“Cropshield using Convolutional Neural Network”

Submitted in partial fulfillment of the requirements of the degree of

BACHELOR OF COMPUTER ENGINEERING

by

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A. P. SHAH INSTITUTE OF TECHNOLOGY, THANE

(2022-2023)

A. P. SHAH INSTITUTE OF TECHNOLOGY, THANE

CERTIFICATE

This is to certify that the Mini Project 2B entitled "**CropShield using Convolutional Neural Networks**" is a bonafide work of **"Janhavi Silaskar (20102029), Chaitali Sule (20102035), Shriya Vidwans (20102033), Srushti Singh (20102186)"** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Engineering.**

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Project Report Approval for Mini Project-2B

This project report entitled "**Cropshield using Convolutional Neural Network**" by ***Janhavi Silaskar, Shriya Vidwans, Chaitali Sule, Srusti Singh*** is approved for the partial fulfillment of the degree of ***Bachelor of Engineering*** in ***Computer Engineering***, ***2022-23***.

Examiner Name	Signature
1.__________________	______________
2.___________________	______________

Date:

Place:

Declaration

We declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Janhavi Silaskar – 20102029

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Date:

Abstract

Agriculture is the most important sector in today's life. The classification and recognition of crop diseases are of major technical and economical importance in the agricultural Industry. To automate these activities, like texture, color and shape, a disease recognition system is feasible. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. The naked eye observation of experts is the main approach adopted in practice for detection of plant diseases. However this requires continuous monitoring of experts which might be prohibitively expensive in large farms 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.There is need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over a large area. 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. The process of this software solution began with data segregation and image augmentation. A suitable model for predicting the disease was trained , tested and deployed. The result is a deep-learning based system that takes an image of leaves as an input from the user and predicts the disease, accordingly recommending a suitable fertilizer as well.

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Chapter 1 Introduction

1.1 Project Overview

Agriculture is the mainstay of the Indian economy. Almost 70% of people depend on it & shares major part of the GDP. Diseases in crops mostly on the leaves effects on the reduction of both quality and quantity of agricultural products. Perception of the human eye is not so much stronger so as to observe minute variation in the infected part of leaf.

Leaves are a delicate part of the plant, The evaluation of agricultural harvest Classification is dynamic. The most important visual property is leaf texture and color. Hence, classification of leaf disease is necessary in evaluating agricultural produce, increasing market value and meeting quality standards. Identifying and taking further dealings for further diffusion of the diseases is also helpful. The process will be too slow. If the identification and categorization is done through physical techniques, we need the experts help sometimes it will be error prone and who are less available. The labor’s classify based on color, size etc. if these quality methods are recorded into automatic system by using appropriate program design language then the effort will be error free and faster.

Thus, an automated system integrated with deep learning techniques has been created that will assist the farmers get the accurate information about their crops using their mobile phone. The uploaded pictures of paddy captured by the mobile phones will be processed in the central server and the analysis report will be presented to an expert group for their opinion, who will then be able to send proper recommendations through a simple notification using the system, according to the severity of the situation.

1.2. Purpose

To Detect and recognize the plant diseases and to recommend fertilizer, it is necessary to provide symptoms in identifying the disease at its earliest. Hence new fertilizers Recommendation System for crop disease prediction has been proposed.

Chapter 2

Literature Survey

1. **Soil Based Fertilizer Recommendation System for Crop Disease Prediction System Dr.P. Pandi Selvi [1], P. Poornima [2], Volume 8 Issue 2, Mar-Apr 202**

The authors of the paper put forward a novel method for predicting fertilizers for soil-based crops. Their system was effective in analyzing the soil's nutrient content, identifying the specific type of leaf disease afflicting the crop, and making accurate fertilizer predictions. This approach was adaptable and could be customized to meet the requirements of individual users more effectively. The authors also tested their method on five distinct crops, and suggest that in the future, it could be expanded to encompass a broader range of crops and analyze their performance more comprehensively.

2. IoT-based Crop Recommendation, Crop Disease Prediction, and its solution, Rani Holambe1, Pooja Patil [2], Padmaja Pawar [3], Saurabh Salunkhe [4], Mr. Hrushikesh Joshi [5] Volume: 07 Issue: 10 | Oct 2020

The proposed system is a smart agriculture system that is automated to help farmers to increase crop production by predicting the crop to be sown. The system used different sensors that measured pH level, soil moisture, temperature, and humidity. Different machine learning algorithms like Decision trees, Random forests, Naïve Bayes, and ANN on the training dataset are used to prepare a training model to recommend the crop. Fosssssr crop disease prediction, it fetches the data from the database for crop disease segmentation by providing an infected crop image. Then on extracted features image processing algorithms will apply and crop disease prediction will be done. For a particular disease, the system will also recommend the best pesticide and fertilizer for soil to increase crop yield.

3. A nutrient recommendation system for soil fertilization based on evolutionary computation, Usman Ahmed [1], Jerry Chun-Wei Lin [2], Gautam Srivastava [3], Youcef Djenouri [4]

This paper develops a model that enables efficient exploration of the correct usage of nutrients for developing a knowledge-based system for the ICT environment. Developing knowledge is then applied directly to the environment, which recommends balancing soil fertility and crop production. The recommended setting also helps to improve crop yield.

4. Fertilizers Recommendation System For Disease Prediction In Tree Leave R. Neela [1] , P. Nithya [2] Volume 8, Issue 11, November 2019

The proposed method uses SVM to classify tree leaves, identify the disease and suggest fertilizer. The proposed method is compared with the existing CNN-based leaf disease prediction. The proposed SVM technique gives a better result when compared to existing CNN. For the same set of images, F-Measure for CNN is 0.7 and 0.8 for SVM, the accuracy of identification of leaf disease of CNN is 0.6 and SVM is 0.8.

5. Farmer's Assistant: A Machine Learning-Based Application for Agricultural Solutions Sholka Gupta [1] , Ashok Jain [2] , Nishit Jain [3] , Aparna Bhonde [4] , Cornell University, April 2022.

