INTRODUCTION

Project Overview

Fertilizer Recommendation System For Disease Prediction

A vital part of living in the modern world, agriculture also plays a vital role in protecting the environment. As a result of the many natural catastrophes that occur nowadays, agriculture is exceedingly difficult to practice. Due to pollution in the soil, water, and air, most plants are susceptible to several illnesses. One of the most difficult obstacles in agriculture is identifying the illness. It's challenging to locate the right fertilizer to treat leaf disease, which affects the majority of plants. Finding the plant illness and curing it at an early stage of infection are the key goals of this study. Due to variations in pathogen types, adjustments in farming practices, and insufficient plant protection systems, the number of plant diseases and the severity of the damage they cause have grown during the past few years. A new automated technique has been developed to detect plant illnesses. To detect the illnesses and provide preventative measures for certain diseases, deep learning algorithms are applied.

PROBLEM STATEMENT:

Mr.Narasimma Rao is a 65 years old man. He had his own farming land and did Agriculture for the 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 best 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 plant is affected by leaf disease, then it reduces the growth and productiveness. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants.
When does the issue occur?	During the development of the crops as they will be affected by various diseases.

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 maximize the crop yield.

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

Purpose

Plant disease problems can affect farmers, everyday people, businesses, shoppers, and employees who grow crops. The introduction of an automated approach for identifying various plant diseases by examining the symptoms shown on the plant's leaves.

LITERATURE SURVEY

Existing problem

[1] Dos Santos Ferreiraet al.[2017] proposed a method to identify unwanted weeds in the soybean field. Unwanted weed includes unwanted grasses and broadleaf. Convolution neural network technique is applied in the process of identifying the weeds in the soybean field. For the purpose of capturing the image, drones were used in it. The database used for analyzing purpose includes fifteen thousand pictures weeds, soil, soybean, grass weed, and broadleaf. SafeNet architecture is used for training the neural network. The cafe software includes Alex Net in it. Pynovisao algorithm is used to build a robust image database. The results are compared with Support Vector Machine, Ada Boost, and Random Forest. The accuracy of 99 % is achieved using the convolution neural network. Super pixel algorithm (Simple Linear Iterative Clustering (SLIC) Super pixel) mainly focus on object localization and segmentation of the image.

[2] Carranza-Rojaset al.[2017] proposed a technique for herbarium species identification using deep learning technique. It mainly focuses on how convolution neural networks help in automatic identification of plant species. Image-Net classification performs very well in convolution neural network process. TL is also used for domain related training. Results show a greater accuracy when it is trained and tested for a different set of species. It has been shown in it that by using herbarium dataset Transfer learning is possible to another region even when the species don't match. Handwritten tags and noise can be removed by the pre-processing technique. The transfer learning from herbarium to non-dried plants are clearly listed in the table.

[3] Luet al.[2017b] proposed a technique for identifying the pathogen in the vegetable. Deep convolution neural network technique is used for the identification of the rice disease. Training and testing the model consist of 500 images of rice leaves and stem with 10 types of rice disease in it. Ten fold cross validation method is used for identification of rice disease. The proposed novel model provides an accuracy of 95.48 %. The structure of 10 cross field deep convolution network consist of input (3@512 * 512), convolution (362@244 * 224), stochastic pooling (32@112 * 1112), convolution (16@56 * 56), stochastic pooling(16@28 * 28), convolution (16@28 * 28), stochastic pooling (16@14 *14), and two fully connected one. In the pre-processing stage scale normalization and mean normalization is done for colour image and grey image and then PCA and whitening method is applied. Finally trained and tested feature map is plotted. Recognition accuracy for mean, max and stochastic pooling is as follows 92.11, 93.24,95.48 and the recognition accuracy for different filter (5*5, 9*9, 16*16, 32*32) are 93.15, 92.56, 93.29, 92.48. The proposed method is compared with BP, SVM, and PSO.
[4] Barbedo [2019] proposed a technique based on deep learning for the purpose of image classification. Data augmentation technique helps in the lack of a database for plant image. This paper mainly focuses on identifying the individual lesion and spot instead of considering the whole leaf for identification. While using only lesion and spot the accuracy is 12 % higher than using the entire leaf. The complete details about the recent architecture used for identifying the plant disease and where the data are collected for identifying the plant disease and its accuracy after identification is also mentioned clearly. The list of disorder found in the plant specimen is also listed out clearly in it. Google Net CNN was used in the experimental setup. In the experiment, three different types of images were used and they are
1. Image with-out any modification 2. Image with background removed 3. Expanded dataset. Accuracy for both original and expanded images are calculated.

[5] Barbedo [2018] the problems faced in the machine learning technique has been overcoming by the deep learning concepts such as Convolution Neural Networks (CNN). Large data sets are needed for processing this technique. This paper mainly focuses on

how the size of data and its variety affects the performance of the deep learning concepts. 12 plant species with different samples, different disease, and different character are taken into consideration. This analysis describes the different CNN network used for disease classification along with where this large amount of data are collected for classification. Accuracy is also calculated for each deep learning concepts. The number of correctly classified sample divided by the total number of samples provides the accuracy value. List of different plant species and its disease are listed in it. Removing background from image improves the prediction accuracy. This analysis was performed mainly using dataset obtained from different sources.

[6] Tavakoli and Gebbers [2019] presented an analysis of winter wheat nitrogen and assessment of water in the field by using a camera. This experiment was conducted during a period of three years (2012,2013, and 2014). Nitrogen fertilization and different level of water are applied in the field for the purpose of the experiment. Two machine learning algorithm was developed for the purpose of analysis namely Random Forest (RF) and Partial Least Square Regression (PLSR). Specter radiometer was used for radial measurement. Separately Vegetation Index (VI) is also calculated. For analysing the nitrogen content R2(RMSE) model is used and it is calculated separately for both data type. Random forest algorithm performs better in combined-date data. Nitrogen estimation calculation performs better while using the digital camera. It can also be integrated with the smartphone. It has a limitation of accessing only these spectral bands so that the analysis of plant status is also limited.

