and Machine Learning	multiple decision trees is used where each tree is trained by using different subsets of the whole dataset to reduce the overfitting and improves the accuracy of the classifier.	scores. It requires less time for prediction than other deep learning-based approaches since it uses statistical machine learning and image processing algorithm.	only.
Fertilizers Recommendation System for Disease Prediction in Tree Leaves	Support Vector Machine (SVM) algorithm classifies the leaf image as normal or affected. And it is used to identify a function Fx which obtain the hyper-plane.	Recommend the fertilizer for affected leaves and its measurement or quantity are suggested based on severity level of the disease.	The proposed algorithm cannot be used to identify the disease that affects the other plant organs such as stems and fruits.
Farmer's Assistant: A Machine Learning Based Application for Agricultural Solutions	Extreme Gradient Boosting (XGBoost), is a scalable, distributed gradient-boosted decision tree (GBDT) machine learning library. It provides parallel tree boosting and is the leading machine learning library for regression, classification, and ranking problems.	It is expected that boosting (Random Forest) and bagging (XG Boost) models will usually perform and generalize better than non-ensemble methods.	This model performs well only on the images which are from those classes that the model already knows and it will not be able to detect the correct class for any data that is out of the domain.

	Random forest algorithm is also used.		
Cloud Based Automated Irrigation and Plant Leaf Disease Detection System Using an Android Application.	K-means clustering is used for feature extraction.	It is simple and cost-effective system for plant leaf disease detection.	Any H/w failures may affect the system performance.
Detection of LeafDiseases and Classification using Digital Image Processing.	K-Means Clustering used for image segmentation and then system extract the GLCM features from disease detected images. The disease classification done through the SVM classifier.	The system detects the diseases on citrus leaves with 90% accuracy.	System only able to detect the disease from citrus leaves.

2.2 References

Author	Title	Year	Source	Findings	Advantages	Disadvantages
Apurva Save, Aksham Gupta, Sarthak Pruthi, Divyanjana Nikam, Prof. Dr. Shilpa Paygude	***Plant Disease Detection and Fertilizer Suggestions***	2022		Different approaches and models of Deep Learning methods were explored and used in this project so that it can detect and classify plant diseases correctly through image processing of leaves of the plants. The procedure starts from collecting the images used for training, testing and validation to image preprocessing and augmentation and finally comparison of different pretrained models over their accuracy. Finally, at the end , our model detects and distinguishes between a healthy plant and different diseases and provides suitable remedies so as to cure the	The Accuracy of training percentage is 90.88%	The training Loss percentage is 1.3739

				disease.		
Devdatta A. Bondre Student, NICT Solutions & Research, Belagavi, Karnataka, India Mr. Santosh Mahagaonkar Research Head, NICT Solutions & Research, Belagavi, Karnataka, India	Prediction Of Crop Yield And Fertilizer Recommendation Using Machine Learning Algorithms	2019		The prediction of crop yield based on location and proper implementation of algorithms have proved that the higher crop yield can be achieved. From above work concludes that for soil classification Random Forest is good with accuracy 86.35% compare to Support Vector Machine. For crop yield prediction Support Vector Machine is good with accuracy 99.47% compare to Random Forest algorithm.	SVM calculation has a regularization parameter, which stays away from over-fitting. The random forest algorithm is not biased, since, there are multiple trees and each tree is trained on a subset of data.	Most of the existing system are hardware based which makes them expensive and difficult to maintain. Also they lack to give accurate results. Some systems suggest crop sequence depending on yield rate and market price. The system proposed tries to overcome these drawbacks and predicts crops by analyzing structured data.

Tiago Domingues , Tomás Brandão and João C. Ferreira	Machine Learning for Detection and Prediction of Crop Diseases and Pests:	2022		Data sets containing weather, diseases, and pests data should keep records for long periods of time. Time-series ML models, such as RNN, can be employed to accurately forecast the occurrence of diseases and pests based on meteorological measurements series. NDVI measurements can also be helpful, since they provide additional information regarding the crop's development	ML models enable researchers to get insight into data and existing correlations between various factors that influence occurrence of diseases and pests in crops. After data is processed and features are extracted, models can be used for classification, regression, among other goals	Pesticides and chemical treatments have long been used by farmers to keep pests away. The use of pesticides for crop protection is on the rise with negative consequences for human health and increased environmental damage to soil and groundwater. On the other hand, this also increases the risk.
Srinivas Chilukuri, ZS New York AI Center of Excellence	***Crop Disease Detection Using Machine Learning and Computer Vision***	2021		Deep learning techniques can be applied to detect wheat rust in crops based on close-shot images. In addition to good prediction accuracy, the model is able to effectively learn the right representations through the explanations inferred from class activation maps. When scaled, this approach can help in digitally	The Dataset can be viewed in colored, Grayscale or Leaf Segmented	In order to develop accurate image classifiers for the purposes of plant disease diagnosis, we needed a large, verified dataset of images of diseased and healthy plants. Until very recently, such a dataset did not exist, and even smaller datasets were not freely available.

				monitoring crop health and could lead to significant improvement in the agriculture productivity and yield.		
Dr.P. Pandi Selvi P. Poornima	Soil Based Fertilizer Recommendation System for Crop Disease Prediction System	2021		The first step involves the registration phase, where the user has to present his personal details, details of land and the soil type. • In the second step the user will upload the soil test report into the system for soil analysis. In this step, if the soils test report was not submitted by the user, soil analysis will be carried out by the sensors. Sensors measure the nutrients level of the soil and the data was stored within the database. • In the third step, the corresponding crops infection status will be analyzed	If crop gets infected, then captures the images of an infected crop via mobile camera for recommendation of best fertilizer then all data stored on cloud.	Plant diseases are a principal threat to the safety of food. In agriculture sectors, it is the greatest challenge to identify plant diseases.

				and recorded. • In the fourth step, comparison and classification of the soil type was carried out using Long or Short term Memory algorithm. Finally the fertilizers are recommended.		
R. Neela, P. Nithya	Fertilizers Recommendation System For Disease Prediction In Tree Leave	2019		Agriculture is the main aspect of country development. Many people lead their life from agriculture field, which gives fully related to agricultural products. Plant disease, especially on leaves, is one of the major factors of reductions in both quality and quantity of the food crops. In agricultural aspects, if the plant is affected by leaf disease then it reduces the growth of the agricultural level. Finding the leaf disease is an important role of agriculture preservation. After pre-processing using a median filter,	Recommend the fertilizer for affected leaves based on severity level. Fertilizers may be organic or inorganic.Which the Admin or a farmer can store the fertilizers based on disease categorization with severity levels. The measurements of fertilizers suggested based on disease severity	The main problem of farmers is the detection of leaf diseases. The leaf disease detection

				segmentation is done by Guided Active Contour method and finally, the leaf disease is identified by using Support Vector Machine. The disease-based similarity measure is used for fertilizer recommendation.		

2.3 Problem Statement Solution

Problem Statement:

Mr.Narasimma Rao is a 65 years old man. He had a own farming land and do Agriculture for past 30 Years , In this 30 Years he Faced a problem in Choosing Fertilizers and Controlling of Plant Disease.

- Narasimma Rao wants to know the better recommendation for fertilizers for plants with the disease.
- He has faced huge losses for a long time.
- This problem is usually faced by most farmers.
- Mr. Narasimma Rao needs to know the result immediately.

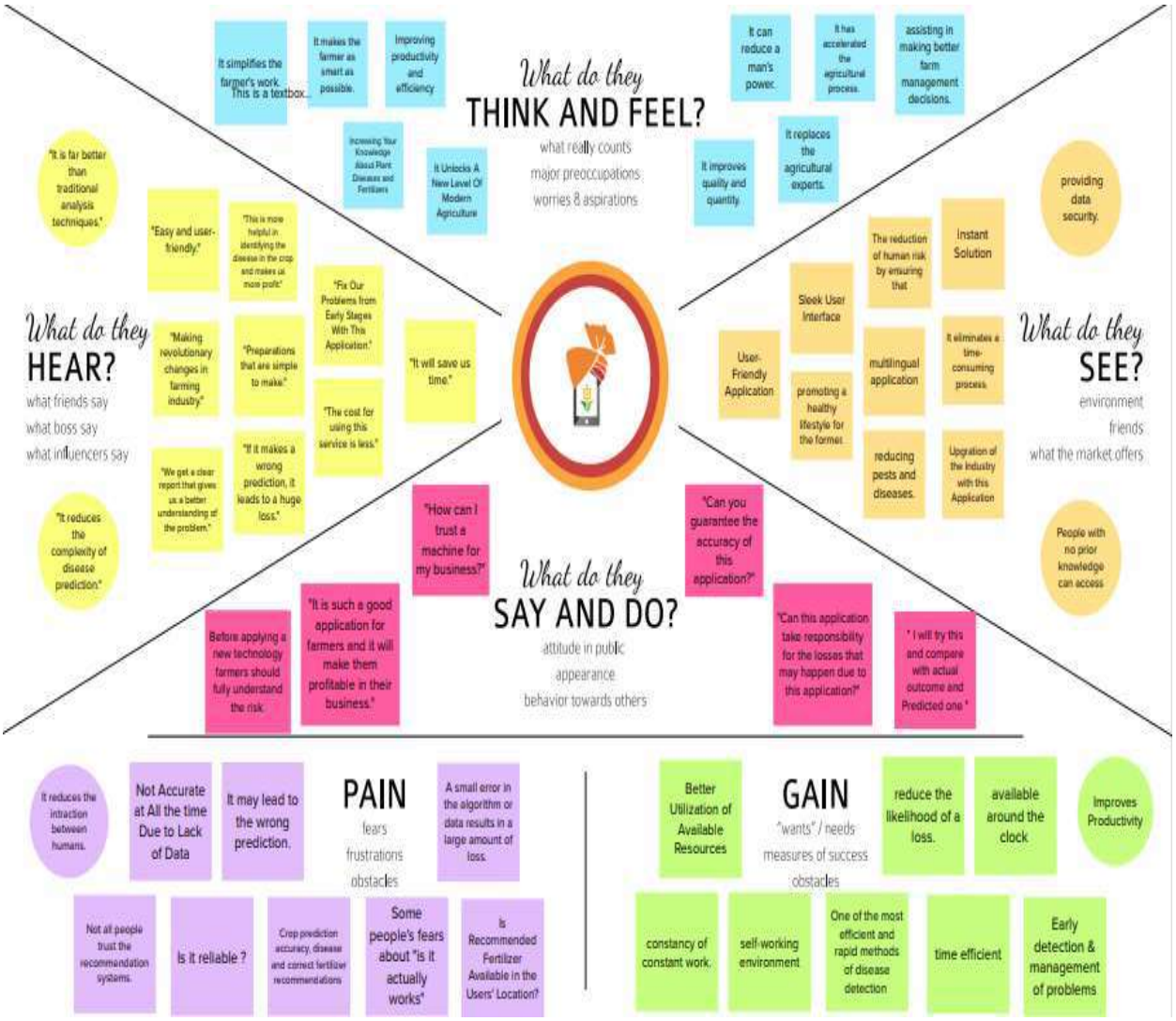
Who does the problem affect?	Persons who do Agriculture
What are the boundaries of the problem?	People who Grow Crops and facing Issues of Plant Disease
What is the issue?	In agricultural aspects, if the plantis affected by leaf disease, then it reduces the growth and productiveness. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants.

Where does the issue occur?	The issue occurs in agriculture practicing areas, particularly in rural regions.
Why is it important that we fix the problem?	It is required for the growth of better quality food products. It is important to maximise the crop yield.
What solution to solve this issue?	An automated system is introducedto identify different diseases on plants by checking the symptoms shownon the leaves of the plant.
What methodology used to solvethe issue?	Deep learning techniques are usedto identify the diseases and suggestthe precautions that can be taken forthose diseases.
When does the issue occur?	During the development of the crops as they will be affected by various diseases.

3. IDEATION & PROPOSED SOLUTION

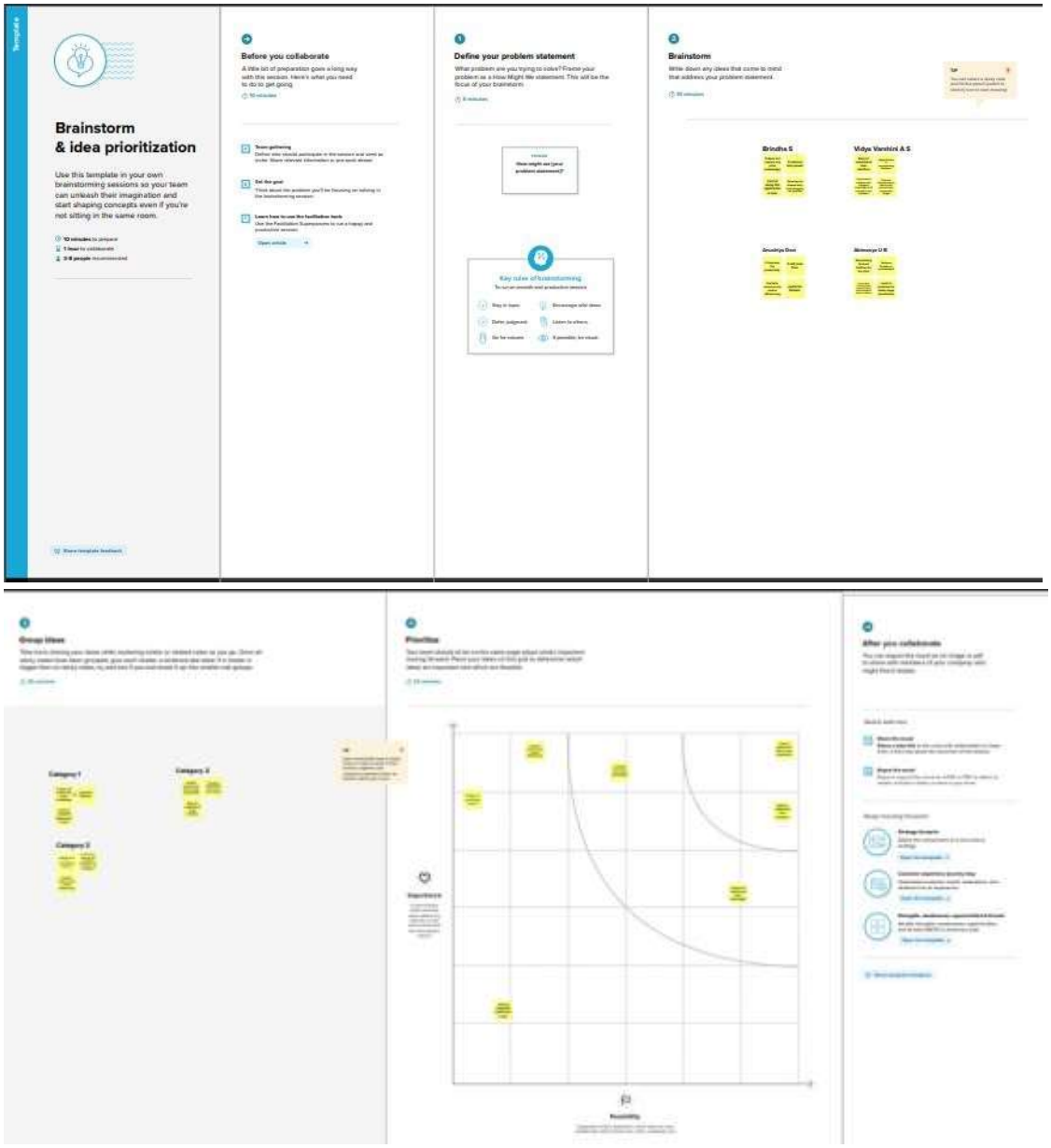
3.1 Empathy Map Canvas

An empathy map is used to gain deeper insights into the customer's interaction with the system. It gives an idea of what the user feels and experiences while using the system, what fears the user has respective to the system, etc. It also specifies how supportive the system environment is and what the users are likely to hear from the people around them regarding the usage of the system.