In this paper, the proposed system is a user-friendly web application based on machine learning and web-scraping called the 'Farmer's Assistant'. With this system, they are successfully able to provide several features - crop recommendation using the Random Forest algorithm, fertilizer recommendation using a rule-based classification system, and crop disease detection using EfficientNet model on leaf images

6. CROFED - Crop and Fertilizer Recommendation and Disease diagnosis system using Machine Learning and Internet of Things, Taranjeet Singh [1] , Saurabh Anand [2] , Anmol Sehgal [3] , Siddhesh Mahajan [4] , Prof. Pranoti Kavimandan [5] Volume 9 Issue 2

This paper is about CROFED a web application that will help farmers to deal with these problems by providing the following aids: Crop Recommendation system, Fertiliser suggestion system, and Crop Disease Detection System.They have used a machine Learning classification algorithm to predict suitable crops based on the values we get from our device and we will also provide suitable fertilizers required for that land.

7. Plant Disease Detection Using Image Processing Techniques Y.Sanjana[1] , AshwathSivasamy [2] , SriJayanth [2] IJIRSET Vol. 4, Special Issue 6, May 2015

The system consists of a mobile application, which will enable the farmers to take images of plants using their mobile phones and send them to a central server where the central system in the server will analyze the pictures based on visual symptoms using image processing algorithms in order to measure the disease type. An expert group will be available to check the status of the image analysis data and provide suggestions based on the report and their knowledge, which will be sent to the farmer as a notification in the application

8. Leaf Disease Detection Using ImageProcessing IJARIIE Thete Vaishali V. [1] ,

Thakare Pradnya R. [2] , Kadlag Gaurav B. [3] ,Prof. P.A. Chaudhari [4] Vol-3 Issue-2 2017

The study reviews and summarizes image processing techniques for several plant species that have been used for recognizing plant diseases. The major techniques used are K-means clustering, GLCM and BPNN. Some of the challenges in these techniques are optimization of the technique for a specific plant, effect of the background noise in the acquired image and automation technique for a continuous automated monitoring of plant leaf diseases under real world field conditions

Research Paper	Summary
1. Soil Based Fertilizer Recommendation System for Crop Disease Prediction System Dr.P. Pandi Selvi [1], P. Poornima [2], Volume 8 Issue 2, Mar-Apr 202	The authors of the paper put forward a novel method for predicting fertilizers for soil-based crops. Their system was effective in analyzing the soil's nutrient content, identifying the specific type of leaf disease afflicting the crop, and making accurate fertilizer predictions.

2.IoT-based Crop Recommendation, Crop Disease Prediction, and its solution, Rani Holambe1, Pooja Patil [2], Padmaja Pawar [3], Saurabh Salunkhe [4], Mr. Hrushikesh Joshi [5] Volume: 07 Issue: 10 | Oct 2020	The proposed system is a smart agriculture system that is automated to help farmers to increase crop production by predicting the crop to be sown.
3. A nutrient recommendation system for soil fertilization based on evolutionary computation, Usman Ahmed [1], Jerry Chun-Wei Lin [2], Gautam Srivastava [3], Youcef Djenouri [4]	This paper develops a model that enables efficient exploration of the correct usage of nutrients for developing a knowledge-based system for the ICT environment.
4. Fertilizers Recommendation System For Disease Prediction In Tree Leave R. Neela [1] , P. Nithya [2] Volume 8, Issue 11, November 2019	This system recommends the fertilizer for affected leaves based on severity level. Fertilizers may be organic or inorganic. Admin can store the fertilizers based on disease categorization with severity levels. The measurements of fertilizers are suggested based on disease severity.

5. Farmer’s Assistant: A Machine Learning-Based Application for Agricultural Solutions Sholka Gupta [1] , Ashok Jain [2] , Nishit Jain [3] , Aparna Bhonde [4] , Cornell University, April 2022.	In the proposed system they are successfully able to provide several features - crop recommendation using Random Forest algorithm, fertilizer recommendation using a rule based classification system, and crop disease detection using the EfficientNet model on leaf images.
6. CROFED - Crop and Fertilizer Recommendation and Disease diagnosis system using Machine Learning and Internet of Things, Taranjeet Singh [1] , Saurabh Anand [2] , Anmol Sehgal [3] , Siddhesh Mahajan [4] , Prof. Pranoti Kavimandan [5] Volume 9 Issue 2	They have used a machine Learning classification algorithm to predict suitable crops based on the values we get from our device and we will also provide suitable fertilizers required for that land.
7. Plant Disease Detection Using Image Processing Techniques, Y.Sanjana[1], AshwathSivasamy [2], SriJayanth [2] IJIRSET Vol. 4, Special Issue 6, May 2015	The system consists of a mobile application, which will enable the farmers to take images of plants using their mobile phones and send them to a central server where the central system in the server will analyze the pictures based on visual

	symptoms using image processing algorithms in order to measure the disease type.
8. Leaf Disease Detection Using ImageProcessing IJARIIE Thete Vaishali V. [1] ,Thakare Pradnya R. [2] , Kadlag Gaurav B. [3] ,Prof. P.A. Chaudhari [4] Vol-3 Issue-2 2017	The given system does accurate detection of leaf diseases by computing the severity and amount of disease present on the crop, only necessary and sufficient amounts of pesticides can be used making the agriculture production system economically efficient.

Chapter 3

Problem Statement, Objective & Scope

Problem Statement: -

Traditional methods of detecting and diagnosing these diseases rely on visual inspection and laboratory analysis, which can be time-consuming, expensive, and may not provide a comprehensive analysis of the disease's progression and diseases like Black rot, Northern Leaf Blight can cause significant crop loss and reduce the overall productivity of farming.