[7] Grinblatet al.[2016] proposed a method used for the identification of plant using leaf vein pattern. The classification of white bean, red bean and soybean are also done in this. Referred pipeline accuracy is also improved in it. The vein pattern is obtained by analysing the visualization technique with the obtained results. The image processing is done in four different stages namely vein segmentation, central patch extraction, vein measure, and classification. Random forest, support vector machine, and penalized discriminant analysis algorithm are used for classification purpose. Central patch extraction and vein measure are replaced by the convolution neural network technique where it learns from the data set and solve this problem. In the proposed system of CNN, the depth of the model is increased from 2 layers to6 layers. While analysing the results it shows that the accuracy gets improved when we go deep into the layer at the 5th layer an accuracy of 92.6 is achieved.

[8] Ferentinos [2018b] proposed a technique on convolution neural network. For the purpose of training, the model 87,848 images of healthy and diseased plant leaves are taken which includes 25 plant variety. These plants are tested under two different condition namely laboratory and field condition. Alex Net, AlexNetOWTBn, Google Net,

over feat and VGG architecture are used for identification of plant disease from the leaves. Its implementation is done using Torch7. It is a machine learning framework. Its training portion is implemented in the Linux environment. 80 % of training data and 20 % testing data for CNN.99.49 % success rate is achieved when using AlexNetOWTBn and 99.53 % of success rate is achieved using VGG model. The success rate for both the original image and the pre-processed image is analyzed as well for all the five models. The success rate is more when the model is first trained for field condition and then laboratory condition. The success rate is low when it is tested under laboratory conditions and then field conditions. It can be integrated with the mobile device due to low computational power.

References

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[6] K. Kamal, Z. Yin, B. Li, B. Ma and M. Wu, "Transfer learning for fine-grained crop disease classification based on leaf images", Proc. 10th Workshop Hyperspectral Imag. Signal Process. Evol. Remote Sens. (WHISPERS), pp. 1-5, 2019. https://ieeexplore.ieee.org/document/8921213

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[9] Guillermo L Grinblat, Lucas C Uzal, M´onica G Larese, and Pablo M Granitto. Deep learning for plantidentification using vein morphological patterns.Computers and Electronics in Agriculture, 127:418–424, 2016. [10] B. Liu, Y. Zhang, D. He and Y. Li, "Identification of apple leaf diseases based on deep convolutional neural networks", Symmetry, 2018.

Problem Statement Definition

Agriculture is incredibly important to India's economic, social, and employment growth. Nearly 48% of the people in India rely on the agriculture industry for their livelihood. According to the 2019–2020 Economic Survey, the median income for Indian farmers is Rs. 2500 across 16 states. The majority of Indians rely on agriculture for their livelihood. Villagers in India have the option to work in agriculture, which helps the country develop economically and on a huge scale. The issue of planting the wrong crop on their property based on a traditional or non-scientific approach affects the majority of farmers.For a nation like India, where agriculture provides food for over 42% of the population, this is a difficult undertaking. And the consequences for the farmer of selecting the incorrect crop for the land include migrating to a big city for work, committing suicide, giving up farming, and leasing out the property to an industrialist or using it for purposes unrelated to agriculture. The result of poor crop selection is a lower yield and lower revenue.

Machine learning, one of the applications of artificial intelligence, is being used to construct the suggested system as a solution to the issue. The best crop to cultivate on your property will be suggested to you by crop suggestion based on the soil nutrition value and the local climate. Additionally, it can be difficult to suggest the optimum fertilizer for a given crop. The second, and maybe more crucial, problem is when a plant contracts a variety of illnesses, which reduces agricultural output and degrades product quality. This recommendation has been put forth to address all of these problems.

Problem Statement Definition

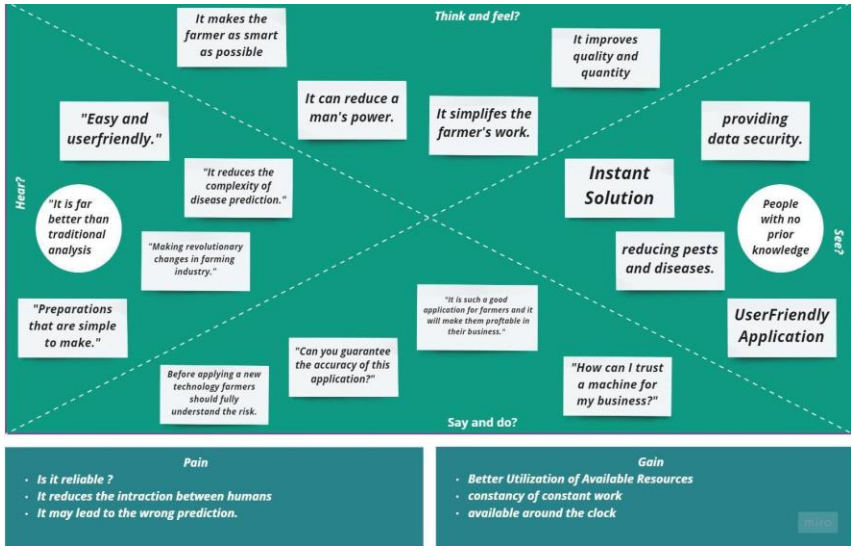
In India, The Agriculture industry is extremely vital and crucial for economic and social development and jobs. In India, the agricultural sector provides a living for almost 48% of the population. As per the 2019-2020 economic survey, an Indian farmer's median wage in 16 states is Rupees 2500. Most of the Indian population depends on agriculture for their livelihood. Agriculture gives an opportunity of employment to the village people to develop a country like India on large scale and give a push in the economic sector. The majority of farmers face the problem of planting an inappropriate crop for their land based on a conventional or non-scientific approach. This is a challenging task for a country like India, where agriculture feeds approximately 42% of the population. And the outcomes

for the farmer of choosing the wrong crop for land is moving towards metro city for livelihoods, suicide, quitting the agriculture and give land on lease to industrialist or use for the non-agriculture purpose. The outcome of wrong crop selection is less yield and less profit.