3.2 Ideation and Brainstorming

Ideation and Brainstorming are performed to generate ideas and solutions Brainstorming is a group activity unlike ideation.



3.3 Proposed Solution

An automated system that takes images of plant parts as input and identifies different diseases on plants by checking the symptoms shown on the leaves of the plant is built. Deep learning techniques are used to identify the diseases and suggest fertilizers that can help cure the disease. The user need not consult any specialist for the identification of diseases that affected the leaves or for the recommendation of the fertilizers.

Project Design Phase -I

Proposed Solution

Date	4 October 2022
Team Id	PNT2022TMID46442
Project Name	Fertilizer recommendation system for disease prediction
Maximum Marks	2 marks

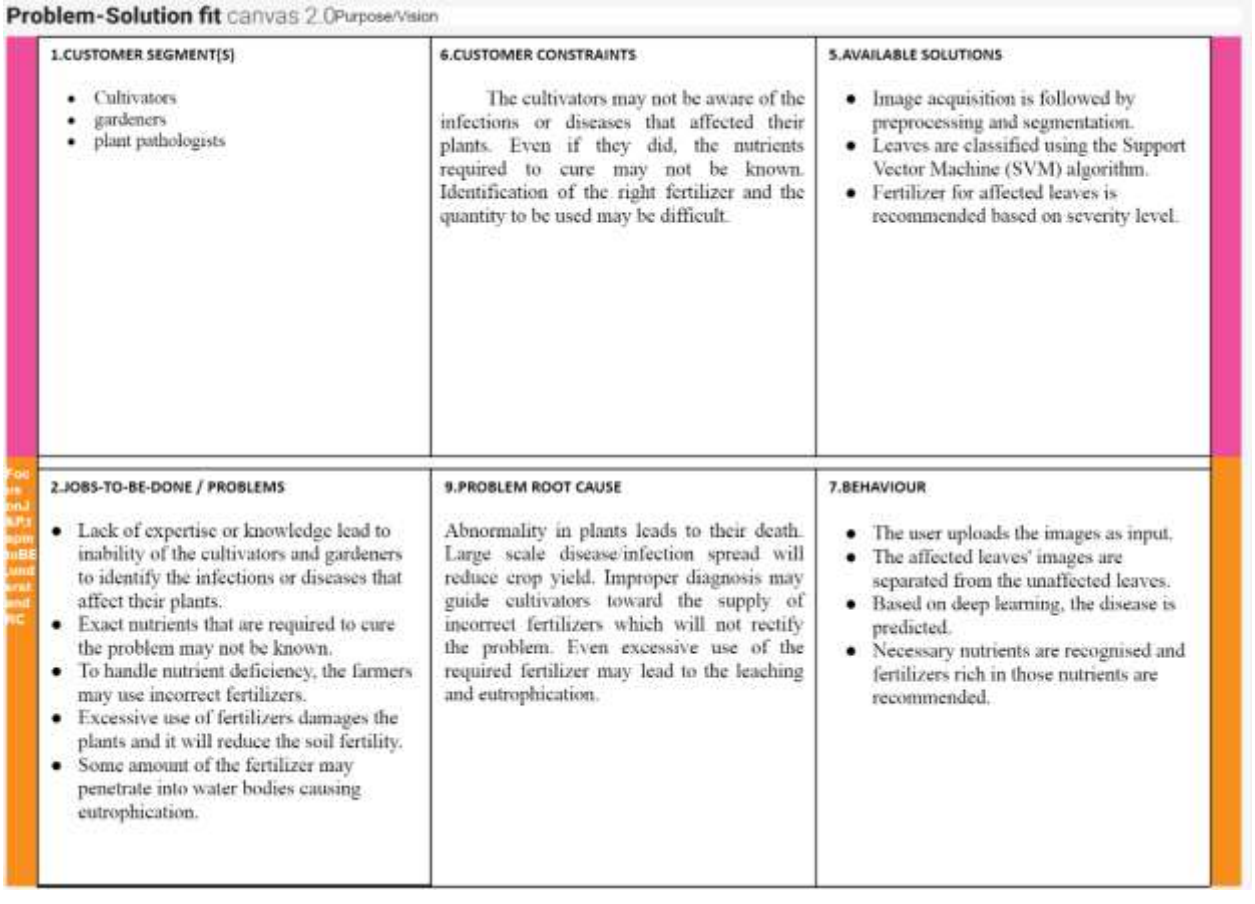
Proposed solution :

S.No	Parameter	Description
1	Problem statement (problem to be solved)	Disease in plants reduced the quantity and quality of the plantsproductivity. Identifying the disease in plant is hard to find.
2	Idea/solution description	One of the solution of the problemis to identifying the disease in early stage and using the correct fertilizer.
3	Novelty / uniqueness	This application can suggest good fertilizer for the disease in the plant by recognizing the images
4	Social impact/customersatisfaction	It helps the farmer by identifying the disease in the early stage and increase the quality and quantityof crops in efficient way.

5	Business model(revenue model)	The application is recommends to farmer in subscription basis.
6	Scalability of the solution	This application can be improved by introducing online purchases of crops, fertilizer easily

3.4 Problem Solution Fit

The Problem-Solution Fit means that the solution that is realized can actually solve the problem that the customer faces.



Problem-Solution fit canvas 2.0 Purpose/Vision

1.CUSTOMER SEGMENT(S)

- Cultivators
- gardeners
- plant pathologists

6.CUSTOMER CONSTRAINTS

The cultivators may not be aware of the infections or diseases that affected their plants. Even if they did, the nutrients required to cure may not be known. Identification of the right fertilizer and the quantity to be used may be difficult.

5.AVAILABLE SOLUTIONS

- Image acquisition is followed by preprocessing and segmentation.
- Leaves are classified using the Support Vector Machine (SVM) algorithm.
- Fertilizer for affected leaves is recommended based on severity level.

2.JOBS-TO-BE-DONE / PROBLEMS

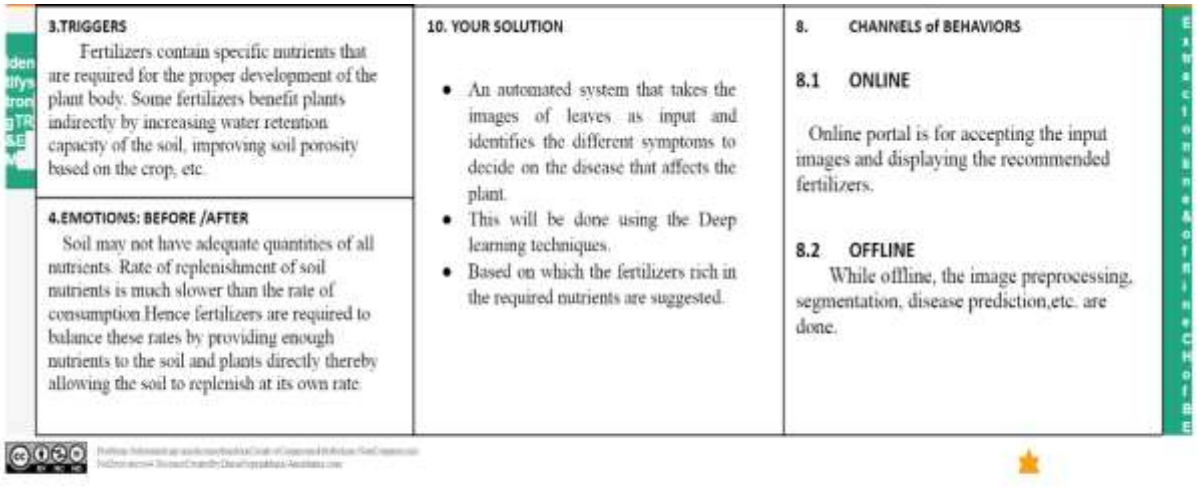
- Lack of expertise or knowledge lead to inability of the cultivators and gardeners to identify the infections or diseases that affect their plants.
- Exact nutrients that are required to cure the problem may not be known.
- To handle nutrient deficiency, the farmers may use incorrect fertilizers.
- Excessive use of fertilizers damages the plants and it will reduce the soil fertility.
- Some amount of the fertilizer may penetrate into water bodies causing eutrophication.

9.PROBLEM ROOT CAUSE

Abnormality in plants leads to their death. Large scale disease/infection spread will reduce crop yield. Improper diagnosis may guide cultivators toward the supply of incorrect fertilizers which will not rectify the problem. Even excessive use of the required fertilizer may lead to the leaching and eutrophication.

7.BEHAVIOUR

- The user uploads the images as input.
- The affected leaves' images are separated from the unaffected leaves.
- Based on deep learning, the disease is predicted.
- Necessary nutrients are recognised and fertilizers rich in those nutrients are recommended.



3.TRIGGERS

Fertilizers contain specific nutrients that are required for the proper development of the plant body. Some fertilizers benefit plants indirectly by increasing water retention capacity of the soil, improving soil porosity based on the crop, etc.

4.EMOTIONS: BEFORE /AFTER

Soil may not have adequate quantities of all nutrients. Rate of replenishment of soil nutrients is much slower than the rate of consumption.Hence fertilizers are required to balance these rates by providing enough nutrients to the soil and plants directly thereby allowing the soil to replenish at its own rate.

10. YOUR SOLUTION

- An automated system that takes the images of leaves as input and identifies the different symptoms to decide on the disease that affects the plant.
- This will be done using the Deep learning techniques.
- Based on which the fertilizers rich in the required nutrients are suggested.

8. CHANNELS of BEHAVIORS

8.1 ONLINE

Online portal is for accepting the input images and displaying the recommended fertilizers.

8.2 OFFLINE

While offline, the image preprocessing, segmentation, disease prediction,etc. are done.

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

Functional Requirements specify the features and functions of the proposed system.

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registering through Gmail
FR-2	User confirmation	Confirmation is done through Email
FR-2	Image Capture	Take a picture of a leaf and verify that the leaf was captured using the specified criteria.
FR-3	Image Processing	Upload the image of the leaf for detecting the diseases that is present in the leaf.
FR-4	Leaf Prediction	Determine the parameter that should be taken into account for disease identification for identifying the leaf and predicting the disease in it.
FR-5	Image Description	Show the prescribed fertilizer that has to be used for the diseased leaf
FR-6	Providing Dataset	Training the datasets Testing the datasets
FR-7	Adding Datasets	Datasets for fruits and vegetables are added.

4.2 Non-Functional Requirements

Non-functional requirements specify the general properties of the proposed system.

Non-functional Requirements:

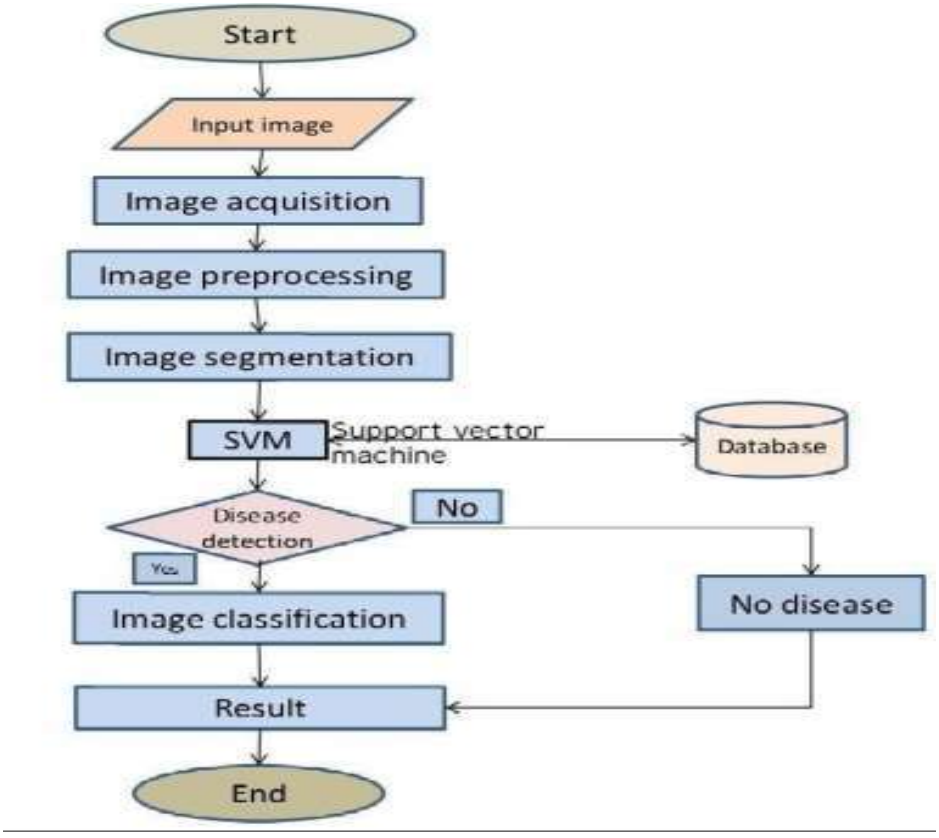
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Data sets can be prepared according to the leaf .Leaf datasets can be used for detection of all kind of leaf's Datasets can be reusable to detect diseases present in leaf.
NFR-2	**Security**	User information and leaf data are secured The employed algorithms are more secure.
NFR-3	**Reliability**	The leaf quality is more for predicting the disease in leaf. The datasets and image capture consistently performs well.
NFR-4	**Performance**	The leaf problem is specified when the leaf is detected. Performs well according to the quality of the leaf and provides a specific cure to it by showing recommendation of fertilizer.
NFR-5	**Availability**	The quality of the leaf will be used again for detection. Datasets will be made available and easily accessible. It is available to all users to predict plant disease.
NFR-6	**Scalability**	Increasing the accuracy of disease prediction in the leaf.

5. PROJECT DESIGN

5.1 Data Flow Diagram

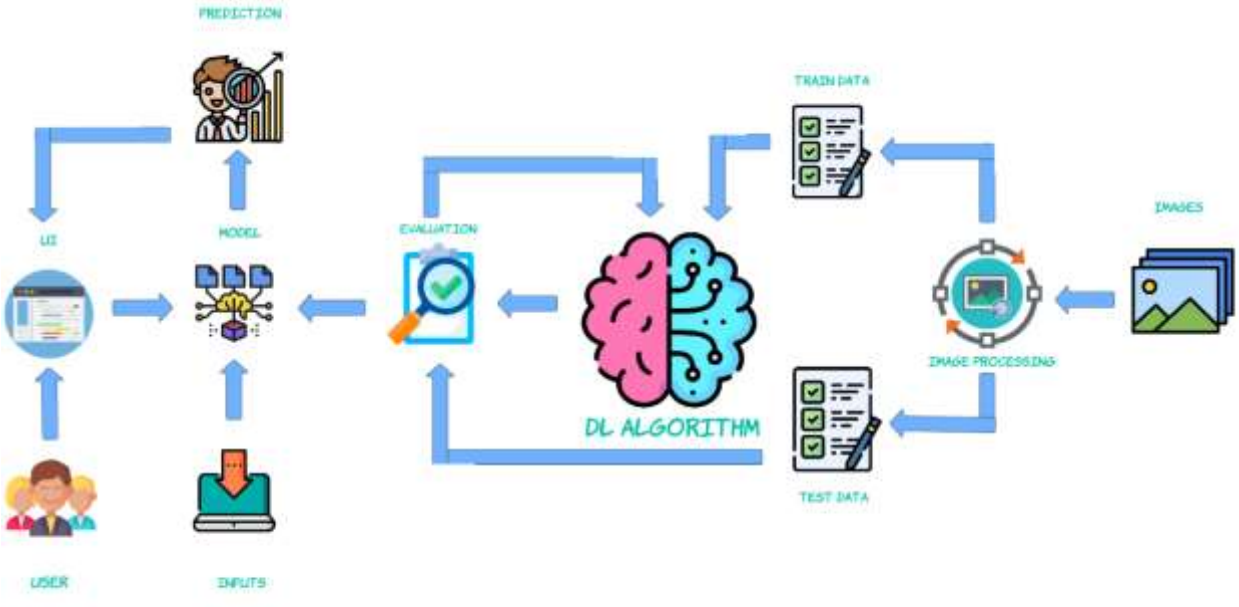
A data flow diagram or DFD(s) maps out the flow of information for any process or system. DFDs help you better understand process or system operations to discover potential problems, improve efficiency, and develop better processes.



