SYSTEM DESIGN

SYSTEM DESIGN AND METHODOLOGY

In the automation of multiple processes, machine learning plays a critical role. The proposed architecture was designed with that goal in mind, and it is based on machine learning methodologies. Especially in the case of detecting and categorizing images into various disease categories. This section has been structured such that the topic begins with the device specifications and data acquisition for the data used in the currently suggested approach using Keras and TensorFlow. The second point of discussion would be CNN (Convolution Neural Network). Image augmentation and image pre-processing would be the next thing to focus on. The fourth point of discussion would be Adam (Optimization algorithm).

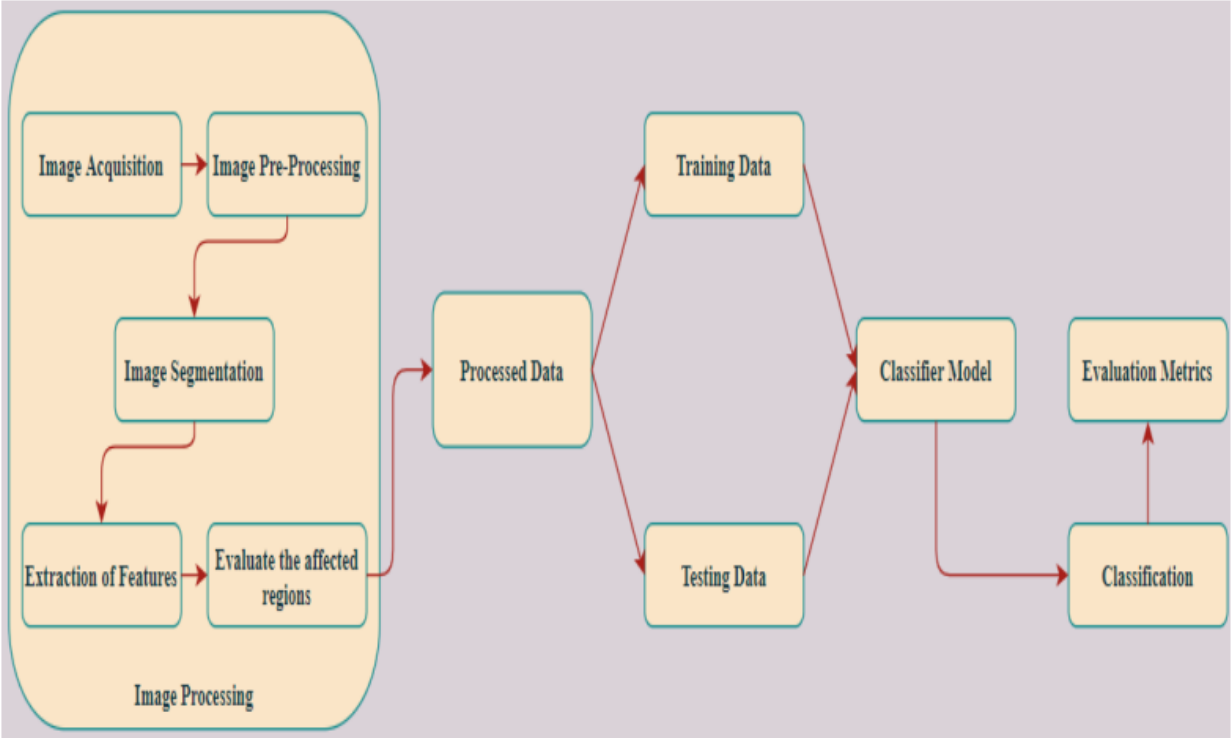


Figure 1. Flow Chart of the Machine Learning Methodology

1) Keras

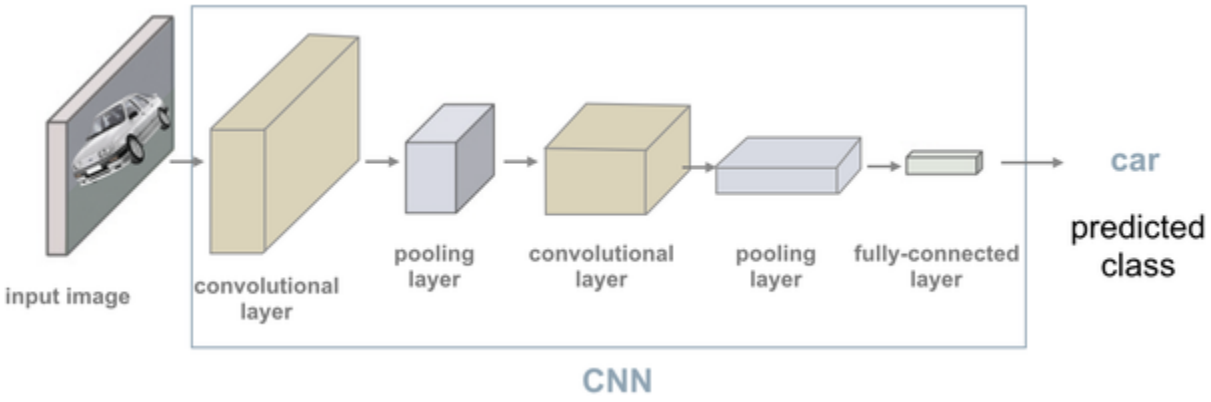
Keras is a high-level, deep learning API developed by Google for implementing neural networks. It is written in Python and is used to make the implementation of neural networks easy. It also supports multiple backend neural network computation. Keras has features such as:
a) It runs smoothly on both CPU and GPU. b) It supports almost all neural network models.

2) TensorFlow