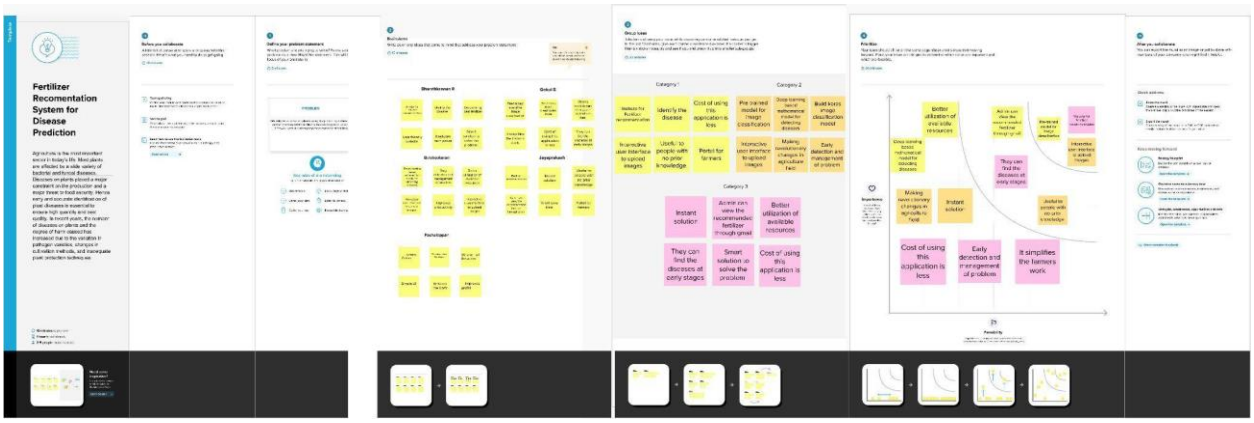
IDEATION & PROPOSED SOLUTION

Empathy Map Canvas

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community.



Ideation & Brainstorming



Proposed Solution

Chemical fertilizers were added to the mix to boost yield. However, overusing them degrades the natural qualities of the land and makes plants dependent on chemical fertilizers. In order to improve output while maintaining the natural qualities of the soil, it is crucial to only add the necessary quantity of fertilizers. Knowing the levels of soil nutrients is crucial for this. Real-time disease detection on plants is the goal of our project. Our system will also suggest the sort of fertilizer to use and how much to put into the soil sample based on the results, allowing the production to be increased to the maximum.

Problem Solution fit

Introduction:

In the Modern World, improving the technology and upgrading the automation process. Currently the industry movie on Industry 4.0 revolution by implementing Artificial Intelligence (AI) on various cross domains like Machineries, Auto Driving Cars, Self-Control Robots, etc.…

Solution:

Dataset: We are collecting an Experimental lab Dataset to process and train the AI Model to obtain the maximum Accuracy. In a minimum of time, we process the project using the published dataset called Plant Village and Plant doc.

Pre-Processing: In Pre-Processing process, we are converting the image size into a 224x224 based on the model performance. In preprocessing we are doing the same technique to scale the image to obtain the maximum accuracy

- Augmentation technique
- Image Resizing

- Image Resize

Model Selection: In Deep Learning we have the separate module for the Computer Vision Neural Network task which should be applied on image classification, Object Detection, segmentation etc. In Deep learning we have the Specific neural network that can extract the feature from the image and train the Network. We are selecting the Transfer learning Concept to train the model with High-Accuracy.

Transfer Learning: Transfer learning is a research problem in machine learning that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem Transfer learning Models we are used for obtain the High Accuracy are

- ResNet-50
- Efficient Net – B4
- MobileNetV2

Web application:

We integrate the web page and Machine Learning Model using the flask framework and deploy in cloud using the IBM Cloud. In web application contain the four more pages:

Page1: In first page contain the basic web page to introduction to the Web Application

Page2: In Second Page it will fetch the image from the user and it sent to the back-end (Machine Learning Model)

Page3: In third page contain the important part of an project machine learning Module image classification in cloud

Page 4: In the final part of the web application the result for the Disease can be classified in the DL Model.

Conclusion:

In our Solution we are implementing the disease classification using the Deep Learning(DL) technique to process an image and classify the Leaf disease in an plant and it integrate with the web application implemented in IBM Cloud

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	Registration through Form
FR-2	User Confirmation	Confirmation via Email
FR-3	User Profile	Filling the profile page after logging in

FR-4	Uploading Dataset (Leaf)	Images of the leaves are to be uploaded
FR-5	Requesting solution	Uploaded images is compared with the pre-defined Model and solution is generated
FR-6	Downloading Solution	The Solution in pdf format which contains the recommendations of fertilizers and the possible diseases.

Non-functional Requirements:

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

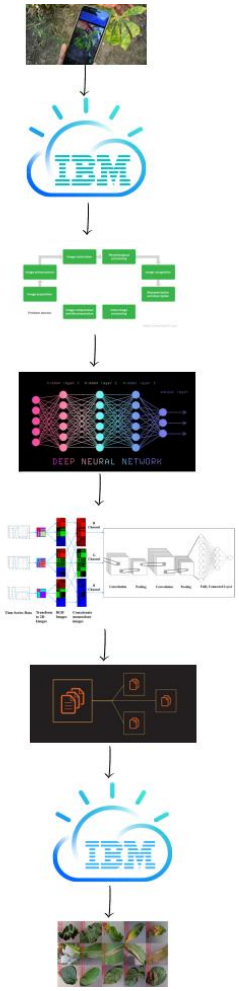
FR No.	**Non - Functional Requirement**	**Description**
NFR-1	Description	The system allows the user to perform the tasks easily and efficiently and effectively.
NFR-2	Security	Assuring all data inside the system or its part will be protected against malware attacks or unauthorized access.
NFR-3	Reliability	The website does not recover from failure quickly ,it takes time as the application is running

		in single server
NFR-4	Performance	Response Time and Net Processing Time is Fast
NFR-5	Availability	The system will be available up to 95% of the time
NFR-6	Scalability	The website is scalable