5.2 Solution And Technical Architecture

Solution Architecture:

Solution architecture is the process of developing solutions based on predefined processes, guidelines,+ and best practices with the objective that the developed solution fits within the enterprise architecture in terms of information architecture, system portfolios, integration requirements, etc.



FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

5.3 User Stories

An informal, generic explanation of a software feature written from the viewpoint of the end user is known as a user story. Its objective is to explain how a software feature will benefit the user.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobileuser)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Login	USN-2	As a user, I can log into the application by entering email & password	I can login using my E-mail ID accounts or user credentials	High	Sprint-1
	Dashboard	USN-3	As a user, I can view the page of the application where i can upload my images and the fertilizer should be recommended	I can access my account/ dashboard	High	Sprint-2
Customer (Web user)	Registration	USN-4	As a user, I can login to web dashboard just Like website dashboard	I can register using my username and password	High	Sprint-3
	Login	USN-5	As a user, I can login to my web dashboard with the login credentials	I can login using my User credentials	High	Sprint-3
	Dashboard	USN-6	As a user, I can view the web application where i can upload my images for getting the suggestion of the fertilizer	I can access my account/ dashboard	High	Sprint-4
		USN-7	As a user, the fertilizer recommended to me Is in high accurate	I can access my account/ dashboard	High	Sprint-4

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Administrator	Login	USN-8	As a admin, I can login to the website using my login credentials	I can log in to the websiteusing my login credentials	High	Sprint-5
	Dashboard	USN-9	As an admin, I can view the dashboard of theapplication	I can access my dashboard	High	Sprint-5

6. Project Planning And Scheduling

Team id : PNT2022TMID46442

6.1 Sprint Delivery Planning & Estimation

The delivery plan of project deliverables is a strategic element for every Project Manager. The goal of every project is to produce a result that serves a specific purpose. With the word „purpose “, we can mean the most disparate goals: a software program, a chair, a building, a translation, etc.…
In Project, Sprint Delivery Planning is one of the processes of Completing the project and Show Casing the Time Line of the Project Planning. This Delivery plan help to understand the process and Work Flow of the Project working by the Team Mates.

Every Single Module is assigned to the teammates to showcase their work and contribution to developing the Project

6.2 Sprint Delivery Schedule

Agile sprints typically last from one week to one month. The goal of sprints is to put pressure on teams to innovate and deliver more quickly, hence the shorter The sprint , The better

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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

Velocity:

Sprint 1 Average Velocity:
Average Velocity = 20/2 = 10

Sprint 2 Average Velocity:
Average Velocity = 20/2 = 10

Sprint 3 Average Velocity:
Average Velocity = 20/1 = 20

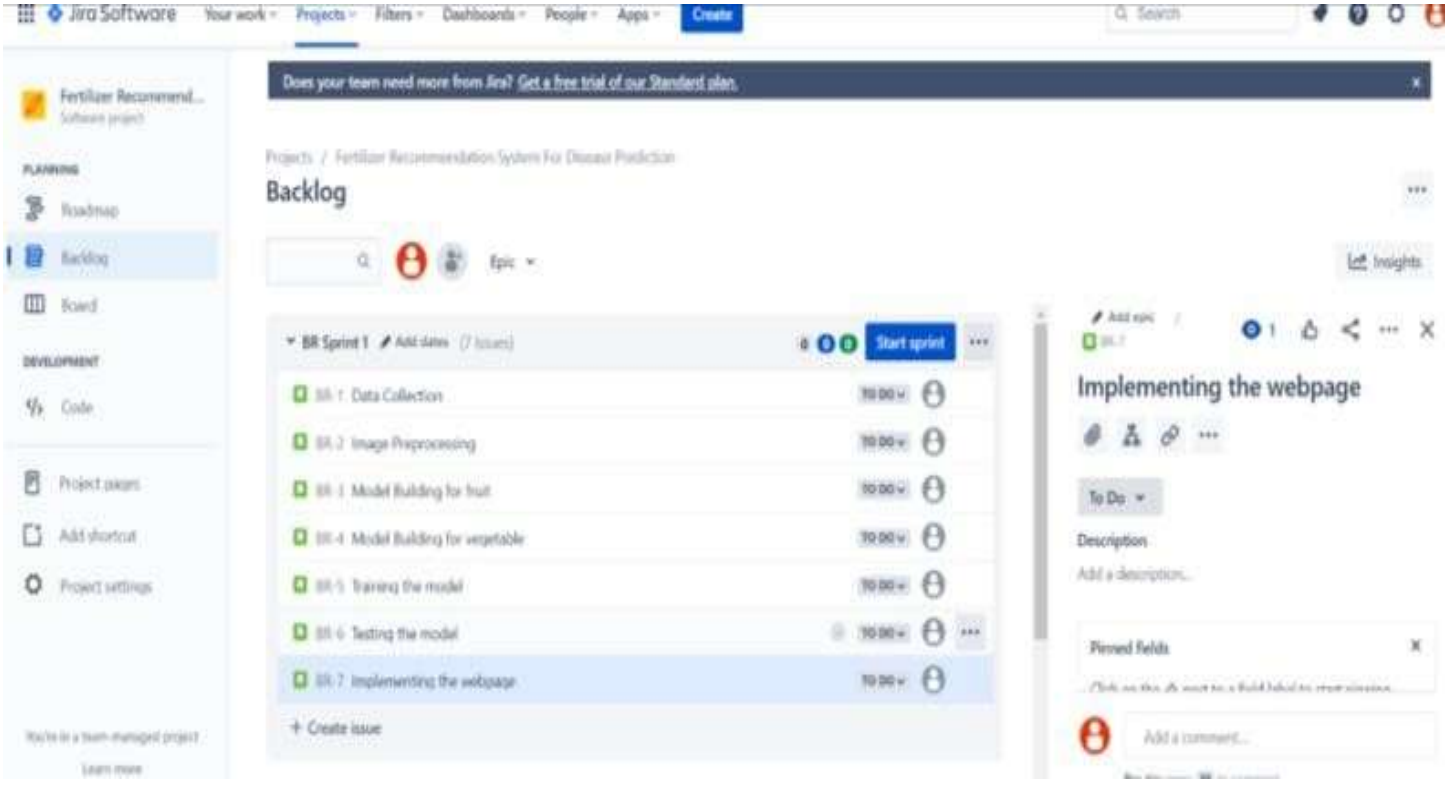
Sprint 4 Average Velocity:
Average Velocity = 20/2 = 10

Burndown Chart:

6.3 Reports from JIRA

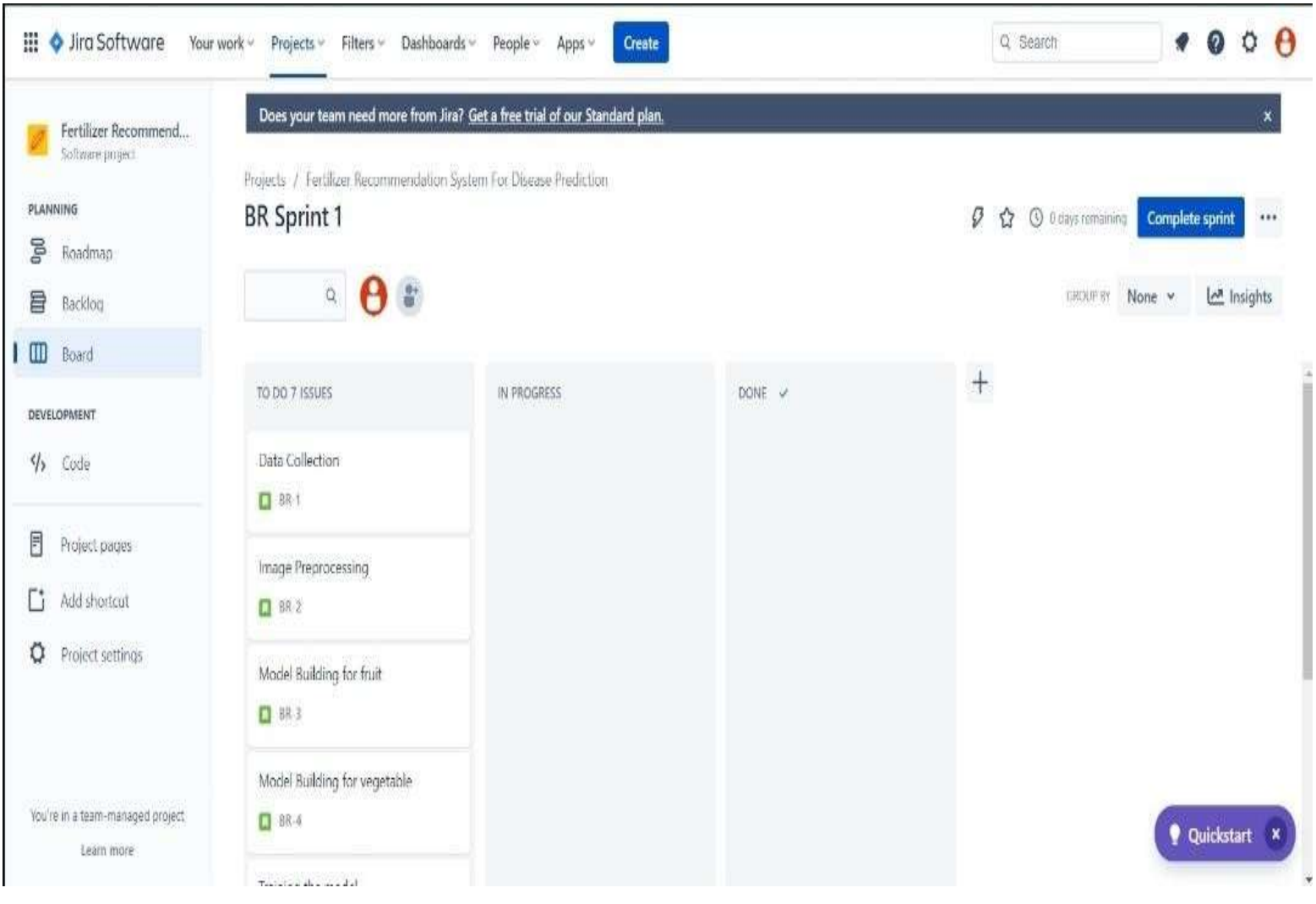
Backlog:

A backlog is a list of issues that's related to the project and the functions of the system. It makes it simple to make, store, and manage a variety of problems including the ones the team is working on



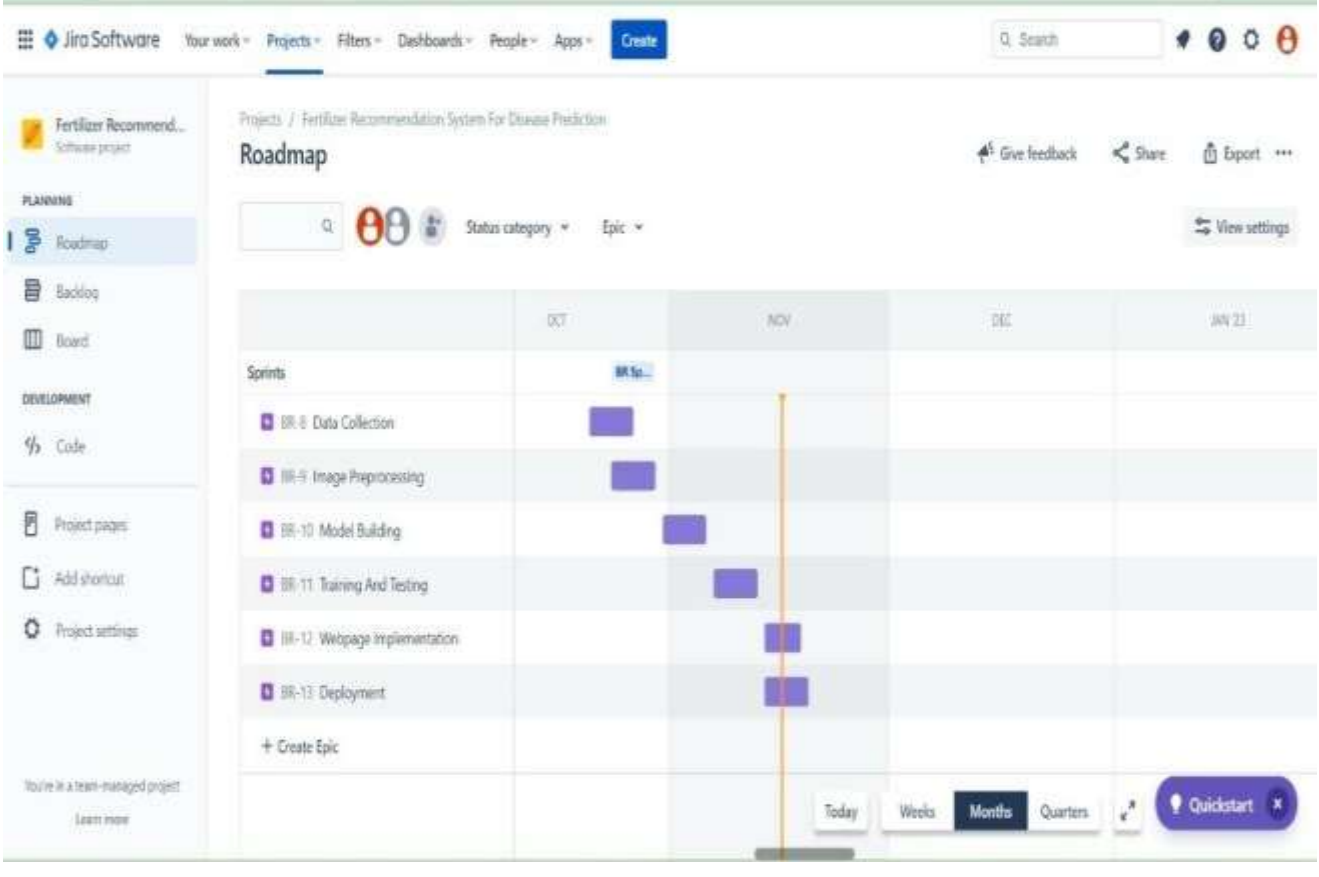
Board:

A board reflects your team's process, tracking the status of work. The columns on the board represent the status of your team's issues. The visual representation of the work helps in discussing and tracking of the progress of the project from start to finish



Roadmap:

A Roadmap offers quick and easy planning that helps teams better manage their dependencies and track progress on big pictures in real-time



7.CODING & SOLUTIONING

Python-app.py

```
import os
import numpy as np
import pandas as pd
from tensorflow.keras.models import load_model
# from tensorflow.keras.preprocessing import image
from werkzeug.utils import secure_filename
from flask import Flask, render_template, request
app = Flask(__name__)
#load both the vegetable and fruit models
model = load_model("vegetable.h5")
model1=load_model("fruit.h5")
   #home page

@app.route('/')
def home():
return render_template('home.html')
#prediction page
@app.route('/prediction')
def prediction():
return render_template('predict.html')
@app.route('/predict',methods=['POST'])
def predict():
if request.method == 'POST':
# Get the file from post request
f = request.files['image']
# Save the file to ./uploads
basepath = os.path.dirname(__file__)
file_path = os.path.join(
basepath, 'uploads', secure_filename(f.filename))
f.save(file_path)
img = image.load_img(file_path, target_size=(128, 128))
x = image.img_to_array(img)
x = np.expand_dims(x, axis=0)
plant=request.form['plant']
print(plant)
if(plant=="vegetable"):
preds = model.predict(x)
preds=np.argmax(preds)
print(preds)
df=pd.read_excel('precautions - veg.xlsx')
print(df.iloc[preds]['caution'])
else:
preds = model1.predict(x)
preds=np.argmax(preds)
df=pd.read_excel('precautions - fruits.xlsx')
```

```
print(df.iloc[preds]['caution'])
return df.iloc[preds]['caution']
if __name__ == "__main__":
app.run(debug=False)
   s
```