TensorFlow is an open-source library developed by Google primarily for deep learning applications. It also supports traditional machine learning. TensorFlow was originally developed for large numerical computations without keeping deep learning in mind. However, it proved to be very useful for deep learning development as well. TensorFlow accepts data in the form of multi-dimensional arrays of higher dimensions called tensors. Multi-dimensional arrays are very handy in handling large amounts of data.

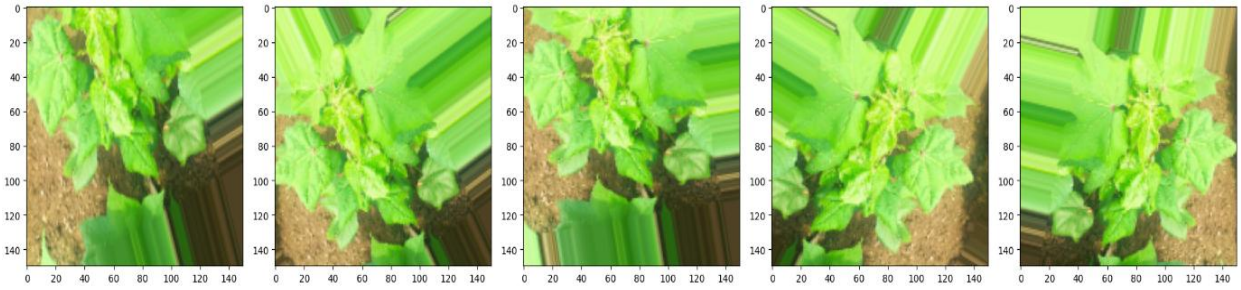
3) CNN (Convolution Neural Network)

A Convolutional Neural Network (CNN) is a type of Deep Learning architecture commonly used for image classification and recognition tasks. Convolutional neural networks are distinguished from other neural networks by their superior performance with image, speech, or audio signal inputs. They have three main types of layers, which are: 1) Convolutional layer 2) Pooling layer 3) Fully-connected (FC) layer. With each layer, the CNN increases in its complexity, identifying greater portions of the image. Earlier layers focus on simple features, such as colors and edges. As the image data progresses through the layers of the CNN, it starts to recognize larger elements or shapes of the object until it finally identifies the intended object.