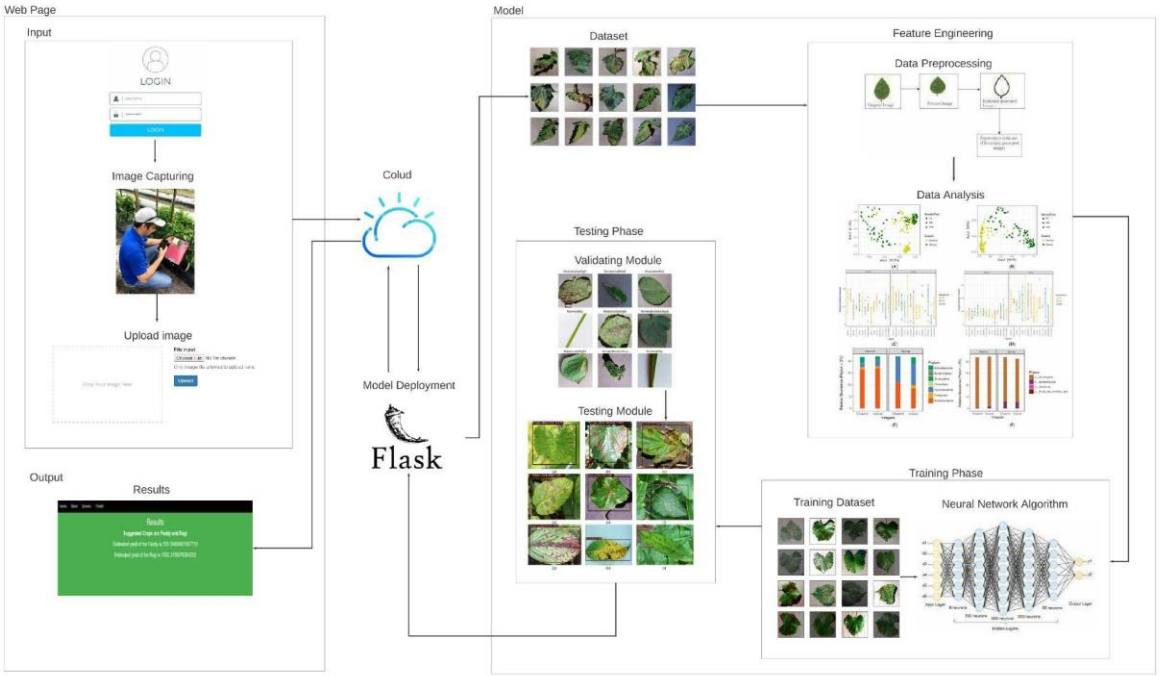
PROJECT DESIGN

Data Flow Diagrams

A Increasing the Automated Product to make easier and Efficient Life Style to the Human Being. In Advanced Technologies like Artificial Intelligences, IOT, Cloud makes efficient. In Agriculture Department increasing the Crop yield by using the Advanced technology efficiently to reduce the wastage and Disease Affection using Fertilizer. In our proposed System we are given a technology Architecture to recommend a system for Fertilizer for the Modern formers. In Technology Architecture we are using the Computer Vision to process to classify the image from the disease effected or not. In the first image processing process to normalize and resize the image and pipeline into the image feature extraction model. After identification of the classify the image, it shows the case into the web application.



Solution & Technical Architecture



PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

Milestone:

Prediction

Modern Technology is increasing and optimizing the Performance of the Artificial Intelligences (AI) Model. The Crop Yield Disease Prediction System, is helpful for farmers to prevent the crop from the various diseases which can identify the Disease within a process of capturing the Image at the plant and Machine Learning Algorithm will give affected Disease names. In this Project Milestone will be given the Best Solution for the farmer using the complete friendly and simple user interface web application to fetch the solution by own. In addition, we are planning to add a valid Module that is a Fertilizer recommendation for the Specific Disease. It can give both Artificial fertilizer and Natural Fertilizer in a suggested manner.

Activity List:

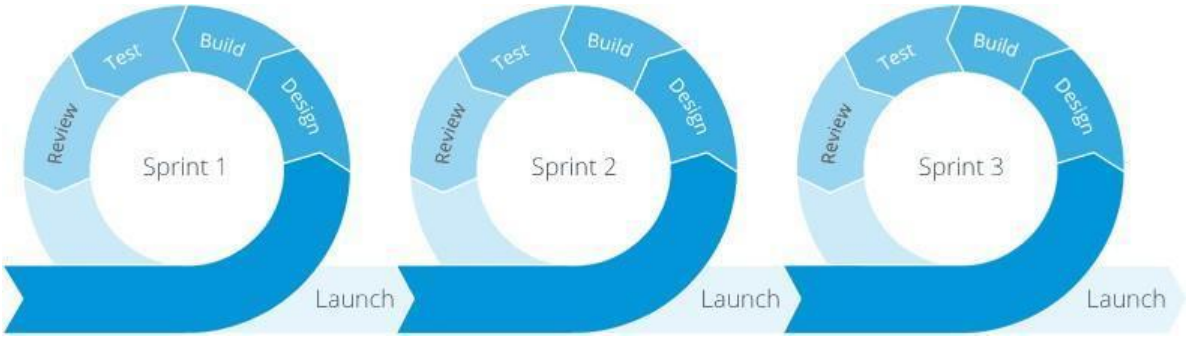
In Project Management Planning is an Important task to scheduling the phrase of the project to the Team Member. In this Activity can show the various activities are allocated and Done by the Team Members! In Project we can split into the Four Step of Phrases are

Phrase 1: Information Collection and Requirement Analysis.

Phrase 2: Project Planning and Developing Modules

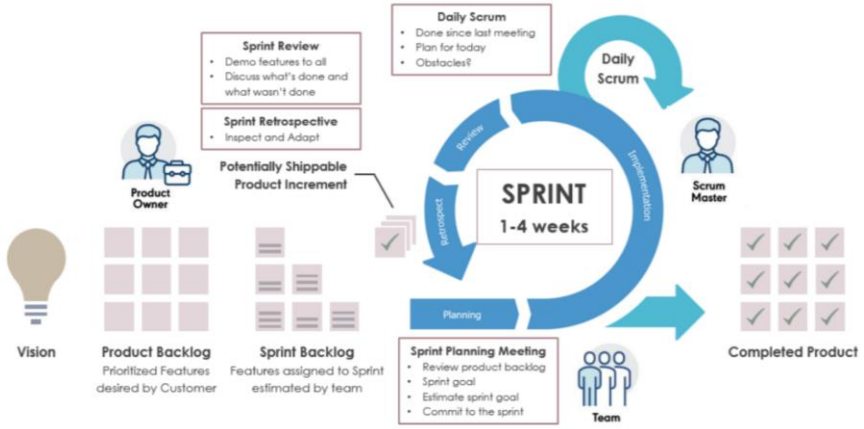
Phrase 3: Implementing the High Accuracy Deep Learning Algorithm to Perform

Phrase 4: Deploying the Model on Cloud and Testing the Model and I Performance



Sprint Delivery Schedule

Agile focuses on keeping the process lean and creating minimum viable products (MVPs) that go through several iterations before anything is final. Feedback is gathered and implemented continually and in all, it is a much more dynamic process where everyone is working together towards one goal.