Feature 1:

Home.html

```
<!DOCTYPE html>
<html >
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Plant Disease Prediction</title>
<link href='https://fonts.googleapis.com/css?family=Pacifico' rel='stylesheet'
type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo' rel='stylesheet'
type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300' rel='stylesheet'
type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300'
rel='stylesheet' type='text/css'>
<link rel="stylesheet" href="{{ url_for('static', filename='css/style.css') }}">
<link href='https://fonts.googleapis.com/css?family=Merriweather'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Josefin Sans'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Montserrat' rel='stylesheet'>
<script type="text/javascript" src="https://gc.kis.v2.scr.kaspersky-
labs.com/FD126C42-EBFA-4E12-B309-
BB3FDD723AC1/main.js?attr=AMFGethlf4Q6r2IdpTrTqcDQGNLDU5Cbc3diYnUdLkg5mQrVB_td22OH
UAsBJSd0oo8OR0zM3rIPeFWfnEY4XCxQu4KOxMSqlshEoIBOzvYw0SsMYpyUv4fnvKEjmJoj_Y6cI4ov-
6AMOkz3Sh3epkfq0gltfnAPvvQBRdXqRmdqePVjlvvqL28ONZCiS0Qr5t0XGxJ0bSiWVT-
rH3cqaKCk05eP1Dx04mieTcjsA_TtFLx15PUu0ed6soaj-FOO6-
1d4OQxbJYBXUBefiUhzmOYCpsGIs1OyQvA0huo8AUYwYB72dvs07U3O2hq8BmYBv98h13sSo8iXKxyKx4F
UsOMkixjxYP6hu0wwi7yv1E2rei3GHtPl5YwHkWioQIPqvAmrlmaPtFZmF-
jE4_UUCi9IEKws8IduDiqQIFkxfO3YT_sUC9gWmxKSpGbiebwCgV-
wvdGEnbUxY18p9Db6jC6FVKRhqdMBianq63qv-
zZRMZbEpjzQT0DQAH3Yho4o4A00FIW2004q8Q80xt2kV928P_nBgS9HOgHI5EZxenbjfqANTs1rh8GGhBd
7RJaE8-
2AaqT6zbLf2tILJ8j4fk3bV1qsdw0fPmp6foJbDu4343XH36a0VGHsMLeVqcc30PSsE1pJbGE4_C_ExQd0
_uRSA40mRjnFwHdLo9SJc1qghyc5YGQil_utG48olMy9cC6z-iyKg1EeLKB43u-
q4SlUimRnuUsZW7drNWaijSfJPDmkm7lUJ0POwQXPfnLa2_spc3FisWCOZ7dFuIgDciIu0yF8rio2X0Pz6
pZkGQW4Fwl6vWKrLplmHagJElKXg58YSWwAT2DILilBjuSPiTwCHR9Ya_mAXW4C03v7xzJlaSK9jneECqc
tvKnH3RFgDS8ocfDcY65lXNRkq6v1hrcdv5sM2ek4Kjq4OFgX-wijr-0JdpSDpZlbIK00sPb4-
u1B8c7MaCqBcbJAhfmg4utLU67fn5GLoCX_-5TAWV0ID-_sC1Vs9glWRPkKmmktJMbVy98XqC5-
DhtE3yd5I9ZM1SEH1gGYLlRjxwzPjWwHE-YH1Nx9lm-
Esq27TK7M86uT8iAe7LgtviO2YsCB0buShHWmjh3RzwMGqNqeymFSxPRK_sDmTFoVjcaYpGa0kaMwhmmF
```

9AtPwGmFaGglv3rryVg0X0bGoXRetnrPpDG7jUoq5zQuXQSedBf9hmNwEqWsSZtI4zNTxjiEkxU0djhPXq
ByZbnelp_3z6pqqniLzqj9jzAkvX6wDOW7ZycfDzOt-
zNgTxWdtf41P6ZjVu8EWSf65Wqgen5jD4IPXgXGtxkjrSbrqiX-
NxxxfKVJUOoOcEO0F6n3DWD0BMWS8UGOQO8gZZeXCfpuTIGYTD6okyD91kLk5AmhaNTJVKjkHO-
dHZqMHxikVhdK6C2PIfg4lEY0yuE3Fjj_5NNX5ZalIpOl3LN6YQ8Jqis_UmC_OXmjW2F5Y4p8VRRKc1HW2
DFaUxBrEgfSwe_keyaofodrjde_pfPuDQDryEgGy9DNIhpGUV_bQJ8jlPxRL7WSpmPU7-
IZ1mVN_onhqq2oI-WTl7ep-8w0GsJH3OhSRyyJC0XC9xtetqVjIHzcbKYFsxOaXT-
LLe7U9oHaXHzjDK3hn-ZNFYwzV_aoq8180eb" charset="UTF-8"></script><style>
```
.header {
top:0;
margin:0px;
left: 0px;
right: 0px;
position: fixed;
background-color: #28272c;
color: white;
box-shadow: 0px 8px 4px grey;
overflow: hidden;
padding-left:20px;
font-family: 'Josefin Sans';
font-size: 2vw;
width: 100%;
height:8%;
text-align: center;
}
.topnav {
overflow: hidden;
background-color: #333;
}
.topnav-right a {
float: left;
color: #f2f2f2;
text-align: center;
padding: 14px 16px;
text-decoration: none;
font-size: 18px;
}
.topnav-right a:hover {
background-color: #ddd;
color: black;
}
.topnav-right a.active {
```

```
background-color: #565961;
color: white;
}
.topnav-right {
float: right;
padding-right:100px;
}
body {
background-color:#ffffff;
background-repeat: no-repeat;
background-size:cover;
background-position: 0px 0px;
}
.button {
background-color: #28272c;
border: none;
color: white;
padding: 15px 32px;
text-align: center;
text-decoration: none;
display: inline-block;
font-size: 16px;
border-radius: 12px;
}
.button:hover {
box-shadow: 0 12px 16px 0 rgba(0,0,0,0.24), 0 17px 50px 0 rgba(0,0,0,0.19);
}
form {border: 3px solid #f1f1f1; margin-left:400px;margin-right:400px;}
input[type=text], input[type=password] {
width: 100%;
padding: 12px 20px;
display: inline-block;
margin-bottom:18px;
border: 1px solid #ccc;
box-sizing: border-box;
}
button {
background-color: #28272c;
color: white;
padding: 14px 20px;
```

```
margin-
bottom:8px;
border: none;
cursor:
pointer;
width: 15%;
border-
radius:4px;
}
```

```
button:hover {
opacity: 0.8;
}
.cancelbtn {
width: auto;
padding: 10px 18px;
background-color: #f44336;
}
.imgcontainer {
text-align: center;
margin: 24px 0 12px 0;
}
img.avatar {
width: 30%;
border-radius: 50%;
}
.container {
padding: 16px;
}
span.psw {
float: right;
padding-top: 16px;
}
/* Change styles for span and cancel button on extra small screens */
@media screen and (max-width: 300px) {
span.psw {
display: block;
float: none;
}
.cancelbtn {
width: 100%;
}
```

```
}
.home{
margin:80px;
width: 84%;
height: 500px;
padding-top:10px;
padding-left: 30px;
}
.login{
margin:80px;
box-sizing: content-box;
width: 84%;
height: 420px;
padding: 30px;
border: 10px solid blue;
}
.left,.right{
box-sizing: content-box;
height: 400px;
margin:20px;
border: 10px solid blue;
}
.mySlides {display: none;}
img {vertical-align: middle;}
/* Slideshow container */
.slideshow-container {
max-width: 1000px;
position: relative;
margin: auto;
}
/* Caption text */
.text {
color: #f2f2f2;
font-size: 15px;
padding: 8px 12px;
position: absolute;
bottom: 8px;
width: 100%;
text-align: center;
```

```
}
/* The dots/bullets/indicators */
.dot {
height: 15px;
width: 15px;
margin: 0 2px;
background-color: #bbb;
border-radius: 50%;
display: inline-block;
transition: background-color 0.6s ease;
}
.active {
background-color: #717171;
}
/* Fading animation */
.fade {
-webkit-animation-name: fade;
-webkit-animation-duration: 1.5s;
animation-name: fade;
animation-duration: 1.5s;
}
@-webkit-keyframes fade {
from {opacity: .4}
to {opacity: 1}
}
@keyframes fade {
from {opacity: .4}
to {opacity: 1}
}
/* On smaller screens, decrease text size */
@media only screen and (max-width: 300px) {
.text {font-size: 11px}
}
</style>
</head>
<body style="font-family:'Times New Roman', Times, serif;background-
color:#C2C5A8;">
<div class="header">
```

```
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:white;
padding-top:1%">Plant Disease Prediction</div>
<div class="topnav-right"style="padding-top:0.5%;">
<a class="active" href="{{ url_for('home')}}">Home</a>
<a href="{{ url_for('prediction')}}">Predict</a>
</div>
</div>
<div style="background-color:#ffffff;">
<div style="width:60%;float:left;">
<div style="font-size:50px;font-family:Montserrat;padding-left:20px;text-
align:center;padding-top:10%;">
<b>Detect if your plant<br> is infected!!</b></div><br>
<div style="font-size:20px;font-family:Montserrat;padding-left:70px;padding-
right:30px;text-align:justify;">Agriculture is one of the major sectors worls
wide. Over the years it has developed and the use of new technologies and
equipment replaced almost all the traditional methods of farming. The plant
diseases effect the production. Identification of diseases and taking necessary
precautions is all done through naked eye, which requires labour and laboratries.
This application helps farmers in detecting the diseases by observing the spots on
the leaves, which inturn saves effort and labor costs.</div><br><br>
</div>
</div>
<div style="width:40%;float:right;"><br><br>
<img src="{{url_for('static',filename='images/12456.png')}}" style="max-
height:100%;max-width:100%;">
</div>
</div>
<div class="home">
<br>
</div>
<script>
var slideIndex = 0;
showSlides();
function showSlides() {
var i;
var slides = document.getElementsByClassName("mySlides");
var dots = document.getElementsByClassName("dot");
```

```
for (i = 0; i < slides.length; i++) {
slides[i].style.display = "none";
}
slideIndex++;
if (slideIndex > slides.length) {slideIndex = 1}
for (i = 0; i < dots.length; i++) {
dots[i].className = dots[i].className.replace(" active", "");
}
slides[slideIndex-1].style.display = "block";
dots[slideIndex-1].className += " active";
setTimeout(showSlides, 2000); // Change image every 2 seconds
}
</script>
</body>
</html>
```

Feature 2

Predict.html

```
<!DOCTYPE html>
<html >
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Plant Disease Prediction</title>
<link href='https://fonts.googleapis.com/css?family=Pacifico' rel='stylesheet'
type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo' rel='stylesheet'
type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300' rel='stylesheet'
type='text/css'>
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
<script type="text/javascript" src="https://gc.kis.v2.scr.kaspersky-
labs.com/FD126C42-EBFA-4E12-B309-
BB3FDD723AC1/main.js?attr=3wvf44XdejigWHFj22ANQmgfA-L5oa67wZhZwPtEITSot6t8o-
DPZwNcHRFhpa2tgGpDJGis4-1IHYyxyIAN2GE0-kSZKkCLRkbKttCLVN9mKhGFVtGJ3auoiiByn_jJ-
mA447x4TmdjGgz8XvMdLSPF4Gu5xwt0joGxWDXuOEF18Sa5usZGgj4TdDiTfDHpElX3P1eH-
lsevFhUJQEZe3981VXjRKYRn2FrxsYwXGSMBn0sRR9IYup35XYNQkvA6DLQV1lwLc4XuAo0BlJYAfI75R4
O5LwTWuT-uaft0DEQeuV_f3rKvkrcBkalcpWnyXVLeLyjMz5CqpZ1aSCy1MgVAzWxGb-
GX3eQb0F5qOksANddV_vhz1Ai4RgptuAfB8mVyuz0nWZzpmwam34lc4NL4tfyWGncKz2taMyGfsK4Mrn0z
fPlY9_n9FP0lMlAX0IQ8TfbVp4B1vbwnA-
```

```
RVJq8mxoTjgMgqhKhp6NQY_8gZULkbqqA0pqUMvfL3_fZC1PFipLNjCyCGe9YOaU9L7QF4CXeKsRhJXmI8
98FhpxB1oI7z0xvndsDLPRsqbNuse_eGL9tz0Te5HLGhtoXSn5O8pHC99_XHYofrlismcByzZlmVqVkCNf
mbnMjaD9IQf6xAACyjkQ927AOvyDVCZKr-
tV6wRZyv_z7Z1J9AG7SGSLoB34AkMytkYXvpgGn21pGFNhvl3YSmyKYc2XJs89zHbp5fSyXsfasogSEYLb
pxCmuvzZKO4haaqouKDcLwBGMFp_Br095f-
AlhhWOdPDx1ezvTMx1NgS4QO97OmbyQCqHUFWWZLYNgjQ8zpfdBXB17L_v_lfmrUWhUiUVc9tRcJy-
lpchFJe8Gz7TUOKCRDjbIWtiqXryDeENrJgQ31laXp-
VVYpOI1L55pek2fgk5OCGNzVges5oG4PpMyCIXtJpv32E5rlPTktG4hD8eXmYQECVU1HvSmEiKvuY6T6i9
wdpqg_AnycRzUXmYdahFT3W7zToIn2RXzNfdOU0zbYBvtJ70TpR4PjfU75lJ0FsnphDuCnero3UYOak7vY
vGYD9YV2md5v-3AmP-eOor2m55JZRH_Hxpn28x-nDNCOHqVBC6leYuYFBVV_vL5l-
E8n92uWUqwMEzdZPZtAyRaCfz3D2Y0IYn-
ZrnfNTg2M_zVJePmUu1xdjYh7d1dx7nwclm7wJrBPb3JnX2kvEGYs9SM17MlwzoY1VJq4UzJ2D6oEvhQwH
vG4e1etlS6iLWzhy8RVMfBlTa4DPDOHmTlHhsKbn0UaMyFFCppe79rtIVRctcomnVmQysUwUOhjzlAq30-
hXJCTqdCWJe2xnxjAuUHVqHSiHiZllZaoOWNCV5Ypx_eqzn-KyZS3u-
2_hGLHHNA2AVBWn_hF3Gz16dw6zA4QSmWZSfDUcNObLJGOSTaDS3Z8jPTloYPFmu8oES6TL1dLlEK5YhcS
GaX4iv6o95drsZGb6bBcWgT7sNFHW6dVE9wdjoDFuBergPIAm0sKaZQ2Ex6j15OWCbE6UaPg-
VNfziA2FEPpJaI9hEPI2gdaSuHqovlEOt5mjuFBBOxpK0t8kOZRtsVzqUuJw3VcLjaP6SfG_KZfgX_g8TP
s6CcFhlLRz63oXMQFPW6AA7eudWfygndazedq5B-
6DqSkOT04GTUJNqLcElg6KEEWqxd88BzoQoK28jrAf-xWHNIZv5HmQQYEnyX0U_cW8HX-
hde54TuY_fY3e5QYu4be-JxTkA4JxWLEagSa7-zs" charset="UTF-8"></script><script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<link href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300'
rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Merriweather'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Josefin Sans'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Montserrat' rel='stylesheet'>
<link href="{{ url_for('static', filename='css/final.css') }}" rel="stylesheet">
<style>
.header {
top:0;
margin:0px;
left: 0px;
right: 0px;
position: fixed;
background-color: #28272c;
color: white;
box-shadow: 0px 8px 4px grey;
overflow: hidden;
padding-left:20px;
font-family: 'Josefin Sans';
```

```
font-size: 2vw;
width: 100%;
height:8%;
text-align: center;
}
.topnav {
overflow: hidden;
background-color: #333;
}
```

```
.topnav-right a {
float: left;
color: #f2f2f2;
text-align: center;
padding: 14px 16px;
text-decoration: none;
font-size: 18px;
}
.topnav-right a:hover {
background-color: #ddd;
color: black;
}
.topnav-right a.active {
background-color: #565961;
color: white;
}
.topnav-right {
float: right;
padding-right:100px;
}
.login{
margin-top:-70px;
}
body {
background-color:#ffffff;
background-repeat: no-repeat;
background-size:cover;
background-position: 0px 0px;
}
.login{
```

```
margin-top:100px;
}
.container {
margin-top:40px;
padding: 16px;
}
select {
width: 100%;
margin-bottom: 10px;
background: rgba(255,255,255,255);
border: none;
outline: none;
padding: 10px;
font-size: 13px;
color: #000000;
text-shadow: 1px 1px 1px rgba(0,0,0,0.3);
border: 1px solid rgba(0,0,0,0.3);
border-radius: 4px;
box-shadow: inset 0 -5px 45px rgba(100,100,100,0.2), 0 1px 1px
rgba(255,255,255,0.2);
-webkit-transition: box-shadow .5s ease;
-moz-transition: box-shadow .5s ease;
-o-transition: box-shadow .5s ease;
-ms-transition: box-shadow .5s ease;
transition: box-shadow .5s ease;
}
</style>
</head>
<body style="font-family:Montserrat;overflow:scroll;">
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:white;
padding-top:1%">Plant Disease Prediction</div>
<div class="topnav-right" style="padding-top:0.5%;">
</div>
</div>
<div class="container">
<div id="content" style="margin-top:2em">
<div class="container">
```

```
<div class="row">
<div class="col-sm-6 bd" >
<br>
<img src="{{url_for('static',filename='images/789.jpg')}}"
style="height:450px;width:550px"class="img-rounded" alt="Gesture">
</div>
<div class="col-sm-6">
<div>
<h4>Drop in the image to get the prediction </h4>
<form action = "" id="upload-file" method="post" enctype="multipart/form-data">
<select name="plant">
<option value="select" selected>Select plant type</option>
<option value="fruit">Fruit</option>
<option value="vegetable">Vegetable</option>
</select><br>
<label for="imageUpload" class="upload-label" style="background: #28272c;">
Choose...
</label>
<input type="file" name="image" id="imageUpload" accept=".png, .jpg, .jpeg">
</form>
<div class="image-section" style="display:none;">
<div class="img-preview">
<div id="imagePreview">
</div>
</div>
<div>
<button type="button" class="btn btn-info btn-lg " id="btn-predict"
style="background: #28272c;">Predict!</button>
</div>
</div>
<div class="loader" style="display:none;"></div>
<h3>
<span id="result" style="font-size:17px; "> </span>
</h3>
</div>
```

```
</div>
</div>
</div>
</div>
</div>
</body>
<footer>
<script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>
   </html>
```