Therefore, there is a need for an automated and efficient system that can detect and diagnose these diseases accurately and in a timely manner, while also providing farmers with targeted fertilizer recommendations to help combat the disease's effects. CropShield is a fertilizer recommendation system that uses deep learning CNN and image detection technology can be an effective solution to this problem by providing farmers with a comprehensive analysis of their crops' nutrient needs, detecting early signs of disease, and providing targeted recommendations to address nutrient deficiencies and reduce the disease's impact on crop yields.

Objective: -

- To help the farmers to choose the best suitable crop.
- The aim is to make farmers aware of modern tools and infrastructure and promote precision farming. A well-informed decision can directly affect their profits.
- To protect their crops from any kind of diseases by recommending the right types of fertilizers for better yield.
- In case the yield seems to be affected by any disease the disease prediction system will analyze the crop with the help of the image uploaded and predict what disease it is and what measures to be taken to prevent it from spreading.

Scope: -

- The scope of the project is to get input from users in the form of images , analyze the image , predict whether the crop is healthy or unhealthy and accordingly recommend the best fertilizer to be used in the given conditions.

Chapter 4

Proposed System Architecture

- **Description about Proposed System:**

Having a major role in the economic development of India, agriculture is the largest economic sector. The manual classification and identification methods are being used to distinguish between different types of leaf diseases that are trusting on human resource. They are subjected to some kind of errors since these techniques are focused by human involvement. Since humans are subjected to tiredness, automated system also helps to reduce the time consumed by manual techniques. Owing to the deficiency of labors, automatic system needs to be incorporated to minimize the work and many new farming computerization tools are being established that pose questions about the effectiveness with which we succeed current farming practices.

The proposed system helps the users to understand what disease is the crop infected with, thereby helping the farmer to analyse and prevent the whole yeild from being destroyed. It also recommends which fertilizer could be used for the disease predicted.

- **Architecture / Block Diagram**

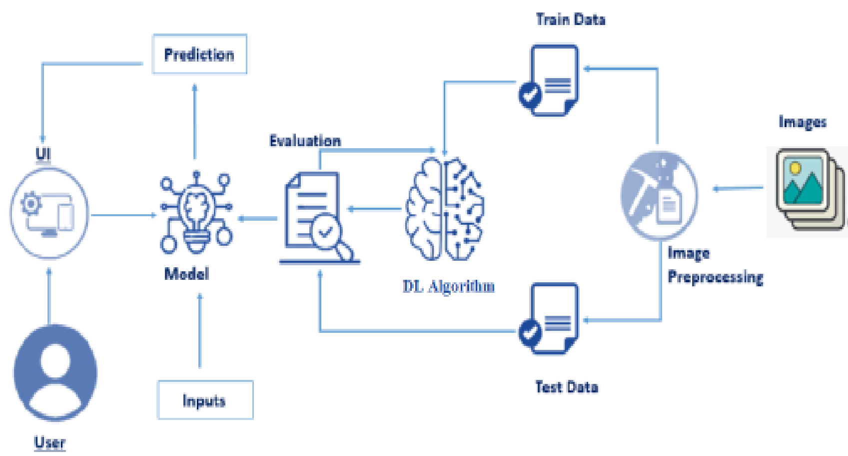


Fig. 4.1. Technical Architecture

The above Fig.4.1 shows the Technical architecture of the system. It shows how the system works and how the input is processed in order to get the desired result. The input, in the form of images is first preprocessed and stored in a specific, common format . This dataset is then split into training and testing dataset and a Deep learning algorithm is applied. The results are then used to analyse the input images , the built model helps to predict the disease and then recommend the fertlizer that can be used.

- **Data Flow Diagram (Level 0, Level 1)**

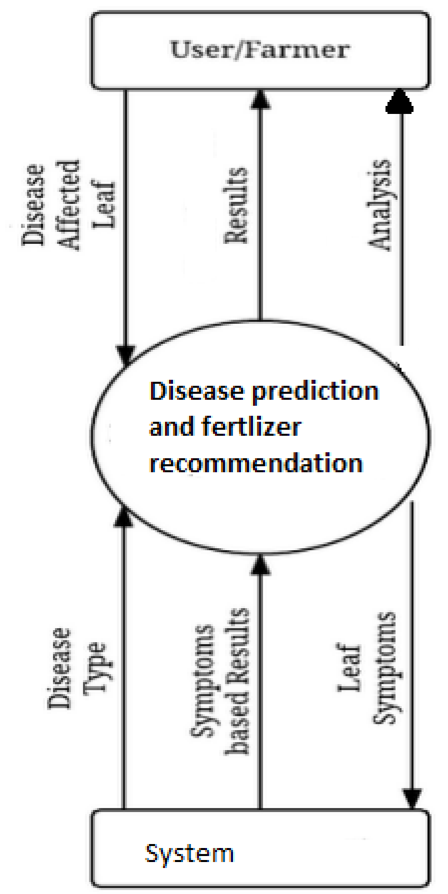


Fig 4.2. DFD Level 0

The Fig. 4.2 shows the Data Flow Diagram , showing the path in which the data flows within the system. The user, here farmer, inputs the images of leaves, which could be either diseased or healthy. The deep learning model built takes the image as input and the result is sent to the user back.