The delivery plan of project deliverables is a strategic element for every Project Manager. The goal of every project is, in fact, 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 Spirit Delivery Planning is one of the processes of Completing the project and Showcasing the TimeLine of the Project Planning. This Delivery plan helps to understand the process and WorkFlow of the Project working by the Team Mates.

Every Single Modules are assigned to the teammates to showcase their work and contribution of developing the Project

CODING & SOLUTIONING(Explain the features added in the project along with code)

Feature 1:

The Phrase of Fertilizer Recommendation System has various features like classifying the image from the source and it is completed by using the Best Pre-Trained Own Creating Model from the Transfer Learning to classify the image.

Image Processing:

In the Image Processing has an important and Preprocessing the image by it size and it Dimensionals

In Additional feature of the web application is been given the validation of the image address and Convert into the image and upscale the by the Pre-Processing in the pipeline of the Web Application

Image Classification:

Image classification is an important process for Disease Classification in the Web Application. It can Fine Tuned and Process in Convolution Neural Network(CNN) and Additionally We are implementing the Transfer Learning Architecture by customizing the parameters and weight for Efficiently and Accurate classification process.

Feature 2:

Recommendation System:

In recommendation System will actively apply on the process of Suggestesting the Solution for the classified Disease in Image. In recommendation System will be embedded into the Hyperlink Text format to process and Suggest the Fertilizer for the Suggestion.

In Recommendation System Model are run on the model by the Machine Learning Algorithm using the Logistic regression and Support Vector Machine will Played a Major role in the recommendation

User Interface:

User Interface is an Important part to use the web application it can applicated by the both Desktop and Mobile View it can create with the Bootstrap application by the minimal interface with efficient way to Interacting with the User

In Web Application Interface will showcase the Rank of the Disease and probability Percentage of the disease affected in the given input image from the User.

TESTING

Test Cases:

In Testing is an important process for validating the application process and find the validation of bugs by process the Application and process the bugs to solve

In this Web application we are using the various Testing Techniques to validation of an Web application by verifying the Test case by the Techniques.

Testing Techniques are :

1. White Box Testing:

   White-box testing is a method of software testing that tests internal structures or workings of an application, as opposed to its functionality. In white-box testing, an internal perspective of the system is used to design test cases

2. Black Box Testing:

   Black box testing assesses a system solely from the outside, without the operator or tester knowing what is happening within the system to generate responses to test actions. A black box refers to a system whose behavior has to be observed entirely by inputs and outputs

3. Functional Testing:

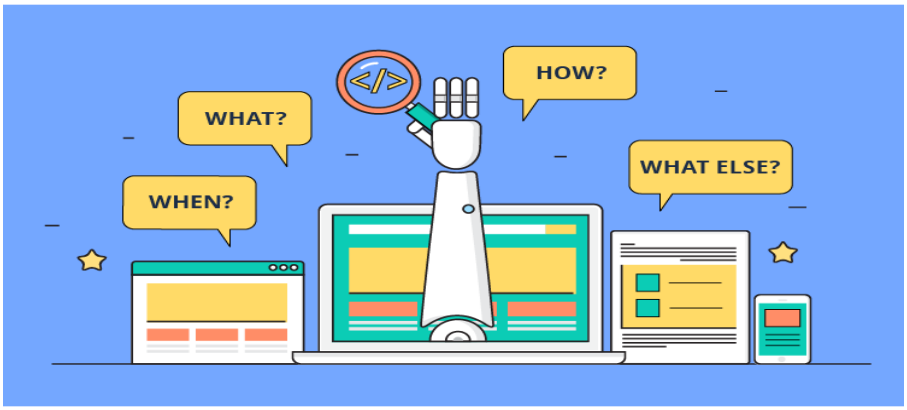
   Functional testing is a type of testing that seeks to establish whether each application feature works as per the software requirements. Each function is compared to the corresponding requirement to ascertain whether its output is consistent with the end user's expectations

4. Alpha Testing:

   Alpha Testing is a type of software testing performed to identify bugs before releasing the product to real users or to the public. Alpha Testing is one of the user acceptance testings

5. Beta Testing:

   In software development, a beta test is the second phase of software testing in which a sampling of the intended audience tries the product out. Beta is the second letter of the Greek alphabet. Originally, the term alpha test meant the first phase of testing in a software development process



Dataset:

Collection of the Dataset will be clearly managing the image quality and validating of the original image Quality and Defined to verify the Duplicated Image will be Replaced or Not in the Dataset.

Image Processing:

In Image Processing is an Important step in process the image dimension and image Arrangement and it can process throughout the different image channels into a RGB Channels

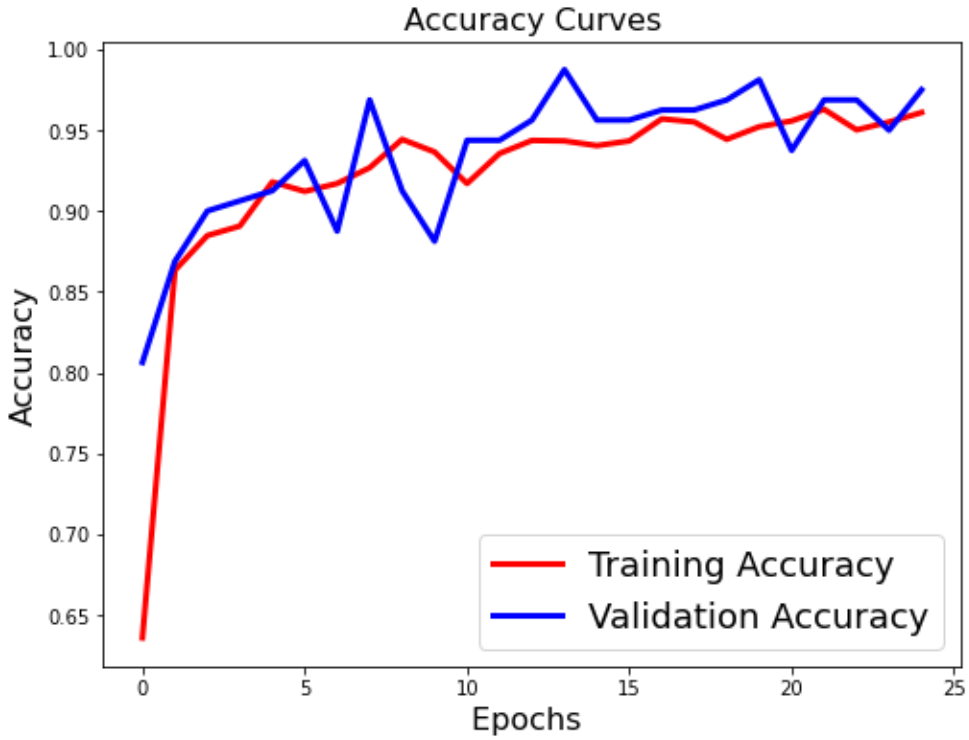
RESULTS:

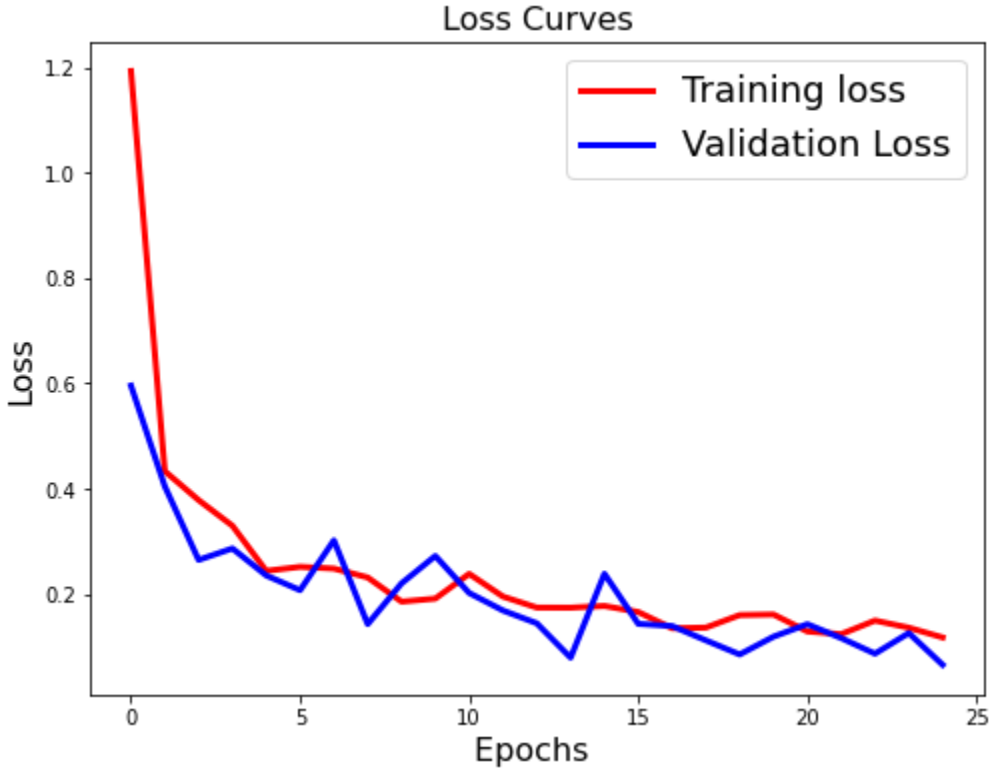
Image Classification Model Testing Accuracy:

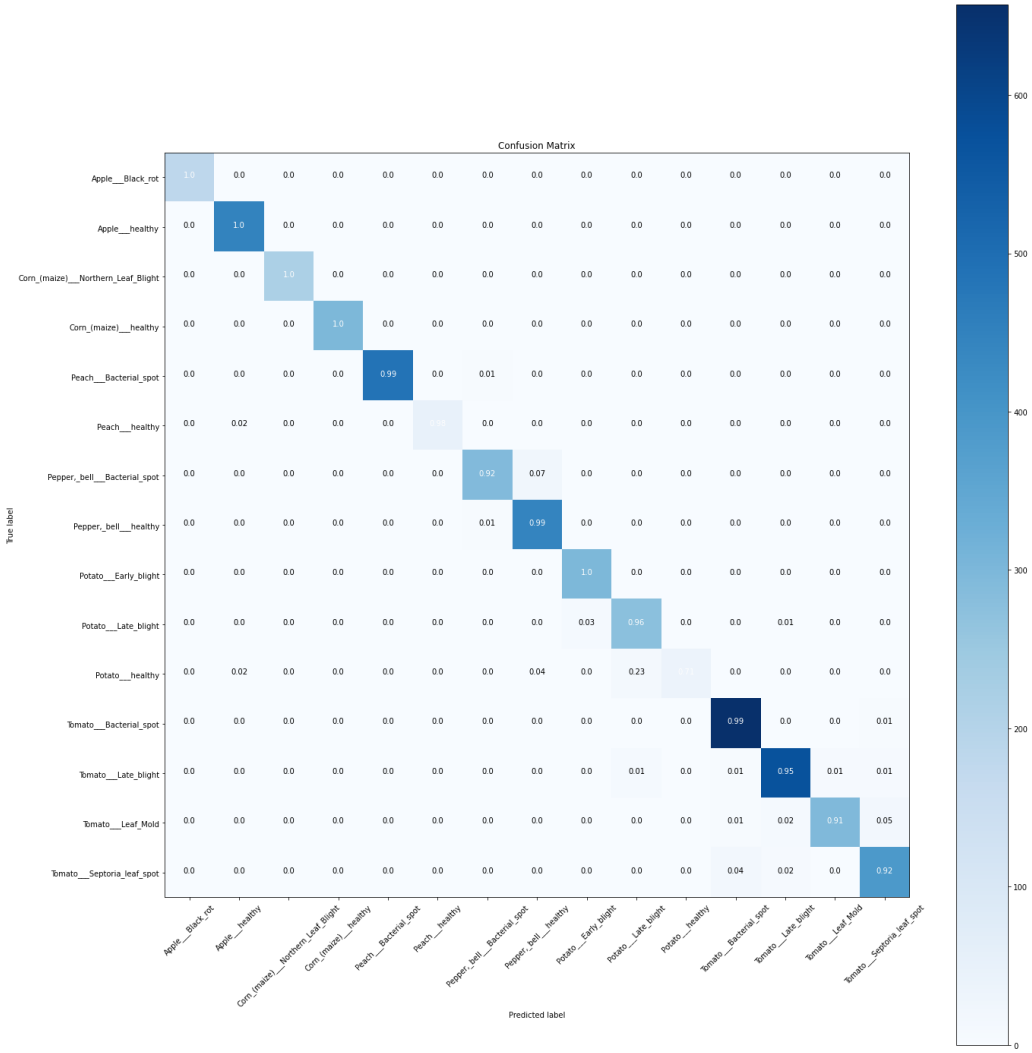
Testing Accuracy for image Classification:
Image Classification Model Testing Accuracy:

```
[54] test_score = model.evaluate_generator(testing_generator, batch_size)

     print("[INFO] accuracy: {:.2f}%".format(test_score[1] * 100))
     print("[INFO] Loss: ",test_score[0])

     /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.eval
       """Entry point for launching an IPython kernel.
     [INFO] accuracy: 99.71%
     [INFO] Loss:  0.015788547694683075
```