Final.css

```
.img-preview {
width: 256px;
height: 256px;
position: relative;
border: 5px solid #F8F8F8;
box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
margin-top: 1em;
margin-bottom: 1em;
}
.img-preview>div {
width: 100%;
height: 100%;
background-size: 256px 256px;
background-repeat: no-repeat;
background-position: center;
}
input[type="file"] {
display: none;
}
.upload-label{
display: inline-block;
padding: 12px 30px;
background: #28272c;
color: #fff;
   font-size: 1em;
```

```
transition: all .4s;
cursor: pointer;
}
.upload-label:hover{
background: #C2C5A8;
color: #39D2B4;
}
.loader {
border: 8px solid #f3f3f3; /* Light grey */
border-top: 8px solid #28272c; /* Blue */
border-radius: 50%;
width: 50px;
height: 50px;
animation: spin 1s linear infinite;
}
@keyframes spin {
0% { transform: rotate(0deg); }
100% { transform: rotate(360deg); }
   }
```

Main.js:

```
$(document).ready(function () {
// Init
$('.image-section').hide();
$('.loader').hide();
$('#result').hide();
// Upload Preview
function readURL(input) {
if (input.files && input.files[0]) {
var reader = new FileReader();
reader.onload = function (e) {
$('#imagePreview').css('background-image', 'url(' + e.target.result + ')');
$('#imagePreview').hide();
$('#imagePreview').fadeIn(650);
}
reader.readAsDataURL(input.files[0]);
}
   }
```

```
$("#imageUpload").change(function () {
$('.image-section').show();
$('#btn-predict').show();
$('#result').text('');
$('#result').hide();
readURL(this);
});
// Predict
$('#btn-predict').click(function () {
var form_data = new FormData($('#upload-file')[0]);
// Show loading animation
$(this).hide();
$('.loader').show();
// Make prediction by calling api /predict
$.ajax({
type: 'POST',
url: '/predict',
data: form_data,
contentType: false,
cache: false,
processData: false,
async: true,
success: function (data) {
// Get and display the result
$('.loader').hide();
$('#result').fadeIn(600);
$('#result').text('Prediction: '+data);
console.log('Success!');
},
});
});
   });
```

8.1 Test Cases

Test cases are a set of actions performed on a system to determine if it satisfies software requirements and functions correctly as it claimed to perform.

8.2 User Acceptance Testing

Before deploying the software application to a production environment the end user or client performs a type of testing known as user acceptance testing, or UAT to ensure whether the software functionalities serve the purpose of development.

9. Results

Performance Metrics

metrics are a baseline for performance tests. Monitoring the correct parameters will help you detect areas that require increased attention and find ways to improve them.

PROJECT DEVELOPMENT PHASE

MODEL PERFORMANCE TEST

DATE	10 NOVEMBER 2022
TEAM ID	PNT2022TMID46442
PROJECT ID	FERTILIZER RECOMMENDATION SYSTEM FOR DISEASE PREDICTION
MAXIMUM MARKS	10 MARKS

MODEL PERFORMANCE TESTING:

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Total params: 45,221,754 Trainable params: 45,221,754 Non trainable params: 0	
2.	Accuracy	Training Accuracy – 97.55 Validation Accuracy – 96.45	

10. ADVANTAGES AND DISADVANTAGES

Advantages:

- Early detection of plant diseases.
- Proper fertilizer recommendation to prevent or cure the plant infection or disease.
- No Need to Consult any Specialists
- Fully Automated System

Disadvantages:

• Requires training the system with large dataset.

• Works only on the pretrained diseases.

• When a plant is infected with multiple diseases the system may not predict all the diseases due to the mixed symptoms.

• Requires a good device connected to the internet.

11. CONCLUSION

Hence a system that takes in images as user input, analyses those for certain symptoms and identifies the disease, recommends the fertilizer to counter the deficiency of the nutrients is built and deployed.

12. FUTURE SCOPE

The system must be trained with numerous images of plant disease symptoms. In case of presence of multiple diseases, suitable classification must be done to predict each disease accurately and recommend separate fertilizers as a solution to each deficiency or infection.

13. APPENDIX

Source Code

Home.html:

```
<!DOCTYPE html>
<html >
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Plant Disease Prediction</title>
<link href='https://fonts.googleapis.com/css?family=Pacifico' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300' rel='stylesheet' type='text/css'>
<link rel="stylesheet" href="{{ url_for('static', filename='css/style.css') }}">
<link href='https://fonts.googleapis.com/css?family=Merriweather' rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Josefin Sans' rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Montserrat' rel='stylesheet'>
<script type="text/javascript" src="https://gc.kis.v2.scr.kaspersky-labs.com/FD126C42-EBFA-4E12-B309-
BB3FDD723AC1/main.js?attr=AMFGethlf4Q6r2IdpTrTqcDQGNLDU5Cbc3diYnUdLkg5mQrVB_td22OHUAsBJ
Sd0oo8OR0zM3rIPeFWfnEY4XCxQu4KOxMSqlshEoIBOzvYw0SsMYpyUv4fnvKEjmJoj_Y6cI4ov-
6AMOkz3Sh3epkfq0gltfnAPvvQBRdXqRmdqePVjlvvqL28ONZCiS0Qr5t0XGxJ0bSiWVT-
rH3cqaKCk05eP1Dx04mieTcjsA_TtFLx15PUu0ed6soaj-FOO6-
1d4OQxbJYBXUBefiUhzmOYCpsGIs1OyQvA0huo8AUYwYB72dvs07U3O2hq8BmYBv98h13sSo8iXKxyKx4F
UsOMkixjxYP6hu0wwi7yv1E2rei3GHtPl5YwHkWioQIPqvAmrlmaPtFZmF-
jE4_UUCi9IEKws8IduDiqQIFkxfO3YT_sUC9gWmxKSpGbiebwCgV-
wvdGEnbUxY18p9Db6jC6FVKRhqdMBianq63qv-
zZRMZbEpjzQT0DQAH3Yho4o4A00FIW2004q8Q80xt2kV928P_nBgS9HOgHI5EZxenbjfqANTs1rh8GGhBd7RJ
aE8-
2AaqT6zbLf2tILJ8j4fk3bV1qsdw0fPmp6foJbDu4343XH36a0VGHsMLeVqcc30PSsE1pJbGE4_C_ExQd0_uRSA4
0mRjnFwHdLo9SJc1qghyc5YGQil_utG48olMy9cC6z-iyKg1EeLKB43u-
q4SlUimRnuUsZW7drNWaijSfJPDmkm7lUJ0POwQXPfnLa2_spc3FisWCOZ7dFuIgDciIu0yF8rio2X0Pz6pZkGQ
W4Fwl6vWKrLplmHagJElKXg58YSWwAT2DILilBjuSPiTwCHR9Ya_mAXW4C03v7xzJlaSK9jneECqctvKnH3
RFgDS8ocfDcY65lXNRkq6v1hrcdv5sM2ek4Kjq4OFgX-wijr-0JdpSDpZlbIK00sPb4-
u1B8c7MaCqBcbJAhfmg4utLU67fn5GLoCX_-5TAWV0ID-_sC1Vs9glWRPkKmmktJMbVy98XqC5-
DhtE3yd5I9ZM1SEH1gGYLlRjxwzPjWwHE-YH1Nx9lm-
Esq27TK7M86uT8iAe7LgtviO2YsCB0buShHWmjh3RzwMGqNqeymFSxPRK_sDmTFoVjcaYpGa0kaMwhmmF
9AtPwGmFaGglv3rryVg0X0bGoXRetnrPpDG7jUoq5zQuXQSedBf9hmNwEqWsSZtI4zNTxjiEkxU0djhPXqByZb
nelp_3z6pqqniLzqj9jzAkvX6wDOW7ZycfDzOt-zNgTxWdtf41P6ZjVu8EWSf65Wqgen5jD4IPXgXGtxkjrSbrqiX-
NxxxfKVJUOoOcEO0F6n3DWD0BMWS8UGOQO8gZZeXCfpuTIGYTD6okyD91kLk5AmhaNTJVKjkHO-
dHZqMHxikVhdK6C2PIfg4lEY0yuE3Fjj_5NNX5ZalIpOl3LN6YQ8Jqis_UmC_OXmjW2F5Y4p8VRRKc1HW2D
FaUxBrEgfSwe_keyaofodrjde_pfPuDQDryEgGy9DNIhpGUV_bQJ8jlPxRL7WSpmPU7-IZ1mVN_onhqq2oI-
WTl7ep-8w0GsJH3OhSRyyJC0XC9xtetqVjIHzcbKYFsxOaXT-LLe7U9oHaXHzjDK3hn-ZNFYwzV_aoq8180eb"
charset="UTF-8"></script><style>
.header {
top:0;
margin:0px;
```

```
left: 0px;
right: 0px;
position: fixed;
background-color: #28272c;
color: white;
box-shadow: 0px 8px 4px grey;
overflow: hidden;
padding-left:20px;
font-family: 'Josefin Sans';
font-size: 2vw;
width: 100%;
height:8%;
text-align: center;
}
.topnav {
overflow: hidden;
background-color: #333;
}
.topnav-right a {
float: left;
color: #f2f2f2;
text-align: center;
padding: 14px 16px;
text-decoration: none;
font-size: 18px;
}
.topnav-right a:hover {
background-color: #ddd;
color: black;
}
.topnav-right a.active {
background-color: #565961;
color: white;
}
.topnav-right {
float: right;
padding-right:100px;
}
body {
background-color:#ffffff;
background-repeat: no-repeat;
background-size:cover;
background-position: 0px 0px;
}
.button {
background-color: #28272c;
border: none;
color: white;
padding: 15px 32px;
text-align: center;
```

```
text-decoration: none;
display: inline-block;
font-size: 16px;
border-radius: 12px;
}
.button:hover {
box-shadow: 0 12px 16px 0 rgba(0,0,0,0.24), 0 17px 50px 0 rgba(0,0,0,0.19);
}
form {border: 3px solid #f1f1f1; margin-left:400px;margin-right:400px;}
input[type=text], input[type=password] {
width: 100%;
padding: 12px 20px;
display: inline-block;
margin-bottom:18px;
border: 1px solid #ccc;
box-sizing: border-box;
}
button {
background-color: #28272c;
color: white;
padding: 14px 20px;
margin-bottom:8px;
border: none;
cursor: pointer;
width: 15%;
border-radius:4px;}
button:hover {
opacity: 0.8;}
.cancelbtn {
width: auto;
padding: 10px 18px;
background-color: #f44336;}
.imgcontainer {
text-align: center;
margin: 24px 0 12px 0;}
img.avatar {
width: 30%;
border-radius: 50%;}
.container {
padding: 16px;}
span.psw {
float: right;
padding-top: 16px;}
/* Change styles for span and cancel button on extra small screens */
@media screen and (max-width: 300px) {
span.psw {
display: block;
```

```
float: none;}
.cancelbtn {
width: 100%;}}
.home{
margin:80px;
width: 84%;
height: 500px;
padding-top:10px;
padding-left: 30px;}
.login{
margin:80px;
box-sizing: content-box;
width: 84%;
height: 420px;
padding: 30px;
border: 10px solid blue;
}
.left,.right{
box-sizing: content-box;
height: 400px;
margin:20px;
border: 10px solid blue;
}
.mySlides {display: none;}
img {vertical-align: middle;}
/* Slideshow container */
.slideshow-container {
max-width: 1000px;
position: relative;
margin: auto;
}
/* Caption text */
.text {
color: #f2f2f2;
font-size: 15px;
padding: 8px 12px;
position: absolute;
bottom: 8px;
width: 100%;
text-align: center;
}
/* The dots/bullets/indicators */
.dot {
height: 15px;
width: 15px;
margin: 0 2px;
background-color: #bbb;
border-radius: 50%;
display: inline-block;
transition: background-color 0.6s ease;
```

```
}
.active {
background-color: #717171;
}
/* Fading animation */
.fade {
-webkit-animation-name: fade;
-webkit-animation-duration: 1.5s;
animation-name: fade;
animation-duration: 1.5s;
}
@-webkit-keyframes fade {
from {opacity: .4}
to {opacity: 1}
}
@keyframes fade {
from {opacity: .4}
to {opacity: 1}
}
/* On smaller screens, decrease text size */
@media only screen and (max-width: 300px) {
.text {font-size: 11px}
}
</style>
</head>
<body style="font-family:'Times New Roman', Times, serif;background-color:#C2C5A8;">
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:white; padding-top:1%">Plant Disease Prediction</div>
<div class="topnav-right"style="padding-top:0.5%;">
<a class="active" href="{{ url_for('home')}}">Home</a>
<a href="{{ url_for('prediction')}}">Predict</a>
</div>
</div>
<div style="background-color:#ffffff;">
<div style="width:60%;float:left;">
<div style="font-size:50px;font-family:Montserrat;padding-left:20px;text-align:center;padding-top:10%;">
<b>Detect if your plant<br> is infected!!</b></div><br>
<div style="font-size:20px;font-family:Montserrat;padding-left:70px;padding-right:30px;text-align:justify;">Agriculture is one of the major sectors worls wide. Over the years it has developed and the use of new technologies and equipment replaced almost all the traditional methods of farming. The plant diseases effect the production. Identification of diseases and taking necessary precautions is all done through naked eye, which requires labour and laboratries. This application helps farmers in detecting the diseases by observing the spots on the leaves, which inturn saves effort and labor costs.</div><br><br>
</div>
```

```
</div>
<div style="width:40%;float:right;"><br><br>
<img src="{{url_for('static',filename='images/12456.png')}}" style="max-height:100%;max-width:100%;">
</div>
</div>
<div class="home">
<br>
</div>
<script>
var slideIndex = 0;
showSlides();
function showSlides() {
var i;
var slides = document.getElementsByClassName("mySlides");
var dots = document.getElementsByClassName("dot");
for (i = 0; i < slides.length; i++) {
slides[i].style.display = "none";
}
slideIndex++;
if (slideIndex > slides.length) {slideIndex = 1}
for (i = 0; i < dots.length; i++) {
dots[i].className = dots[i].className.replace(" active", "");
}
slides[slideIndex-1].style.display = "block";
dots[slideIndex-1].className += " active";
setTimeout(showSlides, 2000); // Change image every 2 seconds
}
</script>
</body>
</html>
```