4) Image Augmentation

Image augmentation is a technique of applying different transformations to original images which results in multiple transformed copies of the same image. Each copy, however, is different from the other in certain aspects depending on the augmentation techniques you apply like shifting, rotating, flipping, etc. These image augmentation techniques not only expand the size of your dataset but also incorporate a level of variation in the dataset which allows your model to generalize better on unseen data. Also, the model becomes more robust when it is trained on new, slightly altered images.



5) Image Pre-Processing

The use of computer algorithms to perform image processing on digital images is known as image pre-processing. We can detect the plant by analyzing the image with a specific algorithm. We use a similar approach for image processing and detection with a specific algorithm. The image quality is critical in this process; we can't use the algorithm if the image isn't clear.

6) Adam (optimization algorithm)

Adam is an optimization algorithm that can be used instead of the classical stochastic gradient descent procedure to update network weights iterative based in training data. The algorithm is called Adam. It is not an acronym and is not written as “ADAM”. *The name Adam is derived from Adaptive Moment Estimation.* Some of the attractive benefits of using Adam are, straightforward to implement, computationally efficient, little memory requirements.

ACCURACY

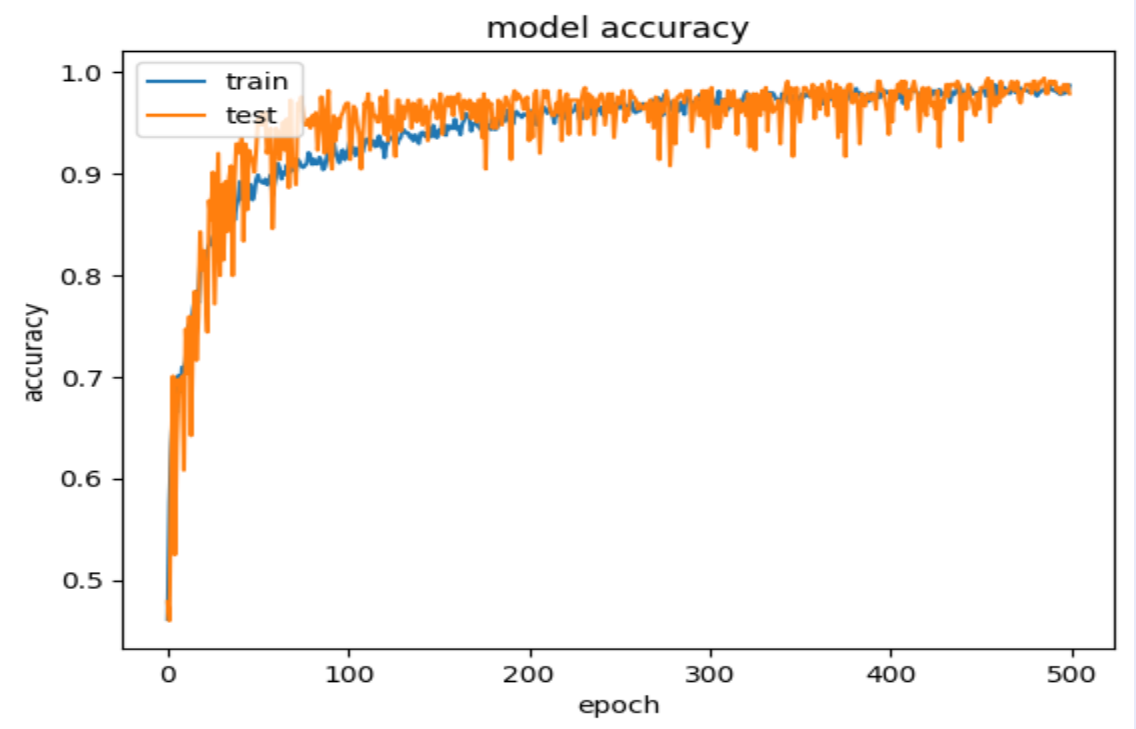
Crop_Disease_Predictor_Model_Training.ipynb