Accuracy Graph:


Accuracy Curves
Accuracy
Epochs
Training Accuracy
Validation Accuracy
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0
5
10
15
20
25

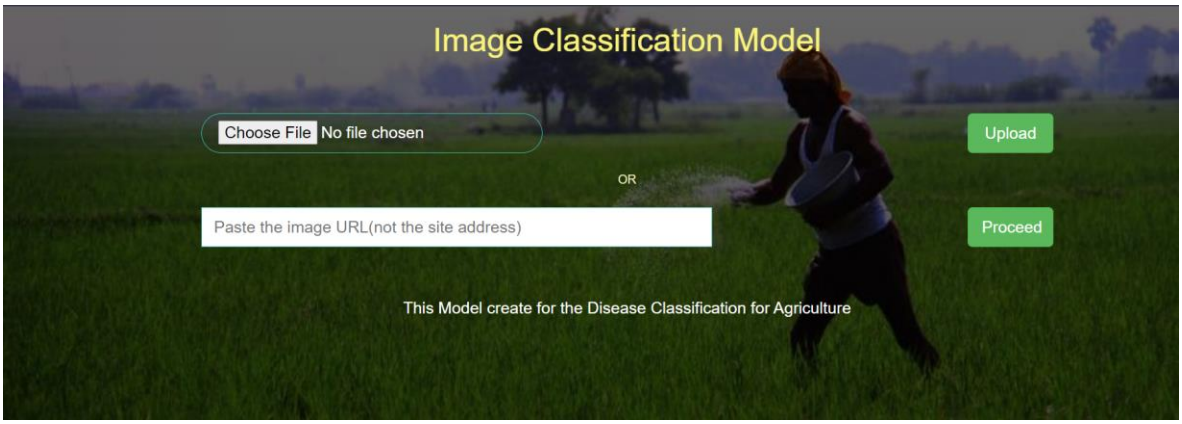

Loss Curves
Loss
Epochs
Training loss
Validation Loss
1.2
1.0
0.8
0.6
0.4
0.2
0
5
10
15
20
25