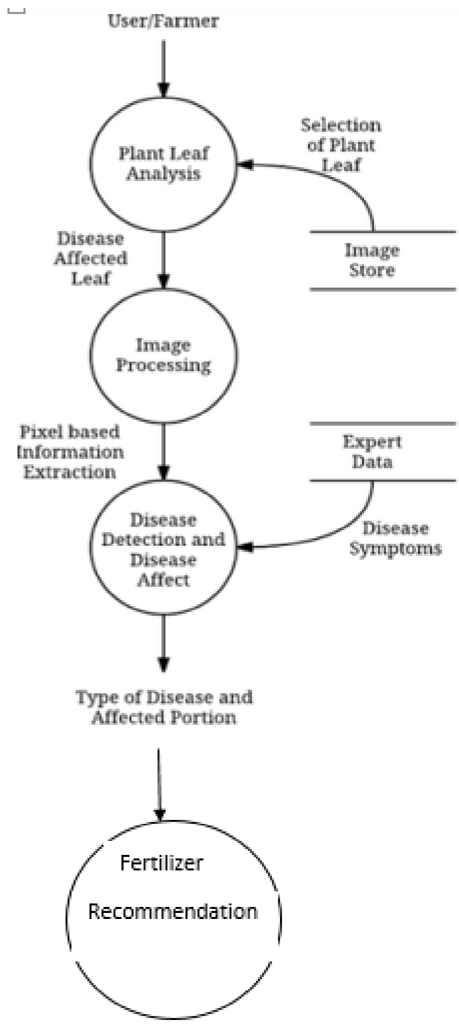


Fig 4.3 Data Flow Diagram Level 1

The above diagram shows detailed flow of data in the system . A plant leaf given as the input to the system in taken from the image database stored, i.e. no live inputs are taken. The image given as input then undergoes image preprocessing . Using the pooling layer of the CNN layers, we extract only the useful pixels from the image leaves and image analysis is given. The image leaf analysis is then used to determine whether the leaf is healthy or diseased. The disease symptoms and compared based on the expert data, based on which the fertlizer is recommended.

- **Use Case Diagram**

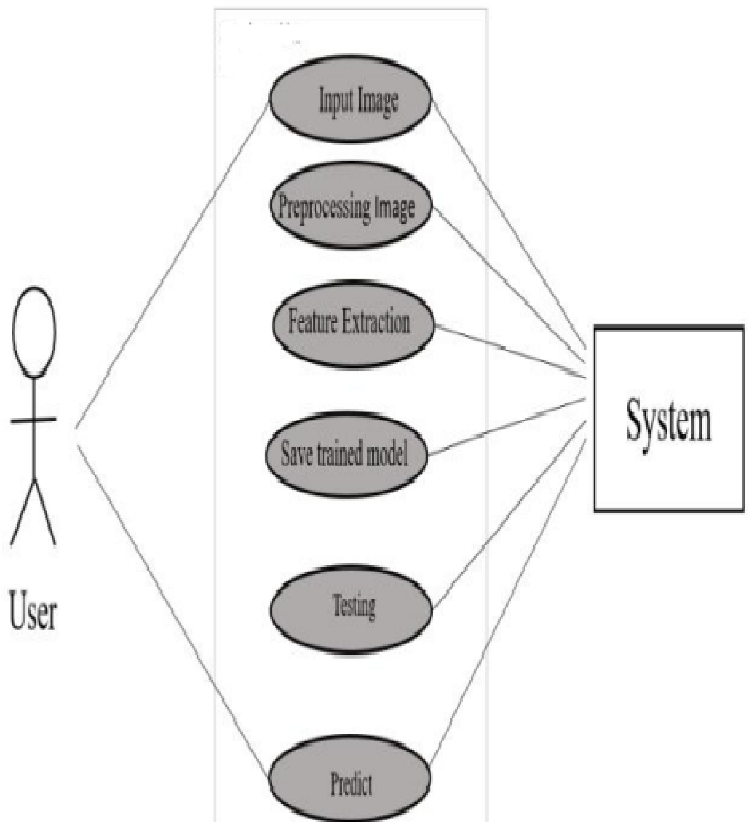


Fig 4.4 Use Case Diagram

The above use-case diagram is used to describe the dynamic behaviout of the system . It identify the interactions between the system and its actors. The use cases and actors in use-case diagrams describe what the system does and how the actors use it, but not how the system operates internally. It models the tasks, services, and functions required by the system of Cropshield. It depicts the high-level functionality of a system and also tells how the user handles a system.The user makes use of input images and the prediction and recommendation. The system is the other actor that uses the elements like image pre-processing, feature extraction, save trained model and testing the model.

- **Sequence Diagram**

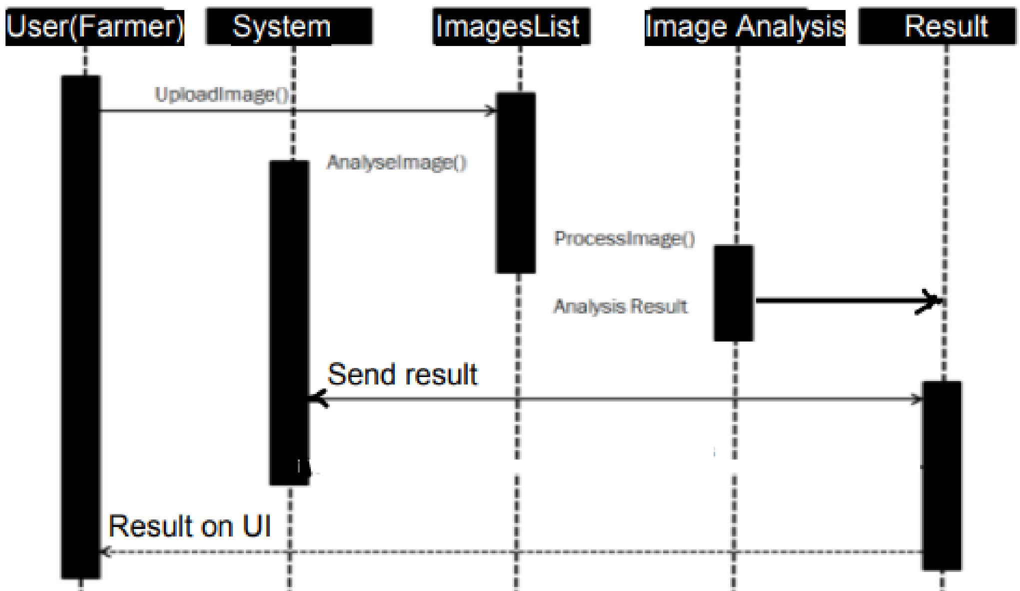


Fig 4.5. Sequence diagram

The above sequence diagram describes how and in what order the group of objects works together.It is time focus and shows the order of the interaction visually by using the vertical axis of the diagram to represent time what messages are sent and when.The horizontal axis shows the elements that are involved in the interaction.