Crop_Disease_Predictor_Model_Training.ipynb > Crop Disease Predictor Model Training

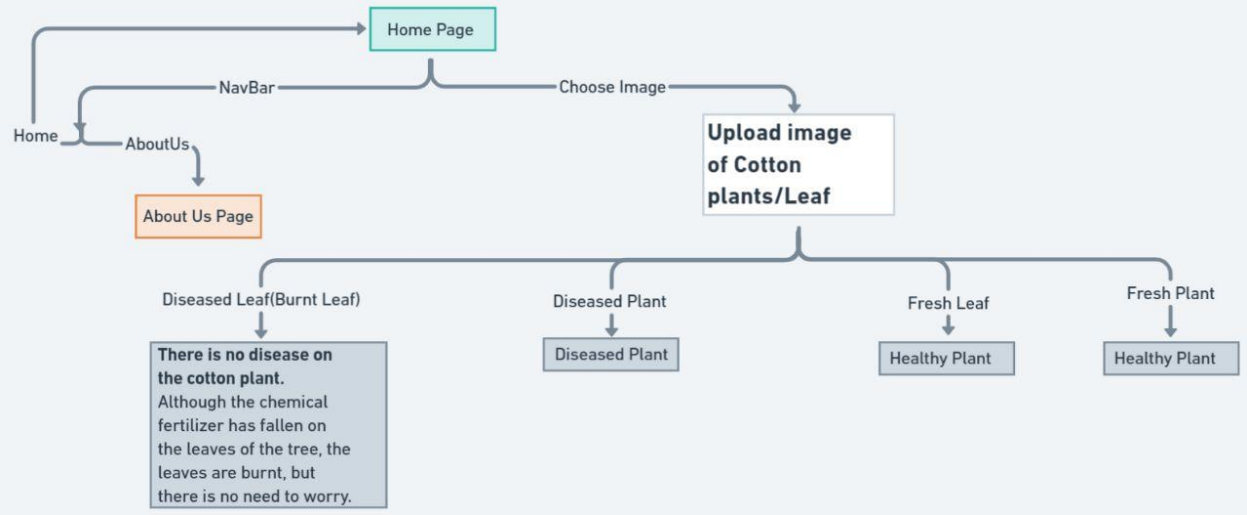
+ Code + Markdown | Run All | Clear All Outputs | Outline ···

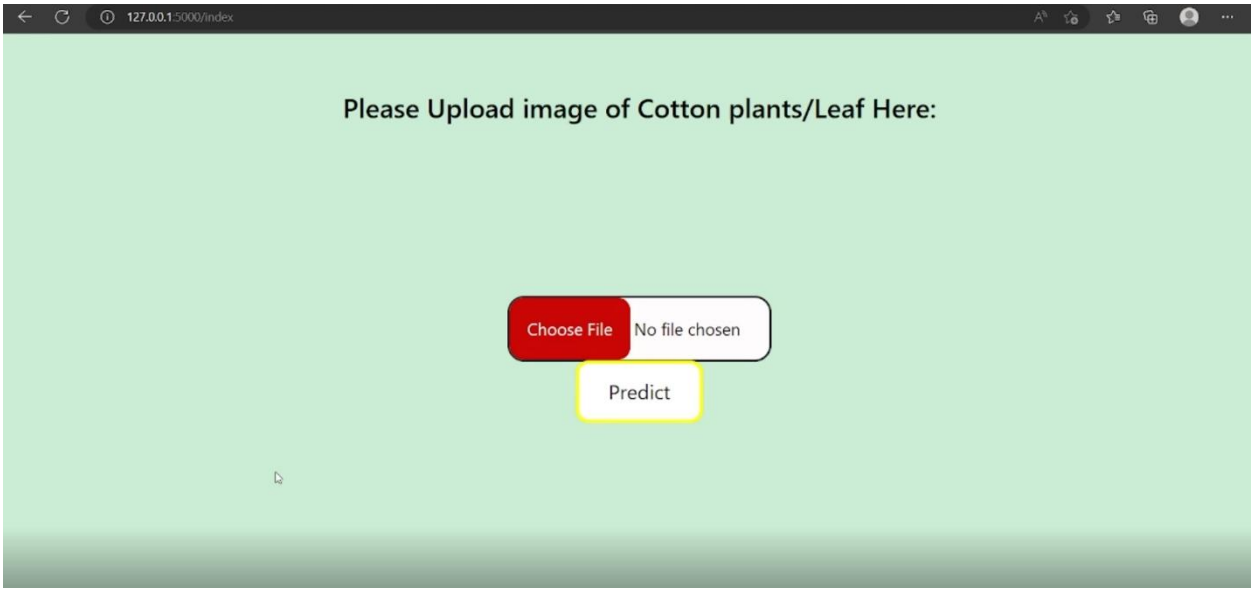
[11]