Predict.html:

```
<!DOCTYPE html>
<html >
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Plant Disease Prediction</title>
<link href='https://fonts.googleapis.com/css?family=Pacifico' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300' rel='stylesheet' type='text/css'>
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
<script type="text/javascript" src="https://gc.kis.v2.scr.kaspersky-labs.com/FD126C42-EBFA-4E12-B309-
BB3FDD723AC1/main.js?attr=3wvf44XdejigWHFj22ANQmgfA-L5oa67wZhZwPtEITSot6t8o-
DPZwNcHRFhpa2tgGpDJGis4-1IHYyxyIAN2GE0-kSZKkCLRkbKttCLVN9mKhGFVtGJ3auoiiByn_jJ-
mA447x4TmdjGgz8XvMdLSPF4Gu5xwt0joGxWDXuOEF18Sa5usZGgj4TdDiTfDHpElX3P1eH-
lsevFhUJQEZe3981VXjRKYRn2FrxsYwXGSMBn0sRR9IYup35XYNQkvA6DLQV1lwLc4XuAo0BlJYAfI75R4
O5LwTWuT-
```

uaft0DEQeuV_f3rKvkrcBkalcpWnyXVLeLyjMz5CqpZ1aSCy1MgVAzWxGb-GX3eQb0F5qOksANddV_vhz1Ai4RgptuAfB8mVyuz0nWZzpmwam34lc4NL4tfyWGncKz2taMyGfsK4Mrn0zfPlY9_n9FP0lMlAX0IQ8TfbVp4B1vbwnA-RVJq8mxoTjgMgqhKhp6NQY_8gZULkbqqA0pqUMvfL3_fZC1PFipLNjCyCGe9YOaU9L7QF4CXeKsRhJXmI898FhpxB1oI7z0xvndsDLPRsqbNuse_eGL9tz0Te5HLGhtoXSn5O8pHC99_XHYofrlismcByzZlmVqVkCNfmbnMjaD9IQf6xAACyjkQ927AOvyDVCZKr-tV6wRZyv_z7Z1J9AG7SGSLoB34AkMytkYXvpgGn21pGFNhvl3YSmyKYc2XJs89zHbp5fSyXsfasogSEYLbpxCmuvzZKO4haaqouKDcLwBGMFp_Br095f-AlhhWOdPDx1ezvTMx1NgS4QO97OmbyQCqHUFWWZLYNgjQ8zpfdBXB17L_v_lfmrUWhUiUVc9tRcJy-lpchFJe8Gz7TUOKCRDjbIWtiqXryDeENrJgQ31laXp-VVYpOI1L55pek2fgk5OCGNzVges5oG4PpMyCIXtJpv32E5rlPTktG4hD8eXmYQECVU1HvSmEiKvuY6T6i9wdpqg_AnycRzUXmYdahFT3W7zToIn2RXzNfdOU0zbYBvtJ70TpR4PjfU75lJ0FsnphDuCnero3UYOak7vYvGYD9YV2md5v-3AmP-eOor2m55JZRH_Hxpn28x-nDNCOHqVBC6leYuYFBVV_vL5l-E8n92uWUqwMEzdZPZtAyRaCfz3D2Y0IYn-ZrnfNTg2M_zVJePmUu1xdjYh7d1dx7nwclm7wJrBPb3JnX2kvEGYs9SM17MlwzoY1VJq4UzJ2D6oEvhQwHvG4e1etlS6iLWzhy8RVMfBlTa4DPDOHmTlHhsKbn0UaMyFFCppe79rtIVRctcomnVmQysUwUOhjzlAq30-hXJCTqdCWJe2xnxjAuUHVqHSiHiZllZaoOWNCV5Ypx_eqzn-KyZS3u-2_hGLHHNA2AVBWn_hF3Gz16dw6zA4QSmWZSfDUcNObLJGOSTaDS3Z8jPTloYPFmu8oES6TL1dLlEK5YhcSGaX4iv6o95drsZGb6bBcWgT7sNFHW6dVE9wdjoDFuBergPIAm0sKaZQ2Ex6j15OWCbE6UaPg-VNfziA2FEPpJaI9hEPI2gdaSuHqovlEOt5mjuFBBOxpK0t8kOZRtsVzqUuJw3VcLjaP6SfG_KZfgX_g8TPs6CcFhlLRz63oXMQFPW6AA7eudWfygndazedq5B-6DqSkOT04GTUJNqLcElg6KEEWqxd88BzoQoK28jrAf-xWHNIZv5HmQQYEnyX0U_cW8HX-hde54TuY_fY3e5QYu4be-JxTkA4JxWLEagSa7-zs" charset="UTF-8"></script><script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<link href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Merriweather' rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Josefin Sans' rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Montserrat' rel='stylesheet'>
<link href="{{ url_for('static', filename='css/final.css') }}" rel="stylesheet">
<style>
.header {
top:0;
margin:0px;
left: 0px;
right: 0px;
position: fixed;
background-color: #28272c;
color: white;
box-shadow: 0px 8px 4px grey;
overflow: hidden;
padding-left:20px;
font-family: 'Josefin Sans';
font-size: 2vw;
width: 100%;
height:8%;
text-align: center;
}
.topnav {
overflow: hidden;
background-color: #333;
}

```
.topnav-right a {
float: left;
color: #f2f2f2;
text-align: center;
padding: 14px 16px;
text-decoration: none;
font-size: 18px;
}
.topnav-right a:hover {
background-color: #ddd;
color: black;
}
.topnav-right a.active {
background-color: #565961;
color: white;
}
.topnav-right {
float: right;
padding-right:100px;
}
.login{
margin-top:-70px;
}
body {
background-color:#ffffff;
background-repeat: no-repeat;
background-size:cover;
background-position: 0px 0px;
}
.login{
margin-top:100px;
}
.container {
margin-top:40px;
padding: 16px;
}
select {
width: 100%;
margin-bottom: 10px;
background: rgba(255,255,255,255);
border: none;
outline: none;
padding: 10px;
font-size: 13px;
color: #000000;
text-shadow: 1px 1px 1px rgba(0,0,0,0.3);
border: 1px solid rgba(0,0,0,0.3);
border-radius: 4px;
box-shadow: inset 0 -5px 45px rgba(100,100,100,0.2), 0 1px 1px rgba(255,255,255,0.2);
-webkit-transition: box-shadow .5s ease;
```

```
-moz-transition: box-shadow .5s ease;
-o-transition: box-shadow .5s ease;
-ms-transition: box-shadow .5s ease;
transition: box-shadow .5s ease;
}
</style>
</head>
<body style="font-family:Montserrat;overflow:scroll;">
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:white; padding-top:1%">Plant Disease
Prediction</div>
<div class="topnav-right" style="padding-top:0.5%;">
</div>
</div>
<div class="container">
<div id="content" style="margin-top:2em">
<div class="container">
<div class="row">
<div class="col-sm-6 bd" >
<br>
<img src="{{url_for('static',filename='images/789.jpg')}}" style="height:450px;width:550px"class="img-rounded"
alt="Gesture">
</div>
<div class="col-sm-6">
<div>
<h4>Drop in the image to get the prediction </h4>
<form action = "" id="upload-file" method="post" enctype="multipart/form-data">
<select name="plant">
<option value="select" selected>Select plant type</option>
<option value="fruit">Fruit</option>
<option value="vegetable">Vegetable</option>
</select><br>
<label for="imageUpload" class="upload-label" style="background: #28272c;">
Choose...
</label>
<input type="file" name="image" id="imageUpload" accept=".png, .jpg, .jpeg">
</form>
<div class="image-section" style="display:none;">
<div class="img-preview">
<div id="imagePreview">
</div>
</div>
<div>
```

```
<button type="button" class="btn btn-info btn-lg " id="btn-predict" style="background:
#28272c;">Predict!</button>
</div>
</div>
<div class="loader" style="display:none;"></div>
<h3>
<span id="result" style="font-size:17px; "> </span>
</h3>
</div>
</div>
</div>
</div>
</div>
</div>
</body>
<footer>
<script src="{{ url_for('static', filename='js/main.js') }}" type="text/javascript"></script>
</footer>
</html>
```

main.js:

```
$(document).ready(function () {
// Init
$('.image-section').hide();
$('.loader').hide();
$('#result').hide();
// Upload Preview
function readURL(input) {
if (input.files && input.files[0]) {
var reader = new FileReader();
reader.onload = function (e) {
$('#imagePreview').css('background-image', 'url(' + e.target.result + ')');
$('#imagePreview').hide();
$('#imagePreview').fadeIn(650);
}
reader.readAsDataURL(input.files[0]);
}
}
$("#imageUpload").change(function () {
$('.image-section').show();
$('#btn-predict').show();
$('#result').text('');
$('#result').hide();
readURL(this);
});
// Predict
$('#btn-predict').click(function () {
var form_data = new FormData($('#upload-file')[0]);
// Show loading animation
$(this).hide();
```

```
$('.loader').show();
// Make prediction by calling api /predict
$.ajax({
type: 'POST',
url: '/predict',
data: form_data,
contentType: false,
cache: false,
processData: false,
async: true,
success: function (data) {
// Get and display the result
$('.loader').hide();
$('#result').fadeIn(600);
$('#result').text('Prediction: '+data);
console.log('Success!');
},
});
});
});
```

Final.css:

```
.img-preview {
width: 256px;
height: 256px;
position: relative;
border: 5px solid #F8F8F8;
box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
margin-top: 1em;
margin-bottom: 1em;
}
.img-preview>div {
width: 100%;
height: 100%;
background-size: 256px 256px;
background-repeat: no-repeat;
background-position: center;
}
input[type="file"] {
display: none;
}
.upload-label{
display: inline-block;
padding: 12px 30px;
background: #28272c;
color: #fff;
font-size: 1em;
transition: all .4s;
cursor: pointer;
}
```

```
.upload-label:hover{
background: #C2C5A8;
color: #39D2B4;
}
.loader {
border: 8px solid #f3f3f3; /* Light grey */
border-top: 8px solid #28272c; /* Blue */
border-radius: 50%;
width: 50px;
height: 50px;
animation: spin 1s linear infinite;
}
@keyframes spin {
0% { transform: rotate(0deg); }
100% { transform: rotate(360deg); }
}
```

Python – app.py:

```
import os
import numpy as np
import pandas as pd
from tensorflow.keras.models import load_model
# from tensorflow.keras.preprocessing import image
from werkzeug.utils import secure_filename
from flask import Flask, render_template, request
app = Flask(__name__)
#load both the vegetable and fruit models
model = load_model("vegetable.h5")
model1=load_model("fruit.h5")
#home page
@app.route('/')
def home():
return render_template('home.html')
#prediction page
@app.route('/prediction')
def prediction():
return render_template('predict.html')
@app.route('/predict',methods=['POST'])
def predict():
if request.method == 'POST':
# Get the file from post request
f = request.files['image']
# Save the file to ./uploads
basepath = os.path.dirname(__file__)
file_path = os.path.join(
```

```
basepath, 'uploads', secure_filename(f.filename))
f.save(file_path)
img = image.load_img(file_path, target_size=(128, 128))
x = image.img_to_array(img)
x = np.expand_dims(x, axis=0)
plant=request.form['plant']
print(plant)
if(plant=="vegetable"):
preds = model.predict(x)
preds=np.argmax(preds)
print(preds)
df=pd.read_excel('precautions - veg.xlsx')
print(df.iloc[preds]['caution'])
else:
preds = model1.predict(x)
preds=np.argmax(preds)
df=pd.read_excel('precautions - fruits.xlsx')
print(df.iloc[preds]['caution'])
return df.iloc[preds]['caution']
if __name__ == "__main__":
app.run(debug=False)
```

DEPLOYMENT MODEL CODE:

Fruit model:

```
ls
sample_data/
pwd
'/home/wsuser/work'
!pip install keras==2.7.0
!pip install tensorflow==2.5.0
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab wheels/public/simple/
Requirement already satisfied: keras==2.7.0 in /usr/local/lib/python3.7/dist-packages (2.7.0)
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab wheels/public/simple/
Requirement already satisfied: tensorflow==2.5.0 in /usr/local/lib/python3.7/dist-packages (2.5.0)
Requirement already satisfied: h5py~=3.1.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (3.1.0)
Requirement already satisfied: protobuf>=3.9.2 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (3.19.6)
Requirement already satisfied: typing-extensions~=3.7.4 in /usr/local/lib/python3.7/dist packages
(from tensorflow==2.5.0) (3.7.4.3)
```

Requirement already satisfied: keras-nightly~=2.5.0.dev in /usr/local/lib/python3.7/dist packages (from tensorflow==2.5.0) (2.5.0.dev2021032900)
Requirement already satisfied: flatbuffers~=1.12.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.12)
Requirement already satisfied: gast==0.4.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (0.4.0)
Requirement already satisfied: absl-py~=0.10 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (0.15.0)
Requirement already satisfied: astunparse~=1.6.3 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.6.3)
Requirement already satisfied: tensorflow-estimator<2.6.0,>=2.5.0rc0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (2.5.0) Requirement already satisfied: tensorboard~=2.5 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (2.9.1)
Requirement already satisfied: opt-einsum~=3.3.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (3.3.0)
Requirement already satisfied: six~=1.15.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.15.0)
Requirement already satisfied: google-pasta~=0.2 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (0.2.0)
Requirement already satisfied: grpcio~=1.34.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.34.1)
Requirement already satisfied: wrapt~=1.12.1 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.12.1)
Requirement already satisfied: termcolor~=1.1.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.1.0)
Requirement already satisfied: keras-preprocessing~=1.1.2 in /usr/local/lib/python3.7/dist packages (from tensorflow==2.5.0) (1.1.2)
Requirement already satisfied: wheel~=0.35 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (0.38.3)
Requirement already satisfied: numpy~=1.19.2 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (1.19.5)
Requirement already satisfied: cached-property in /usr/local/lib/python3.7/dist-packages (from h5py~=3.1.0->tensorflow==2.5.0) (1.5.2)
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.7/dist packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.14.1)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.6.1) Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (1.8.1)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.4.6)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (1.0.1)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (3.4.1)

Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.7/dist packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.23.0)
Requirement already satisfied: setuptools>=41.0.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (57.4.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.7/dist-packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (4.9) Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.7/dist packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (0.2.8) Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.7/dist packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (5.2.0) Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.7/dist packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5->tensorflow==2.5.0) (1.3.1)
Requirement already satisfied: importlib-metadata>=4.4 in /usr/local/lib/python3.7/dist packages (from markdown>=2.6.8->tensorboard~=2.5->tensorflow==2.5.0) (4.13.0) Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.4->markdown>=2.6.8->tensorboard~=2.5->tensorflow==2.5.0) (3.10.0)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.7/dist packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard~=2.5- >tensorflow==2.5.0) (0.4.8)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (1.24.3)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2.10)
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (3.0.4) Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2022.9.24) Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5- >tensorflow==2.5.0) (3.2.2)

Image Augmentation

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,v
ertical_flip=False)
test_datagen=ImageDataGenerator(rescale=1./255)
ls
pwd
/content
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3
def __iter__(self): return 0
```

```
# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your crede ntials.
# You might want to remove those credentials before you share the notebook.
client_4ff9f1114db24196a9abd4f5c1f0b60a = ibm_boto3.client(service_name='s3',
ibm_api_key_id='j4lNXssktSSxQiDx3pbNR_eFi1SMCDE6MFnBQ_EmNCDM',
ibm_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')
streaming_body_1 = client_4ff9f1114db24196a9abd4f5c1f0b60a.get_object(Bucket='trainm odel-
donotdelete-pr-cbqe37eh8gzesa', Key='fruit-dataset.zip')['Body']
# Your data file was loaded into a botocore.response.StreamingBody object. # Please read the
documentation of ibm_boto3 and pandas to learn more about the possibil ities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/ # pandas documentation:
http://pandas.pydata.org/
from io import BytesIO
import zipfile
unzip = zipfile.ZipFile(BytesIO(streaming_body_1.read()), "r")
file_paths = unzip.namelist()
for path in file_paths:
unzip.extract(path)
pwd
'/home/wsuser/work'
import os
filenames = os.listdir('/home/wsuser/work/fruit-dataset/train')
x_train=train_datagen.flow_from_directory("/home/wsuser/work/fruit
dataset/train",target_size=(128,128),class_mode='categorical',batch_size=24) Found 5384 images
belonging to 6 classes.
x_test=test_datagen.flow_from_directory(r"/home/wsuser/work/fruit
dataset/test",target_size=(128,128),
class_mode='categorical',batch_size=24)
Found 1686 images belonging to 6 classes.
x_train.class_indices
{'Apple___Black_rot': 0, 'Apple___healthy': 1, 'Corn_(maize)___Northern_Leaf_Blight': 2,
'Corn_(maize)___healthy': 3, 'Peach___Bacterial_spot': 4, 'Peach___healthy': 5}
```

CNN

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.summary()
Model: "sequential_1"
```

_____ Layer (type)
Output Shape Param #
==========
conv2d_1 (Conv2D) (None, 126, 126, 32) 896
max_pooling2d (MaxPooling2D (None, 63, 63, 32) 0
)
flatten (Flatten) (None, 127008) 0
========== Total
params: 896
Trainable params: 896
Non-trainable params: 0
32*(3*3*3+1)
896
#Hidden Layers
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))

Output Layers

model.add(Dense(6,activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy']) len(x_train)
225
1238/24
51.583333333333336
model.fit_generator(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validatio
n_steps=len(x_test),epochs=10)
/tmp/wsuser/ipykernel_164/1582812018.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 [==========] - 118s 520ms/step - loss: 0.8920 - accuracy:
0.8094 - val_loss: 0.2273 - val_accuracy: 0.9235
Epoch 2/10
225/225 [==========] - 116s 515ms/step - loss: 0.2367 - accuracy:
0.9179 - val_loss: 0.2056 - val_accuracy: 0.9324
Epoch 3/10
225/225 [==========] - 116s 517ms/step - loss: 0.1970 - accuracy:
0.9337 - val_loss: 0.4972 - val_accuracy: 0.8754
Epoch 4/10

225/225 [==============================] - 117s 521ms/step - loss: 0.1688 - accuracy: 0.9422 - val_loss: 0.2279 - val_accuracy: 0.9217
Epoch 5/10
225/225 [==============================] - 116s 516ms/step - loss: 0.1438 - accuracy: 0.9487 - val_loss: 0.1685 - val_accuracy: 0.9484
Epoch 6/10
225/225 [==============================] - 117s 518ms/step - loss: 0.1362 - accuracy: 0.9556 - val_loss: 0.1176 - val_accuracy: 0.9662
Epoch 7/10
225/225 [==============================] - 116s 515ms/step - loss: 0.1282 - accuracy: 0.9590 - val_loss: 0.5466 - val_accuracy: 0.8387
Epoch 8/10
225/225 [==============================] - 116s 514ms/step - loss: 0.1282 - accuracy: 0.9597 - val_loss: 0.1194 - val_accuracy: 0.9620
Epoch 9/10
225/225 [==============================] - 116s 514ms/step - loss: 0.1141 - accuracy: 0.9616 - val_loss: 0.1478 - val_accuracy: 0.9508
Epoch 10/10
225/225 [==============================] - 116s 516ms/step - loss: 0.0927 - accuracy: 0.9695 - val_loss: 0.0772 - val_accuracy: 0.9751
<keras.callbacks.History at 0x7f71e8184070>

Saving Model

ls
fruit-dataset/
model.save('fruit.h5')
!tar -zcvf Train-model_new.tgz fruit.h5
fruit.h5
ls -1
fruit-dataset/
fruit.h5
Train-model_new.tgz

IBM Cloud Deployment Model

!pip install watson-machine-learning-client –upgrade
Collecting watson-machine-learning-client
Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)
|[redacted]| 538 kB 21.2 MB/s eta 0:00:01
Requirement already satisfied: tqdm in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (4.62.3)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (2022.9.24)

Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (2.26.0)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (0.8.9)
Requirement already satisfied: ibm-cos-sdk in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.11.0) Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.3.4)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (0.3.3)
Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.18.21)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.26.7)
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.10.0) Requirement already satisfied: s3transfer<0.6.0,>=0.5.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.5.0) Requirement already satisfied: botocore<1.22.0,>=1.21.21 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (1.21.41) Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->boto3->watson machine-learning-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=1.21.21->boto3->watson machine-learning-client) (1.15.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (3.3) Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (2021.3) Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (1.19.5) Installing collected packages: watson-machine-learning-client
Successfully installed watson-machine-learning-client-1.0.391

```
from ibm_watson_machine_learning import APIClient
wml_credentials = {
"url": "https://us-south.ml.cloud.ibm.com",
"apikey":"0P3XkyCFYqABnc48BNG2ReoGAJy-oDXDRuULl4Y_zFxa"
}
client = APIClient(wml_credentials)
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)['m
etadata']['id'])
space_uid = guid_from_space_name(client, 'Trainmodel')
print("Space UID = " + space_uid)
Space UID = 616c7d74-e99b-4c09-9922-27394a62c2d0
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 020d69ce-
7ac1-5e68-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-4f24-8ae9-62dcc2148306 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-
a4d6-bf776828c4b7 base runtime-22.1-py3.9 12b83a17-24d8-5082-900f-0ab31fbfd3cb 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-cc97-56da-b8e0-39c3880dbbe7 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-d6ed-5dde-b6a5-
3fbdf1665666 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 2b7961e2-e3b1-5a8c-a491-482c8368839a base
pytorch_1.2-py3.6 2c8ef57d-2687-4b7d-acce-01f94976dac1 base spark-mllib_2.3 2e51f700-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 xgboost_0.82-py3.6 39e31acd-5f30-41dc-
ae44-60233c80306e base pytorch-onnx_1.2-py3.6-edt 40589d0e-7019-4e28-8daa-fb03b6f4fe12 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 55a70f99-7320-4be5-9fb9-9edb5a443af5 base spark-mllib_3.0 5c1b0ca2-4977-
5c2e-9439-ffd44ea8ffe9 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 spark-mllib_2.3-r_3.6 6586b9e3-ccd6-4f92-900f-0f8cb2bd6f0c base tensorflow_2.4-py3.7 65e171d7-72d1-55d9-8ebb-f813d620c9bb base spss-modeler_18.2 687eddc9-028a-4117-b9dd-e57b36f1efa5 base ---------- ---------- ----
Note: Only first 50 records were displayed. To display more use 'limit' parameter.
software_space_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1- py3.9")
software_spec_uid
‘1eb25b84-d6ed-5dde-b6a5-3fbdf1665666'
ls
fruit-dataset/ fruit.h5 Train-model_new.tgz
model_details = client.repository.store_model(model= 'Train-model_new.tgz', meta_props={
client.repository.ModelMetaNames.NAME:"CNN",
client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid})
model_id = client.repository.get_model_id(model_details)
model_id
'd0aeb6a2-e89c-4f8d-bf2f-a28ca4ea3cca'
ls
fruit-dataset/ fruit.h5 Train-model_new.tgz
Test The Model
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model=load_model('fruit.h5')
#@title
img=image.load_img(r"C:\Users\LENOVO\Desktop\fruit-dataset\fruit dataset\test\00fca0da-2db3-481b-b98a
9b67bb7b105c___RS_HL 7708.JPG",target_size=(128,128))
Img

img=image.load_img(r"C:\Users\LENOVO\Desktop\ibm\Dataset Plant Disease\fruit dataset\fruit-dataset\test\Apple___healthy\0adc1c5b-8958-47c0-a152- f28078c214f1___RS_HL 7825.JPG",target_size=(128,128))
img
x=image.img_to_array(img)
X
array([[[99., 86., 106.],
[101., 88., 108.],
[118., 105., 125.],

...,
[92., 83., 102.],
[93., 84., 103.],
[89., 80., 99.]],
[[96., 83., 103.],
[87., 74., 94.],
[102., 89., 109.],
...,
[88., 79., 98.],
[89., 80., 99.],
[83., 74., 93.]],
[[86., 73., 93.],
[88., 75., 95.],
[98., 85., 105.],
...,
[107., 98., 117.],
[96., 87., 106.],
[96., 87., 106.]],
...,
[[172., 175., 194.],
[173., 176., 195.],
[175., 178., 197.],
...,
[179., 180., 198.],
[184., 185., 203.],
[179., 180., 198.]],
[[172., 175., 194.],
[170., 173., 192.],
[173., 176., 195.],
...,
[178., 179., 197.],
[182., 183., 201.],
[178., 179., 197.]],
[[169., 172., 191.],
[166., 169., 188.],
[168., 171., 190.],
...,
[187., 188., 206.],
[185., 186., 204.],
[186., 187., 205.]]], dtype=float32) x=np.expand_dims(x,axis=0)
X
array([[[[99., 86., 106.],
[101., 88., 108.],
[118., 105., 125.],
...,
[92., 83., 102.],

```
[ 93., 84., 103.],
[ 89., 80., 99.]],
[[ 96., 83., 103.],
[ 87., 74., 94.],
[102., 89., 109.],
...,
[ 88., 79., 98.],
[ 89., 80., 99.],
[ 83., 74., 93.]],
[[ 86., 73., 93.],
[ 88., 75., 95.],
[ 98., 85., 105.],
...,
[107., 98., 117.],
[ 96., 87., 106.],
[ 96., 87., 106.]],
...,
[[172., 175., 194.],
[173., 176., 195.],
[175., 178., 197.],
...,
[179., 180., 198.],
[184., 185., 203.],
[179., 180., 198.]],
[[172., 175., 194.],
[170., 173., 192.],
[173., 176., 195.],
...,
[178., 179., 197.],
[182., 183., 201.],
[178., 179., 197.]],
[[169., 172., 191.],
[166., 169., 188.],
[168., 171., 190.],
...,
[187., 188., 206.],
[185., 186., 204.],
[186., 187., 205.]]]], dtype=float32)
y=np.argmax(model.predict(x),axis=1)
1/1 [==============================] - 0s 105ms/step
x_train.class_indices
{'Apple___Black_rot': 0, 'Apple___healthy': 1, 'Corn_(maize)___Northern_Leaf_Blight': 2,
'Corn_(maize)___healthy': 3, 'Peach___Bacterial_spot': 4, 'Peach___healthy': 5}
index=['Apple___Black_rot','Apple___healthy','Corn_(maize)___Northern_Leaf_Blight','Corn
_(maize)___healthy','Peach___Bacterial_spot','Peach___healthy']
index[y[0]]
```

'Apple___healthy'
img=image.load_img(r"C:\LENOVO\Desktop\ibm\Dataset Plant Disease\fruit-dataset\fruit dataset\test\Peach___healthy\0a2ed402-5d23-4e8d-bc98-b264aea9c3fb___Rutg._HL 2471.JPG",target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['Apple___Black_rot','Apple___healthy"Peach___Bacterial_spot','Peach___healthy']
index[y[0]]
1/1 [==============================] - 0s 26ms/step
'Peach___healthy'
import os
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask,render_template,request
app=Flask(__name__)
model=load_model("fruit.h5")
@app.route('/')
def index():
return render_template("index.html")
@app.route('/predict',methods=['GET','POST'])
def upload():
if request.method=='POST':
f=request.files['image']
basepath=os.path.dirname('__file__')
filepath=os.path.join(basepath,'uploads',f.filename)
f.save(filepath)
img=image.load_img(filepath,target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred=np.argmax(model.predict(x),axis=1)
index=['Apple___Black_rot','Apple___healthy',
,'Peach___Bacterial_spot','Peach___healthy']
text="The Classified Fruit disease is : " +str(index[pred[0]])
return text
if __name__=='__main__':
app.run(debug=False)

vegetable model :

ls
sample_data/
pwd
'/home/wsuser/work'
!pip install keras==2.7.0