- Activity Diagram

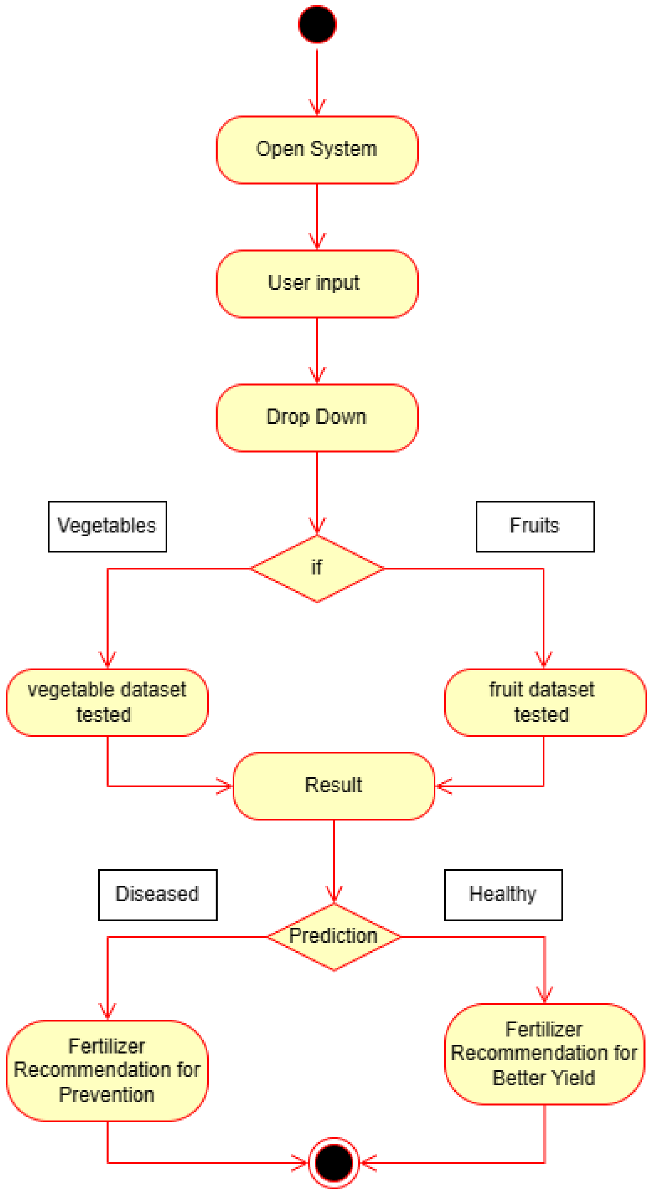


Fig 4.6. Activity Diagram

The activity can be described as an operation of the system. The control flow is drawn from one operation to another . The above describe dynamic aspects of the system. This activity diagram is essentially an advanced version of flow chart that models the flow from one activity to another activity. This Activity Diagram describes how activities are coordinated to provide a service which can be at different levels of abstraction.

Chapter 5

Project Planning

PROJECT TITLE	CropShield	COMPANY NAME	[Company's name]
PROJECT GUIDE	Prof. Tanvi Kapdi	DATE	3-12-18

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION(Weeks)	PCT OF TASK COMPLETE
1	**Project Conception and Initiation**					
1.1	Problem search	Janhavi Silaskar,	1-26-23	2-6-23	3	100%
1.1.1	Problem finalization	Janhavi Silaskar, Chaitali Sule, Shriya	1-26-23	2-6-23	3	100%
1.2	Project Title	Shriya Vidwans	1-26-23	2-6-23	3	100%
1.3	Abstract	Chaitali Sule	1-26-23	2-6-23	1	100%
1.4	Problem Definition	Srushti Deepak	1-26-23	2-6-23	1	100%
1.5	Objectives	Janhavi Silaskar, Chaitali Sule, Shriya	1-26-23	2-6-23	1	100%
1.6	Scope	Shriya Vidwans, Chaitali Sule	2-7-23	2-25-23	1	100%
1.7	Existing System/Project	Srushti Deepak	2-7-23	2-25-23	1	100%
1.8	Technology stack	Janhavi Silaskar	2-7-23	2-25-23	1	80%
1.9	Benefits for environment	Srushti Deepak	2-7-23	2-25-23	1	100%
1.1	Benefits for society	Srushti Deepak	2-7-23	2-25-23	1	80%
1.11	Applications	Srushti Deepak	2-7-23	2-25-23	1	100%
2	**Project Design**					
2.1	Proposed System	Janhavi Silaskar, Chaitali Sule, Shriya	9-19-19	9-27-19	1	70%
2.2	Design(Flow Of Modules)	Janhavi Silaskar	9-19-19	9-27-19	1	70%
2.3	Data Flow Diagram	Chaitali Sule	9-19-19	9-27-19	1	50%
2.4	Modules	Chaitali Sule	9-19-19	9-27-19	1	50%
2.4.1	Module 1	Janhavi Silaskar,	9-19-19	9-27-19	1	20%

PHASE ONE			PHASE TWO	
WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
M T W R F	M T W R F	M T W R F	M T W R F	M T W R F

Chapter 6

Experimental Setup

Software Requirements: -

1) Programming Language : Python
2) Jupyter Notebook : Using this to create and share computation documents for training, testing etc.
3) Flask : It is a library of python whatever module we will create so to integrate that in our web app we use Flask.
4) Tensor & Keras : To build and deploy the system.
5) Numpy : NumPy is a Python library for numerical computing that provides support for multidimensional arrays, mathematical functions, linear algebra, and much more. It is widely used in scientific computing, data analysis, and machine learning.
6) Pandas : Pandas is a popular Python library used for data manipulation, analysis, and cleaning. It provides easy-to-use data structures and data analysis tools for handling tabular data and time series data.
7) Opencv : Used for image processing.
8) Anaconda Navigator : Used to work Application and Framework

Hardware Requirements: -

9) CPU: A multicore processor such as an Intel Core i5 or i7
10) RAM: A minimum of 8GB of RAM, but preferably 16GB or more for more demanding applications.
11) STORAGE: A solid-state drive (SSD) with a capacity of at least 256GB for the operating system and applications, and a separate hard disk drive (HDD) for data storage.
12) OS: Windows 10 or macOS are the most common operating systems used on desktop computers, but Linux is also a viable option for many users.