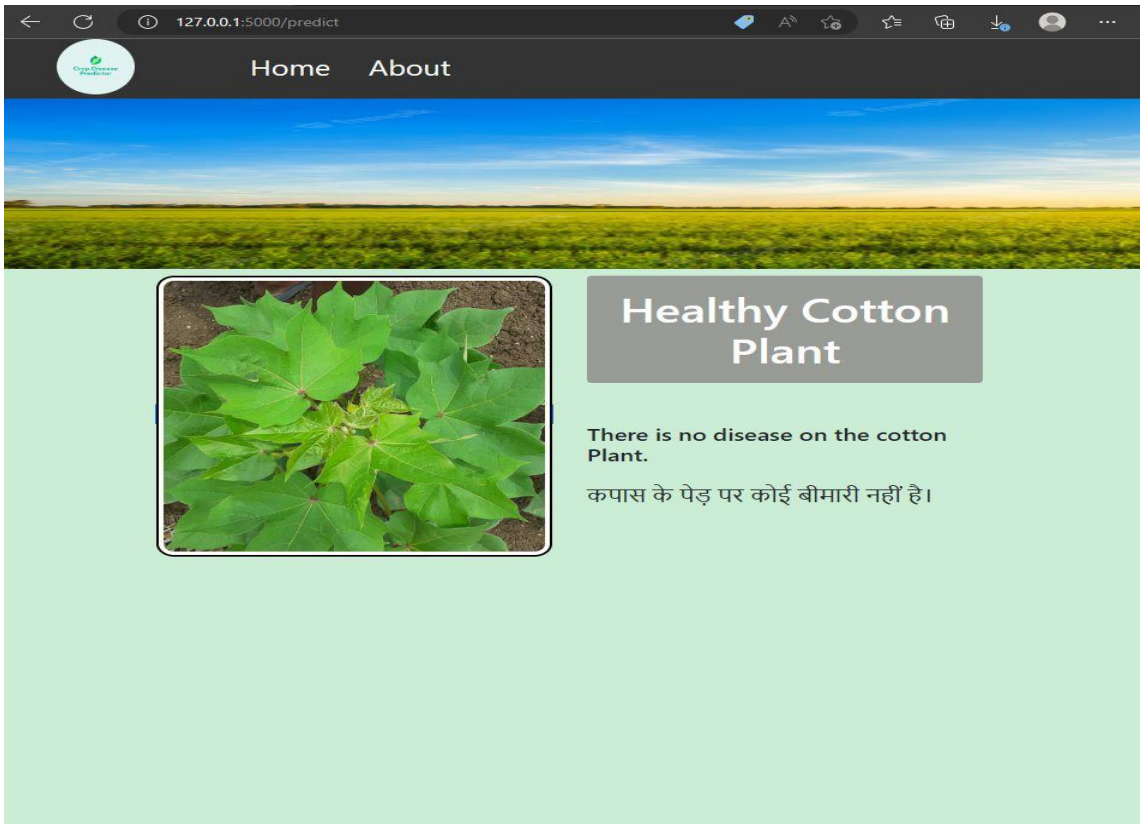
```
Output exceeds the size limit. Open the full output data in a text editor
Epoch 1/500
61/61 [==============================] - ETA: 0s - loss: 1.2330 - accuracy: 0.4613
Epoch 1: val_accuracy improved from -inf to 0.47840, saving model to D:\Plant Disease Predictor\Project\Project\Trained Model\cotton_plant_dis
61/61 [==============================] - 47s 762ms/step - loss: 1.2330 - accuracy: 0.4613 - val_loss: 1.0473 - val_accuracy: 0.4784
Epoch 2/500
61/61 [==============================] - ETA: 0s - loss: 1.0269 - accuracy: 0.5761
Epoch 2: val_accuracy did not improve from 0.47840
61/61 [==============================] - 33s 540ms/step - loss: 1.0269 - accuracy: 0.5761 - val_loss: 1.0837 - val_accuracy: 0.4599
Epoch 3/500
61/61 [==============================] - ETA: 0s - loss: 0.9124 - accuracy: 0.6325
Epoch 3: val_accuracy improved from 0.47840 to 0.61728, saving model to D:\Plant Disease Predictor\Project\Project\Trained Model\cotton_plant_
61/61 [==============================] - 33s 545ms/step - loss: 0.9124 - accuracy: 0.6325 - val_loss: 0.8947 - val_accuracy: 0.6173
Epoch 4/500