```
!pip install tensorflow==2.5.0
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab wheels/public/simple/
Requirement already satisfied: keras==2.7.0 in /usr/local/lib/python3.7/dist-packages (2.7.0)
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab wheels/public/simple/
Requirement already satisfied: tensorflow==2.5.0 in /usr/local/lib/python3.7/dist-packages (2.5.0)
Requirement already satisfied: h5py~=3.1.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (3.1.0)
Requirement already satisfied: protobuf>=3.9.2 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (3.19.6)
Requirement already satisfied: typing-extensions~=3.7.4 in /usr/local/lib/python3.7/dist packages
(from tensorflow==2.5.0) (3.7.4.3)
Requirement already satisfied: keras-nightly~=2.5.0.dev in /usr/local/lib/python3.7/dist packages
(from tensorflow==2.5.0) (2.5.0.dev2021032900)
Requirement already satisfied: flatbuffers~=1.12.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.12)
Requirement already satisfied: gast==0.4.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (0.4.0)
Requirement already satisfied: absl-py~=0.10 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (0.15.0)
Requirement already satisfied: astunparse~=1.6.3 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.6.3)
Requirement already satisfied: tensorflow-estimator<2.6.0,>=2.5.0rc0 in
/usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0) (2.5.0) Requirement already
satisfied: tensorboard~=2.5 in /usr/local/lib/python3.7/dist-packages (from tensorflow==2.5.0)
(2.9.1)
Requirement already satisfied: opt-einsum~=3.3.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (3.3.0)
Requirement already satisfied: six~=1.15.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.15.0)
Requirement already satisfied: google-pasta~=0.2 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (0.2.0)
Requirement already satisfied: grpcio~=1.34.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.34.1)
Requirement already satisfied: wrapt~=1.12.1 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.12.1)
Requirement already satisfied: termcolor~=1.1.0 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.1.0)
Requirement already satisfied: keras-preprocessing~=1.1.2 in /usr/local/lib/python3.7/dist packages
(from tensorflow==2.5.0) (1.1.2)
Requirement already satisfied: wheel~=0.35 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (0.38.3)
Requirement already satisfied: numpy~=1.19.2 in /usr/local/lib/python3.7/dist-packages (from
tensorflow==2.5.0) (1.19.5)
```

Requirement already satisfied: cached-property in /usr/local/lib/python3.7/dist-packages (from h5py~=3.1.0->tensorflow==2.5.0) (1.5.2)
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.7/dist packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.14.1)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.6.1) Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in
/usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (1.8.1)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in
/usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.4.6)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (1.0.1)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (3.4.1)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.7/dist packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.23.0)
Requirement already satisfied: setuptools>=41.0.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard~=2.5->tensorflow==2.5.0) (57.4.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.7/dist-packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (4.9) Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.7/dist packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (0.2.8) Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.7/dist packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (5.2.0) Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.7/dist packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5->tensorflow==2.5.0) (1.3.1)
Requirement already satisfied: importlib-metadata>=4.4 in /usr/local/lib/python3.7/dist packages (from markdown>=2.6.8->tensorboard~=2.5->tensorflow==2.5.0) (4.13.0) Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.4->markdown>=2.6.8->tensorboard~=2.5->tensorflow==2.5.0) (3.10.0)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.7/dist packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard~=2.5- >tensorflow==2.5.0) (0.4.8)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
/usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (1.24.3)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2.10)
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (3.0.4) Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2022.9.24) Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5- >tensorflow==2.5.0) (3.2.2)

Image Augmentation

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,v
ertical_flip=False)
test_datagen=ImageDataGenerator(rescale=1./255)
ls
pwd
/content
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3
def __iter__(self): return 0
# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your crede ntials.
# You might want to remove those credentials before you share the notebook.
client_4ff9f1114db24196a9abd4f5c1f0b60a = ibm_boto3.client(service_name='s3',
ibm_api_key_id='j4lNXssktSSxQiDx3pbNR_eFi1SMCDE6MFnBQ_EmNCDM',
ibm_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')
streaming_body_1 = client_4ff9f1114db24196a9abd4f5c1f0b60a.get_object(Bucket='trainm odel-
donotdelete-pr-cbqe37eh8gzesa', Key='vegetable-dataset.zip')['Body']
# Your data file was loaded into a botocore.response.StreamingBody object. # Please read the
documentation of ibm_boto3 and pandas to learn more about the possibil ities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/ # pandas documentation:
http://pandas.pydata.org/
from io import BytesIO
import zipfile
unzip = zipfile.ZipFile(BytesIO(streaming_body_1.read()), "r")
file_paths = unzip.namelist()
for path in file_paths:
unzip.extract(path)
pwd
'/home/wsuser/work'
import os
filenames = os.listdir('/home/wsuser/work/vegetable-dataset/train')
x_train=train_datagen.flow_from_directory("/home/wsuser/work/vegetable
dataset/train",target_size=(128,128),class_mode='categorical',batch_size=24) Found 5384 images
belonging to 6 classes.
x_test=test_datagen.flow_from_directory(r"/home/wsuser/work/vegetable
dataset/test",target_size=(128,128),
class_mode='categorical',batch_size=24)
Found 1686 images belonging to 6 classes.
x_train.class_indices
```

{'Tomato___Blight': 0, 'Tomato___healthy': 1, 'Corn_(maize)___Northern_Leaf_Blight': 2, 'Corn_(maize)___healthy': 3, 'Potato___Blight': 4, 'Potato___healthy': 5}

CNN

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.summary()
```

Model: "sequential_1"

_____ Layer (type) Output Shape Param #

==========

conv2d_1 (Conv2D) (None, 126, 126, 32) 896

max_pooling2d (MaxPooling2D (None, 63, 63, 32) 0

)

flatten (Flatten) (None, 127008) 0

========== Total params: 896

Trainable params: 896

Non-trainable params: 0

```
32*(3*3*3+1)
```

896

#Hidden Layers

```
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
```

Output Layers

```
model.add(Dense(6,activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy']) len(x_train)
```

225

```
1238/24
```

51.583333333333336

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

/tmp/wsuser/ipykernel_164/1582812018.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 [==============================] - 118s 520ms/step - loss: 0.8920 - accuracy: 0.8094 - val_loss: 0.2273 - val_accuracy: 0.9235
Epoch 2/10
225/225 [==============================] - 116s 515ms/step - loss: 0.2367 - accuracy: 0.9179 - val_loss: 0.2056 - val_accuracy: 0.9324
Epoch 3/10
225/225 [==============================] - 116s 517ms/step - loss: 0.1970 - accuracy: 0.9337 - val_loss: 0.4972 - val_accuracy: 0.8754
Epoch 4/10
225/225 [==============================] - 117s 521ms/step - loss: 0.1688 - accuracy: 0.9422 - val_loss: 0.2279 - val_accuracy: 0.9217
Epoch 5/10
225/225 [==============================] - 116s 516ms/step - loss: 0.1438 - accuracy: 0.9487 - val_loss: 0.1685 - val_accuracy: 0.9484
Epoch 6/10
225/225 [==============================] - 117s 518ms/step - loss: 0.1362 - accuracy: 0.9556 - val_loss: 0.1176 - val_accuracy: 0.9662
Epoch 7/10
225/225 [==============================] - 116s 515ms/step - loss: 0.1282 - accuracy: 0.9590 - val_loss: 0.5466 - val_accuracy: 0.8387
Epoch 8/10
225/225 [==============================] - 116s 514ms/step - loss: 0.1282 - accuracy: 0.9597 - val_loss: 0.1194 - val_accuracy: 0.9620
Epoch 9/10
225/225 [==============================] - 116s 514ms/step - loss: 0.1141 - accuracy: 0.9616 - val_loss: 0.1478 - val_accuracy: 0.9508
Epoch 10/10
225/225 [==============================] - 116s 516ms/step - loss: 0.0927 - accuracy: 0.9695 - val_loss: 0.0772 - val_accuracy: 0.9751
<keras.callbacks.History at 0x7f71e8184070>

Saving Model

ls
vegetable-dataset/
model.save('vegetable.h5')
!tar -zcvf Train-model_new.tgz vegetable.h5
vegetable.h5

ls -1
vegetable-dataset/
vegetable.h5
Train-model_new.tgz

IBM Cloud Deployment Model

!pip install watson-machine-learning-client –upgrade
Collecting watson-machine-learning-client
Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)
|████████████████████████████████| 538 kB 21.2 MB/s eta 0:00:01
Requirement already satisfied: tqdm in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (4.62.3)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (2022.9.24)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (2.26.0)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (0.8.9)
Requirement already satisfied: ibm-cos-sdk in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.11.0) Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.3.4)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (0.3.3)
Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.18.21)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from watson-machine-learning-client) (1.26.7)
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.10.0) Requirement already satisfied: s3transfer<0.6.0,>=0.5.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.5.0) Requirement already satisfied: botocore<1.22.0,>=1.21.21 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (1.21.41) Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->boto3->watson machine-learning-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=1.21.21->boto3->watson machine-learning-client) (1.15.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)

Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (3.3) Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (2021.3) Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python 3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (1.19.5) Installing collected packages: watson-machine-learning-client
Successfully installed watson-machine-learning-client-1.0.391
from ibm_watson_machine_learning import APIClient
wml_credentials = {
"url": "https://us-south.ml.cloud.ibm.com",
"apikey":"0P3XkyCFYqABnc48BNG2ReoGAJy-oDXDRuULl4Y_zFxa"
}
client = APIClient(wml_credentials)
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)['m
etadata']['id'])
space_uid = guid_from_space_name(client, 'Trainmodel')
print("Space UID = " + space_uid)
Space UID = 616c7d74-e99b-4c09-9922-27394a62c2d0
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 020d69ce-7ac1-5e68-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-4f24-8ae9-62dcc2148306 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-a4d6-bf776828c4b7 base runtime-22.1-py3.9 12b83a17-24d8-5082-900f-0ab31fbfd3cb 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-cc97-56da-b8e0-39c3880dbbe7 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-d6ed-5dde-b6a5-3fbdf1665666 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 2b7961e2-e3b1-5a8c-a491-482c8368839a base

pytorch_1.2-py3.6 2c8ef57d-2687-4b7d-acce-01f94976dac1 base spark-mllib_2.3 2e51f700-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 xgboost_0.82-py3.6 39e31acd-5f30-41dc-ae44-60233c80306e base pytorch-onnx_1.2-py3.6-edt 40589d0e-7019-4e28-8daa-fb03b6f4fe12 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 55a70f99-7320-4be5-9fb9-9edb5a443af5 base spark-mllib_3.0 5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9 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 spark-mllib_2.3-r_3.6 6586b9e3-ccd6-4f92-900f-0f8cb2bd6f0c base tensorflow_2.4-py3.7 65e171d7-72d1-55d9-8ebb-f813d620c9bb base spss-modeler_18.2 687eddc9-028a-4117-b9dd-e57b36f1efa5 base ---------- ---- ---------- ----

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

```
software_space_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1- py3.9")
software_spec_uid
‘1eb25b84-d6ed-5dde-b6a5-3fbdf1665666'
ls
vegetable-dataset/ vegetable.h5 Train-model_new.tgz
model_details = client.repository.store_model(model= 'Train-model_new.tgz', meta_props={
client.repository.ModelMetaNames.NAME:"CNN",
client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid} )
model_id = client.repository.get_model_id(model_details)
model_id
'd0aeb6a2-e89c-4f8d-bf2f-a28ca4ea3cca'
ls
vegetable-dataset/ vegetable.h5 Train-model_new.tgz
Test The Model
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model=load_model('vegetable.h5')
#@title
img=image.load_img(r"C:\Users\LENOVO\Desktop\vegetable-dataset\vegetable
dataset\test\00fca0da-2db3-481b-b98a
9b67bb7b105c___RS_HL 7708.JPG",target_size=(128,128))
Img
```

```
img=image.load_img(r"C:\Users\LENOVO\Desktop\ibm\Dataset Plant Disease\vegetable dataset\vegetable-dataset\test\Tomato___healthy\0adc1c5b-8958-47c0-a152-f28078c214f1___RS_HL 7825.JPG",target_size=(128,128))
img
```

```
x=image.img_to_array(img)
X
array([[[ 99., 86., 106.],
[101., 88., 108.],
[118., 105., 125.],
...,
[ 92., 83., 102.],
[ 93., 84., 103.],
[ 89., 80., 99.]],
[[ 96., 83., 103.],
[ 87., 74., 94.],
[102., 89., 109.],
...,
[ 88., 79., 98.],
[ 89., 80., 99.],
[ 83., 74., 93.]],
[[ 86., 73., 93.],
[ 88., 75., 95.],
[ 98., 85., 105.],
```

...,
[107., 98., 117.],
[96., 87., 106.],
[96., 87., 106.]],
...,
[[172., 175., 194.],
[173., 176., 195.],
[175., 178., 197.],
...,
[179., 180., 198.],
[184., 185., 203.],
[179., 180., 198.]],
[[172., 175., 194.],
[170., 173., 192.],
[173., 176., 195.],
...,
[178., 179., 197.],
[182., 183., 201.],
[178., 179., 197.]],
[[169., 172., 191.],
[166., 169., 188.],
[168., 171., 190.],
...,
[187., 188., 206.],
[185., 186., 204.],
[186., 187., 205.]]], dtype=float32) x=np.expand_dims(x,axis=0)
X
array([[[[99., 86., 106.],
[101., 88., 108.],
[118., 105., 125.],
...,
[92., 83., 102.],
[93., 84., 103.],
[89., 80., 99.]],
[[96., 83., 103.],
[87., 74., 94.],
[102., 89., 109.],
...,
[88., 79., 98.],
[89., 80., 99.],
[83., 74., 93.]],
[[86., 73., 93.],
[88., 75., 95.],
[98., 85., 105.],
...,
[107., 98., 117.],

```
[ 96., 87., 106.],
[ 96., 87., 106.]],
...,
[[172., 175., 194.],
[173., 176., 195.],
[175., 178., 197.],
...,
[179., 180., 198.],
[184., 185., 203.],
[179., 180., 198.]],
[[172., 175., 194.],
[170., 173., 192.],
[173., 176., 195.],
...,
[178., 179., 197.],
[182., 183., 201.],
[178., 179., 197.]],
[[169., 172., 191.],
[166., 169., 188.],
[168., 171., 190.],
...,
[187., 188., 206.],
[185., 186., 204.],
[186., 187., 205.]]], dtype=float32)
y=np.argmax(model.predict(x),axis=1)
1/1 [==============================] - 0s 105ms/step
x_train.class_indices
{'Tomato___Blight': 0, 'Tomato___healthy': 1, 'Corn_(maize)___Northern_Leaf_Blight': 2,
'Corn_(maize)___healthy': 3, 'Potato___Blight': 4, 'Potato___healthy': 5}
index=['Tomato___Blight','Tomato___healthy','Corn_(maize)___Northern_Leaf_Blight','Cor
n_(maize)___healthy','Potato___Blight','Potato___healthy']
index[y[0]]
'Tomato___healthy'
img=image.load_img(r"C:\LENOVO\Desktop\ibm\Dataset Plant Disease\vegetable
dataset\vegetable-dataset\test\Potato___healthy\0a2ed402-5d23-4e8d-bc98-
b264aea9c3fb___Rutg._HL 2471.JPG",target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['Tomato___Blight','Tomato___healthy''Potato___Blight','Potato___healthy'] index[y[0]]
1/1 [==============================] - 0s 26ms/step
'Potato___healthy'
import os
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask,render_template,request
```

```
app=Flask(__name__)
model=load_model("vegetable.h5")
@app.route('/')
def index():
return render_template("index.html")
@app.route('/predict',methods=['GET','POST'])
def upload():
if request.method=='POST':
f=request.files['image']
basepath=os.path.dirname('__file__')
filepath=os.path.join(basepath,'uploads',f.filename)
f.save(filepath)
img=image.load_img(filepath,target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred=np.argmax(model.predict(x),axis=1)
index=['Tomato___Blight','Tomato___healthy', ,'Potato___Blight','Potato___healthy'] text="The
Classified Vegetable disease is : " +str(index[pred[0]]) return text
if __name__=='__main__':
app.run(debug=False)
```

ibmapp.py

```
import requests
from tensorflow.keras.preprocessing import image from tensorflow.keras.models import load_model
import numpy as np
import pandas as pd
import tensorflow as tf
from flask import Flask, request, render_template, redirect, url_for import os
from werkzeug.utils import secure_filename
app = Flask(_name_)
#load both the vegetable and fruit models
model = load_model("IBM-vegetable.h5")
model1=load_model("IBM-fruit.h5")
#home page
@app.route('/')
def home():
return render_template('home.html')
#prediction page
@app.route('/prediction')
def prediction():
return render_template('predict.html')
@app.route('/predict',methods=['POST'])
def predict():
if request.method == 'POST':
# Get the file from post request
f = request.files['image']
```

```
# Save the file to ./uploads
basepath = os.path.dirname(_file_)
file_path = os.path.join(
basepath, 'uploads', secure_filename(f.filename)) f.save(file_path)
img = image.load_img(file_path, target_size=(128, 128))
x = image.img_to_array(img)
x = np.expand_dims(x, axis=0)
plant=request.form['plant']
print(plant)
if(plant=="vegetable"):
preds = model.predict(x)
print(preds)
df=pd.read_excel('precautions - veg.xlsx') print(df.iloc[preds]['caution'])
else:
preds = model1.predict(x)
preds=np.argmax(preds)
df=pd.read_excel('precautions - fruits.xlsx') print(df.iloc[preds]['caution']
return df.iloc[preds]['caution']
if _name_ == "_main_":
    app.run(debug=False)
```

GitHub Link: https://github.com/IBM-EPBL/IBM-Project-48060-1660804159

Final Demo Video Link: https://youtu.be/lBZ0_sT5jB4