Chapter 7
Implementation Details

7.1 Module 1 : [Model Building]

1. Import The Libraries

Import the libraries that are required to initialize the neural network layer, and create and add different layers to the neural network model.

2. Initializing The Model

Keras has 2 ways to define a neural network:

● Sequential

● Function API

The Sequential class is used to define linear initializations of network layers which then, collectively, constitute a model. In our example below, we will use the Sequential constructor to create a model, which will then have layers added to it using the add () method. Now, will initialize our model. Initialize the neural network layer by creating a reference/object to the Sequential class.

3. ADD CNN Layers

We will be adding three layers for CNN

● Convolution layer ● Pooling layer ● Flattening layer

4. Add Dense Layers

The name suggests that layers are fully connected (dense) by the neurons in a network layer. Each neuron in a layer receives input from all the neurons present in the previous layer. Dense is used to add the layers

5. Train And Save The Model

-> Compile the model

After adding all the required layers, the model is to be compiled. For this step, loss function, optimizer and metrics for evaluation can be passed as arguments.

-> Fit and save the model

Fit the neural network model with the train and test set, number of epochs and validation steps. Steps per epoch is determined by number of training images//batch size, for validation steps number of validation images//batch size.

6. Test The Model

The model is to be tested with different images to know if it is working correctly.

7.2 Module 2 : Build the application

Build Python Code:

After the model is built, we will be integrating it into a web application so that normal users can also use it. The user needs to browse the images to detect the disease.

Activity 1: Build a flask application

Step 1: Load the required packages

Step 2: Initialize the flask app and load the model

Step 3: Configure the home page

Step 4: Pre-process the frame and run

Run the flask application using the run method. By default, the flask runs on 5000 port. If the port is to be changed, an argument can be passed and the port can be modified.

7.3. Module 3 : Testing

Test Cases:

➤ Verify user is able to see the home page or not.

➤ Verify whether the user can upload the input image

➤ Verify whether the output is healthy for an helthy leaf image

➤ Verify whether the output is ‘diseased’ for an unhealthy leaf

Chapter 8

Result

After applying the various steps needed to build the model, a system where the image input is given and desired output is generated has been made. The image given as an input to the system results in the prediction whether the fruit/vegetable is healthy on not on the basis of deep learning techniques used.The accuracy gained is 94%.

The images in the dataset have been preprocessed

Image Augmentation

```
In [3]: from tensorflow.keras.preprocessing.image import ImageDataGenerator

In [4]: train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)

In [5]: test_datagen=ImageDataGenerator(rescale=1./255)

In [6]: ls

 Volume in drive C is C drive
 Volume Serial Number is 440C-C921

 Directory of C:\Users\acer\Desktop\chaitali sem6 project
```

Fig 8.1 Image augmentation

```
In [11]: x_train.class_indices
```

```
Out[11]: {'Pepper,_bell___Bacterial_spot': 0,
          'Pepper,_bell___healthy': 1,
          'Potato___Early_blight': 2,
          'Potato___Late_blight': 3,
          'Potato___healthy': 4,
          'Tomato___Bacterial_spot': 5,
          'Tomato___Late_blight': 6,
          'Tomato___Leaf_Mold': 7,
          'Tomato___Septoria_leaf_spot': 8}
```

CNN

```
In [12]: from tensorflow.keras.models import Sequential
         from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
```

```
In [13]: model=Sequential()
```

```
In [14]: model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

```
In [15]: model.add(MaxPooling2D(pool_size=(2,2)))
```

```
In [16]: model.add(Flatten())
```

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

Fig. 8.2 Adding CNN layers

SAVING MODEL

In [22]:
```
ls
```