61/61 [==============================] - ETA: 0s - loss: 0.8270 - accuracy: 0.6709
Epoch 4: val_accuracy improved from 0.61728 to 0.70062, saving model to D:\Plant Disease Predictor\Project\Project\Trained Model\cotton_plant_
61/61 [==============================] - 33s 545ms/step - loss: 0.8270 - accuracy: 0.6709 - val_loss: 0.7643 - val_accuracy: 0.7006
Epoch 5/500
61/61 [==============================] - ETA: 0s - loss: 0.8272 - accuracy: 0.6689
Epoch 5: val_accuracy did not improve from 0.70062
61/61 [==============================] - 33s 541ms/step - loss: 0.8272 - accuracy: 0.6689 - val_loss: 1.1228 - val_accuracy: 0.5247
Epoch 6/500
61/61 [==============================] - ETA: 0s - loss: 0.8441 - accuracy: 0.6648
Epoch 6: val_accuracy did not improve from 0.70062
61/61 [==============================] - 33s 541ms/step - loss: 0.8441 - accuracy: 0.6648 - val_loss: 0.8532 - val_accuracy: 0.6327
Epoch 7/500
...
Epoch 500/500
61/61 [==============================] - ETA: 0s - loss: 0.0436 - accuracy: 0.9867
Epoch 500: val_accuracy did not improve from 0.99383
61/61 [==============================] - 34s 561ms/step - loss: 0.0436 - accuracy: 0.9867 - val_loss: 0.0722 - val_accuracy: 0.9784
```