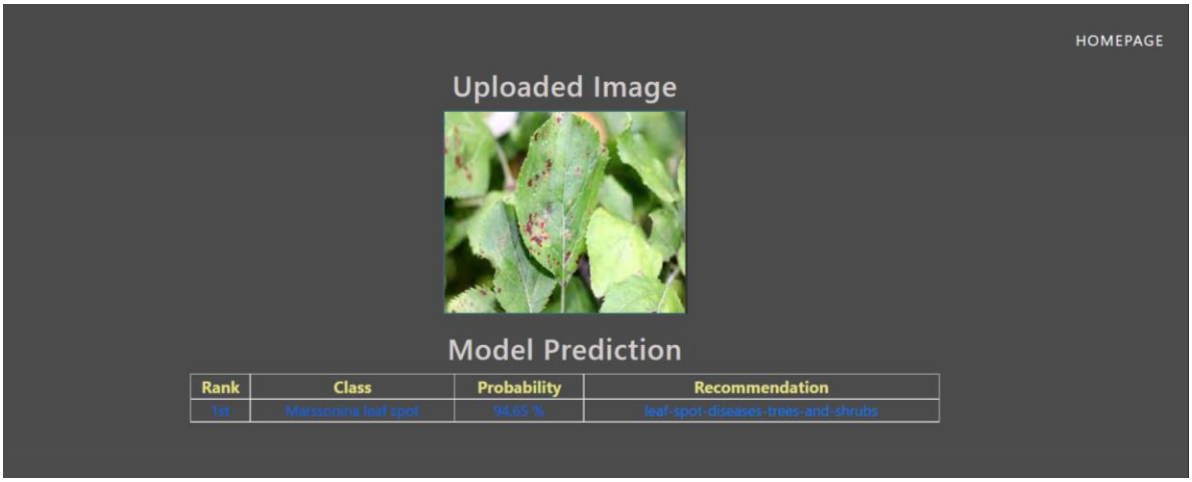


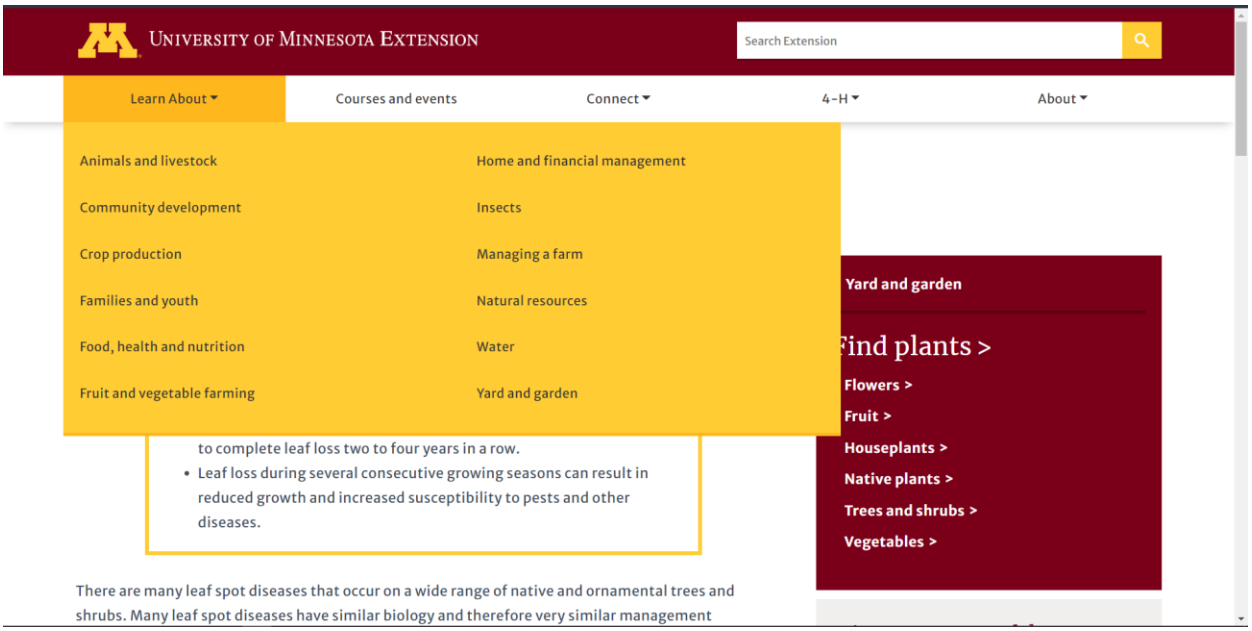

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:47: UserWarning: `Model.predict_generator` is depreca
Confusion Matrix
Normalized confusion matrix
Classification Report
```

	precision	recall	f1-score	support
Apple___Black_rot	0.98	1.00	0.99	181
Apple___healthy	0.99	1.00	1.00	445
Corn_(maize)___Northern_Leaf_Blight	1.00	1.00	1.00	217
Corn_(maize)___healthy	1.00	1.00	1.00	301
Peach___Bacterial_spot	0.99	0.99	0.99	493
Peach___healthy	1.00	0.98	0.99	49
Pepper,_bell___Bacterial_spot	0.97	0.92	0.94	317
Pepper,_bell___healthy	0.94	0.99	0.97	448
Potato___Early_blight	0.96	1.00	0.98	300
Potato___Late_blight	0.92	0.96	0.94	290
Potato___healthy	0.97	0.71	0.82	52
Tomato___Bacterial_spot	0.96	0.99	0.97	667
Tomato___Late_blight	0.96	0.95	0.96	599
Tomato___Leaf_Mold	0.96	0.91	0.94	322
Tomato___Septoria_leaf_spot	0.94	0.92	0.93	421
accuracy			0.97	5102
macro avg	0.97	0.95	0.96	5102
weighted avg	0.97	0.97	0.97	5102

User Interface Result:







ADVANTAGES & 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.

- Traditionally, people used to guess the plant disease by visually examining symptoms such as curling of leaves and change of color. But with the help of scientific advancements, this application helps people to get more clarity regarding the diseases and an accurate fertilizer recommendation.

- As a result, farmers especially do not need significant knowledge on all the diseases and fertilizers. They can make use of the application in order to determine the appropriate and effective fertilizers for their affected crops.

- Essentially, farmers can anticipate any problems or abnormalities and obtain the results online instantly. Moreover, financial losses due to widespread infections leading to poor crop yield can be reduced effectively.

- The application mainly focuses on helping farmers who need a recommendation on usage of best fertilizers for the predicted disease on their crops thereby helping them improve the crop yield. The spread of diseases due to improper guidance can be avoided by early identification of these diseases and usage of appropriate fertilizers.

Disadvantages:

- Requires training the system with a 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.

- The Deep Learning model requires extremely high time complexities due to the enormous amounts of data utilized by the model for training and testing purposes. As a result, these time complexities affect the performance of the model on training and validation datasets.

- The application requires the availability of a good quality internet connection for obtaining results, which is yet another struggle in a developing country like India in remote areas. Moreover, the images of the crop should be captured using a device that meets the availability of a minimum suggested pixels in order to capture the images of the affected crop with greater clarity for accurate identification.

- Lastly, this application is built basically for identifying a set of diseases targeting fruits and vegetables having 6 classes and 9 classes respectively. However, the sky's the limit to such diseases that farmers may or may not have a fair knowledge of.

Thus handling various classes of diseases in both fruits and vegetables is an extremely challenging task that takes a prolonged period in order to collect training and validation data and subsequently train and test the model

CONCLUSION:

The proposed model employs Deep Learning techniques in order to identify diseases observed both in fruits and vegetables and suggest appropriate fertilizers that can be taken for those diseases. In this image classification problem, during model training it was observed that increasing the convolutional layers as well as the Dense layers resulted in significant improvement in accuracies during evaluation. However, the time complexities are extremely high and may take up to a few hours for model training and testing purposes. The model trained in IBM Watson Studio cloud platform using Machine Learning Client was observed to produce results with greater accuracies during model training in addition to relatively better time complexities compared to model built and trained in the local system using Anaconda. Subsequently, the trained model is integrated with the web application using a light-weight framework that is open to all the end users. The core strategy of this project is to predict the crop based on the soil nutrient content and the location where the crop is growing. This system will help the farmers to choose the right crop for their land and to give the suitable amount of fertilizer to produce the maximum yield. The Support Vector Machine algorithm helps to predict the crop precisely based on the pre-processed crop data. This system will also help the newcomers to choose the crop which will grow in their area and produce them a good profit. A decent amount of profit will attract more people towards agriculture. Hence, a system that takes in images as user input, analyzes those for certain symptoms and identifies the disease, recommends the fertilizer to counter the deficiency of the nutrients is built and deployed.

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.This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such as vegetables and fruits. Additionally, helpline support for resolving app related issues can address problems and challenges commonly faced by farmers. Service availability depends on the plans devised and subscribed by the farmers. Moreover, the services provided can be used on a large or small scale, making it practical for farmers as well as common people. Future diseases that are found and the preventative fertilizer for them can easily be incorporated into the current model, making it highly scale.

APPENDIX:

Source:

Github Link:

https://github.com/IBM-EPBL/IBM-Project-34583-1660238989