```
 Volume in drive C is C drive
 Volume Serial Number is 440C-C921

 Directory of c:\Users\acer\Desktop\chaitali sem6 project

29-03-2023  21:36    <DIR>          .
29-03-2023  21:36    <DIR>          ..
25-03-2023  19:19    <DIR>          .ipynb_checkpoints
25-03-2023  18:45            23,567 chaitali sem6.ipynb
13-03-2023  23:08    <DIR>          dataset disease
25-03-2023  19:42       457,838,864 fruit.h5
25-03-2023  18:59            10,056 fruitpreprocessing.ipynb
29-03-2023  21:42           171,099 model_build_fruit.ipynb
25-03-2023  20:50           199,308 model_build_vegetable.ipynb
25-03-2023  16:11                72 Untitled.ipynb
25-03-2023  19:28       152,620,552 vegetable.h5
25-03-2023  19:04             1,748 vegetablepreprocessing.ipynb
               8 File(s)    610,865,266 bytes
               4 Dir(s)  738,933,534,720 bytes free
```

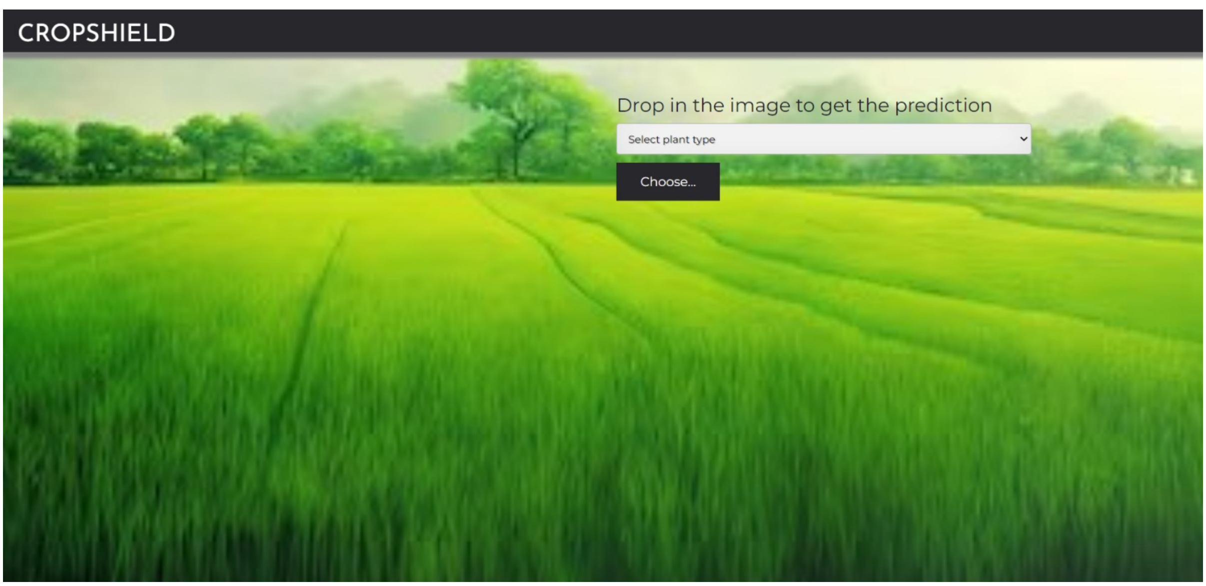
In [23]:
```
model.save('fruit.h5')
```