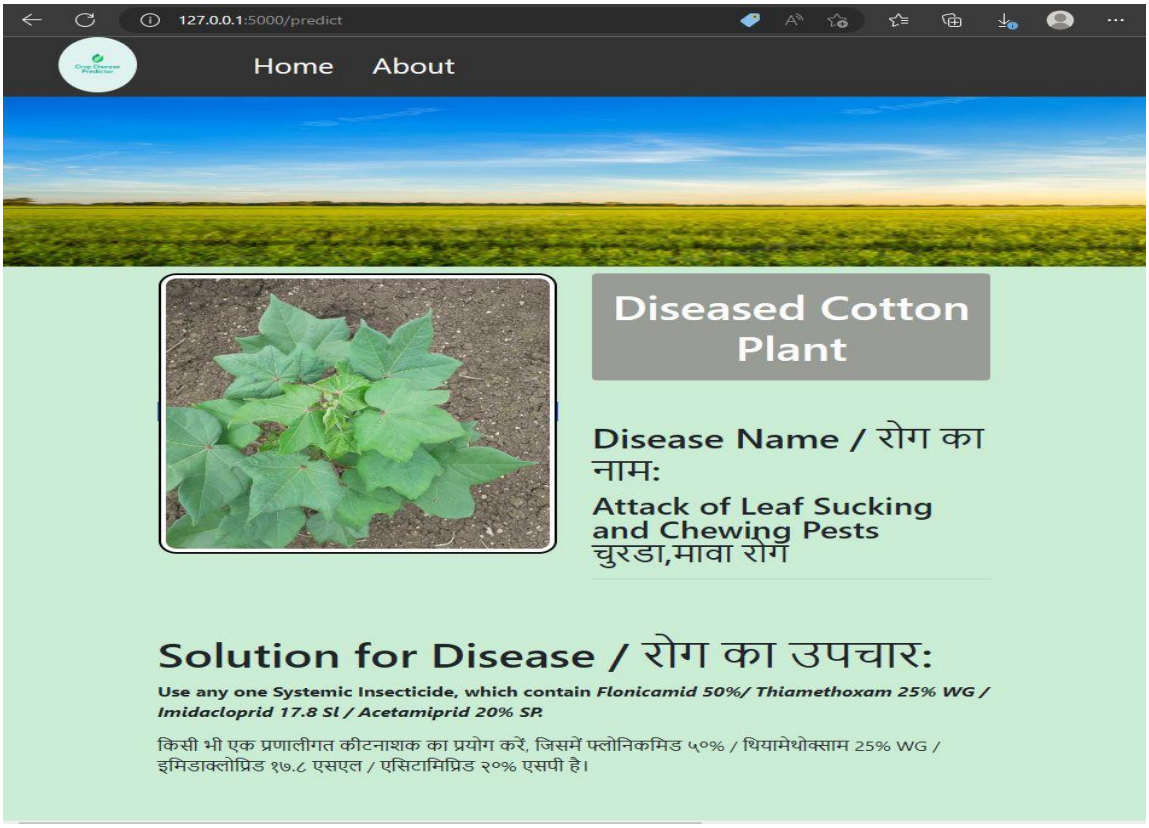


OUTPUT


Home Page
NavBar
Choose Image
Home
AboutUs
About Us Page
Upload image of Cotton plants/Leaf
Diseased Leaf(Burnt Leaf)
Diseased Plant
Fresh Leaf
Fresh Plant
There is no disease on the cotton plant. Although the chemical fertilizer has fallen on the leaves of the tree, the leaves are burnt, but there is no need to worry.
Diseased Plant
Healthy Plant
Healthy Plant


127.0.0.1:5000/index
Please Upload image of Cotton plants/Leaf Here:
Choose File
No file chosen
Predict


127.0.0.1:5000/predict
Home
About
Healthy Cotton Plant
There is no disease on the cotton Plant.
कपास के पेड़ पर कोई बीमारी नहीं है।


127.0.0.1:5000/predict
Home
About
Diseased Cotton Plant
Disease Name / रोग का नाम:
Attack of Leaf Sucking and Chewing Pests
चुरडा,मावा रोग
Solution for Disease / रोग का उपचार:
Use any one Systemic Insecticide, which contain Flonicamid 50%/ Thiamethoxam 25% WG / Imidacloprid 17.8 Sl / Acetamiprid 20% SP.
किसी भी एक प्रणालीगत कीटनाशक का प्रयोग करें, जिसमें फ्लोनिकमिड ५०% / थियामेथोक्साम 25% WG / इमिडाक्लोप्रिड १७.८ एसएल / एसिटामिप्रिड २०% एसपी है।