```
Epoch 1/10
225/225 [==============================] - 189s 826ms/step - loss: 0.7651 - accuracy: 0.8158 - val_loss: 0.2616 - val_accuracy:
0.9140
Epoch 2/10
225/225 [==============================] - 138s 612ms/step - loss: 0.2645 - accuracy: 0.9120 - val_loss: 0.1862 - val_accuracy:
0.9300
Epoch 3/10
225/225 [==============================] - 142s 632ms/step - loss: 0.2051 - accuracy: 0.9309 - val_loss: 0.2586 - val_accuracy:
0.9164
Epoch 4/10
225/225 [==============================] - 142s 629ms/step - loss: 0.1580 - accuracy: 0.9471 - val_loss: 0.1346 - val_accuracy:
0.9537
Epoch 5/10
225/225 [==============================] - 145s 643ms/step - loss: 0.1482 - accuracy: 0.9510 - val_loss: 0.1294 - val_accuracy:
0.9543
Epoch 6/10
225/225 [==============================] - 158s 700ms/step - loss: 0.1224 - accuracy: 0.9582 - val_loss: 0.0962 - val_accuracy:
0.9686
Epoch 7/10
225/225 [==============================] - 144s 640ms/step - loss: 0.0997 - accuracy: 0.9645 - val_loss: 0.0907 - val_accuracy:
0.9715
Epoch 8/10
225/225 [==============================] - 146s 648ms/step - loss: 0.1256 - accuracy: 0.9595 - val_loss: 0.0768 - val_accuracy:
0.9745
Epoch 9/10
225/225 [==============================] - 149s 663ms/step - loss: 0.0844 - accuracy: 0.9727 - val_loss: 0.0953 - val_accuracy:
0.9709
Epoch 10/10
225/225 [==============================] - 142s 629ms/step - loss: 0.0888 - accuracy: 0.9707 - val_loss: 0.1880 - val_accuracy:
0.9401
```

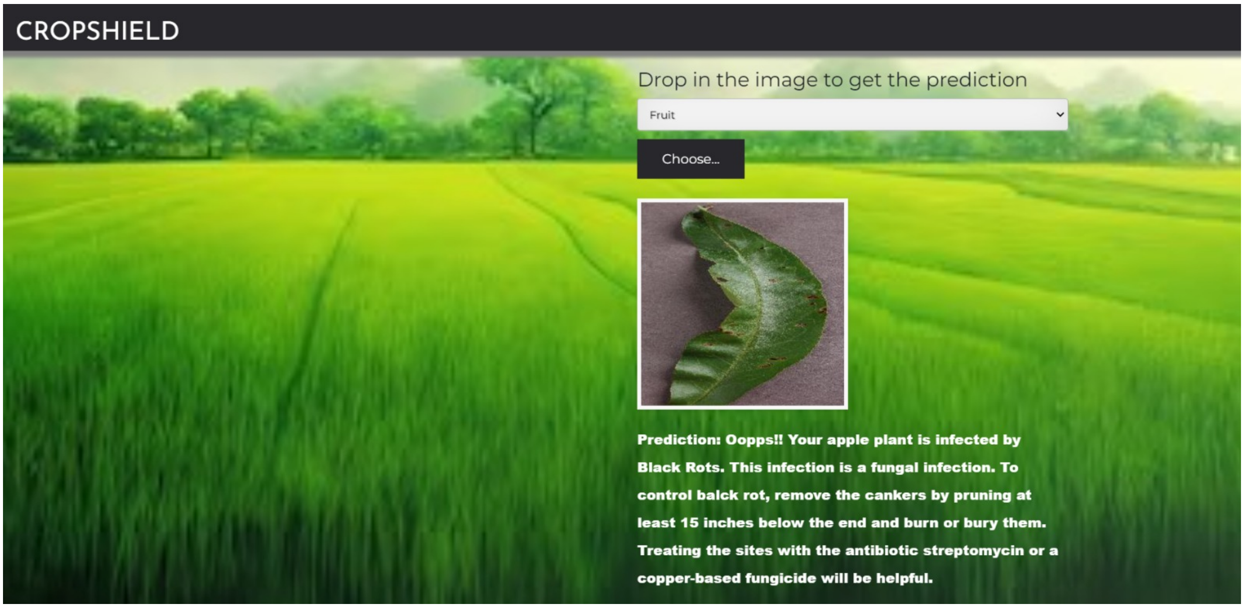
Fig. 8.3 Saving the trained model

FRONTEND: The web page contains two buttons, one labeled "Home" and the other labeled "Predict." The "Home" button leads to the homepage or landing page of the website. The "Predict" button suggests that the website is related to making predictions and some information about agriculture

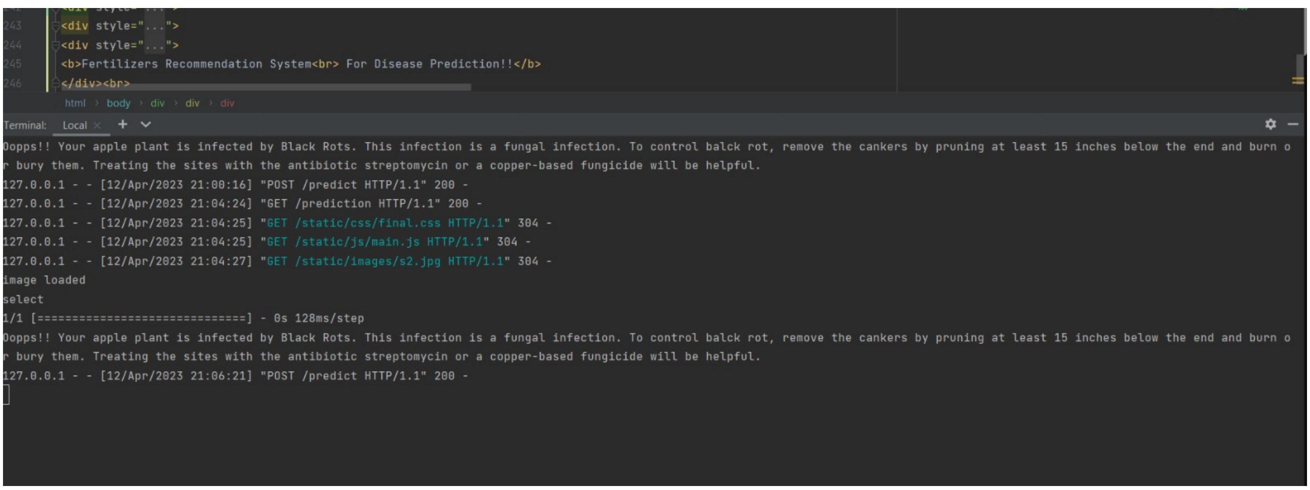
PREDICTION PAGE: This page displays a drop down list which has two options to choose from "fruits" and "vegetables" and then upload the image of a leaf to get the appropriate prediction and suggestions according to that.



Once the image is uploaded the system predicts whether it is diseased or healthy and gives suggestions to improve its condition. In the given image the image of an apple plant is been uploaded and the system has predicted to be infected by black rot and has suggested the neccessary measure to be taken to stop it from spreading



Here we have implemented the whole module and the result will be displayed.



Chapter 9

Conclusion

CropShield is a fertilizer recommendation system that uses deep learning Convolutional Neural Networks (CNN) for fruits and vegetable plants and can be an effective and efficient tool for farmers and gardeners to optimize crop yields and reduce fertilizer waste. By training a CNN on large datasets of plant images and nutrient data, the system can use its hierarchical feature learning capabilities to accurately identify nutrient deficiencies and recommend the appropriate fertilizers to address them.

The network can learn and extract meaningful features from plant images, such as leaf shape, texture, and color, and use these features to classify nutrient deficiencies with high accuracy. The use of transfer learning can also help overcome the challenge of limited training data by leveraging pre-trained models that have learned general features from large datasets.

The use of deep learning CNN for fertilizer recommendation offers several advantages over traditional methods. It can provide more precise and targeted recommendations based on the individual needs of each plant, and can also adapt to changing conditions over time. Additionally, by reducing the need for manual analysis and soil testing, the system can save time and reduce labor costs for farmers. In conclusion, CropShield using deep learning CNN offers a promising solution for optimizing crop yields and reducing fertilizer waste in the agricultural industry.

Chapter 10

References

- Dr.P. Pandi Selvi [1], P. Poornima [2], Soil Based Fertilizer Recommendation System for Crop Disease Prediction System, Volume 8 Issue 2, Mar-Apr 2020

- Rani Holambe1, Pooja Patil [2], Padmaja Pawar3, Saurabh Salunkhe [4], Mr. Hrushikesh Joshi [5] IoT-based Crop Recommendation, Crop Disease Prediction, and its solution, Volume: 07 Issue: 10 | Oct 2020

- Usman Ahmed [1], Jerry Chun-Wei Lin [2], Gautam Srivastava [3], Youcef Djenouri [4] A nutrient recommendation system for soil fertilization based on evolutionary computation

- R. Neela [1] , P. Nithya [2] Fertilizers Recommendation System For Disease Prediction In Tree Leave, Volume 8, Issue 11, November 2019

- Sholka Gupta [1] , Ashok Jain [2] , Nishit Jain [3] , Aparna Bhonde [4] , Farmer's Assistant: A Machine Learning-Based Application for Agricultural Solutions, Cornell University, April 2022

- Taranjeet Singh [1] , Saurabh Anand [2] , Anmol Sehgal [3] , Siddhesh Mahajan [4] , Prof. Pranoti Kavimandan [5], CROFED - Crop and Fertilizer Recommendation and Disease diagnosis system using Machine Learning and Internet of Things, Volume 9 Issue 2,

- Y.Sanjana[1], AshwathSivasamy[2], SriJayanth[2], Plant Disease Detection Using Image Processing Techniques, IJIRSET Vol. 4, Special Issue 6, May 2015

- Thete Vaishali V. [1] , Thakare Pradnya R. [2] , Kadlag Gaurav B. [3] ,Prof. P.A. Chaudhari [4], Leaf Disease Detection Using ImageProcessing IJARIIE Vol-3 Issue-2 2017