IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

State Level Conference – AITCON 2K24

Adarsh Institute of Technology & Research Centre, Vita, Maharashtra

Vol. 11, Special Issue 1, March 2024

Plant Diseases Detection & Remedy Recommendation System

Nikhil Gopal Khodave[1], Namrata Nikhil Patil[2], Sanika Jitendra Kamble[3], Akshata Mohan Pawar[4]

Lecturer, Dept. of Computer Engineering (Diploma), Rajarambapu Institute of Technology, Islampur, India.[1]

Lecturer, Dept. of Computer Engineering (Diploma), Rajarambapu Institute of Technology, Islampur, India.[2]

Student, Dept. of Computer Engineering (Diploma), Rajarambapu Institute of Technology, Islampur, India.[3]

Student, Dept. of Computer Engineering (Diploma), Rajarambapu Institute of Technology, Islampur, India.[4]

Abstract: Plant disease is an ongoing challenge for smallholder farmers, which threatens income and food security. Diseases found in agricultural crops are a major threat that causes production and economic losses as well as reduction in both quality and quantity of agricultural products. The recent revolution in smartphone penetration and computer vision models has created an opportunity for image classification in agriculture. The aim of this project is to detect unhealthy regions plant leaves & to give the remedy information to the user. In this project we can classify the plant diseases using texture features. This service will be available on Mobile App which runs on low level configuration devices.

Keywords*:* CNN- Convolutional Neural Network, ML-Machine Learning, DL-Deep Learning, OpenCV.

I. INTRODUCTION

There are a large number of farmers in India that grow a wide variety of crops. Agriculture is the key industry and the primary source of employment for most people. In terms of agricultural output, India is second only to the United States. A large number of individuals are either directly or indirectly reliant on the agriculture sector's output. To ensure the long term viability of the country, it is essential to produce high-quality agricultural products. There are a number of variables that can affect crop productivity.

Leaf disease is another big danger to food security. It degrades product quality and lowers harvest yields. Diseases in leaves are spread by microorganisms such as insects, pests, fungi, bacteria, and viruses. The entire plant is harmed when they consume the top and bottom of the leaf. There must be an early detection of leaf diseases for future agricultural losses to be avoided. In turn, this boosts the economy by increasing food yields, which in turn helps farmers. It is critical to determine the health of the plant. The illness can be identified by looking at the diseased leaves.

Patches of irregularly shaped black pigment form on the leaf's surface, and fungus can grow in these patches if they are humid. Initially, these spots are minor, but with time, they spread to cover the entire leaf, causing it to decay. A precise window of time must be allowed for the accurate detection of leaf diseases, i.e., at the initial stage, before the basic functions of plants, such as pollen transport and fertilizer absorption is compromised.

II. NEED OF PROJECT

One of the major sources of yield in India is the production of crops. It is of enhancing the technological advancement in the fields related to crop productivity. Here farmers cultivate a maximum diversity of plants and crops. More studies are built with the important domain of qualitative and efficient farming is concentrated on enhancing the yield and food crop productivity at a minimum time with a greater outcome.

The detection of plant disease by human visualization is a more difficult task and at the same time, less efficient, and it's done with a limited set of leaf images and takes more time. Whereas the automatic identification technique will take less effort and time and a more accurate program. Here we use image processing to detect the diseases. We can put the image into a system and a computer can perform various phases for identification and detect the related classes to which that image belongs. This work aims to make a leaf recognition technique based on the specific characteristics derived from images.

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III. PROBLEM DEFINITION

Farmers are unable to detect crop diseases due to a lack of knowledge and old practices, which often result in soil nutrient deterioration and exhaustion. As a result, crop failure occurs. Growing only certain crops depletes the soil, and if the crops are harmed by illnesses, farmers are uninformed of how to recover such crops. Hence, it is essential to provide the system which will help them to detect diseases of plants & recommend them a correct remedy.

Fig 1. Various Diseases and viruses on crops

IV. METHODOLOGY TO SOLVE THE PROBLEM

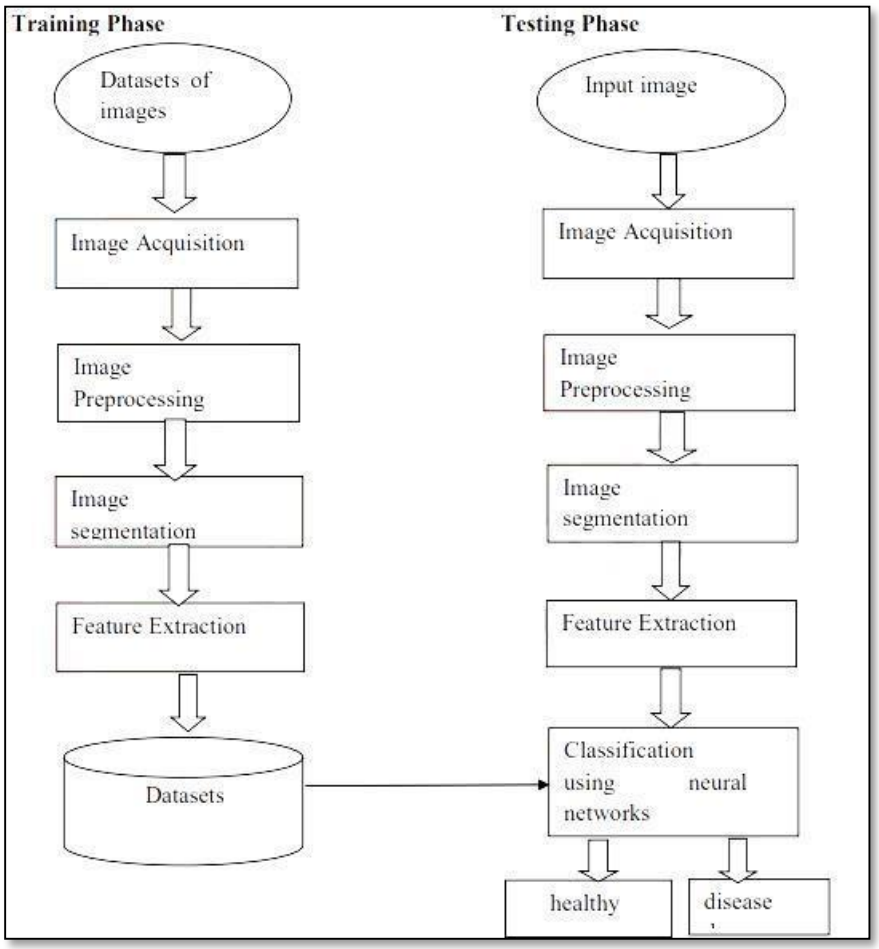

Fig 2. System Architecture

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This area includes the implementation steps and methods consisting of creating and deploying identification, classification techniques. For classification, here we use efficient convolutional neural networks (CNN) algorithm. Here we have two folders train and test.

Training used for building the system on plant leaves and test consists of testing the system and detecting the accuracy of the work. First of All, import the necessary packages like OpenCV, NumPy, TensorFlow, tqdm, matploatlib, etc. Here defining the first function for label images. The developed model builds with four classes of classification.

Next, create a function for loading the training data. Training data load images from our folder then resize it. Here resizes the image with a resolution of 256*256. After resizing append the images and corresponding labels to the list. Testing data build with same as mentioned in above fig 1.

A. Dataset

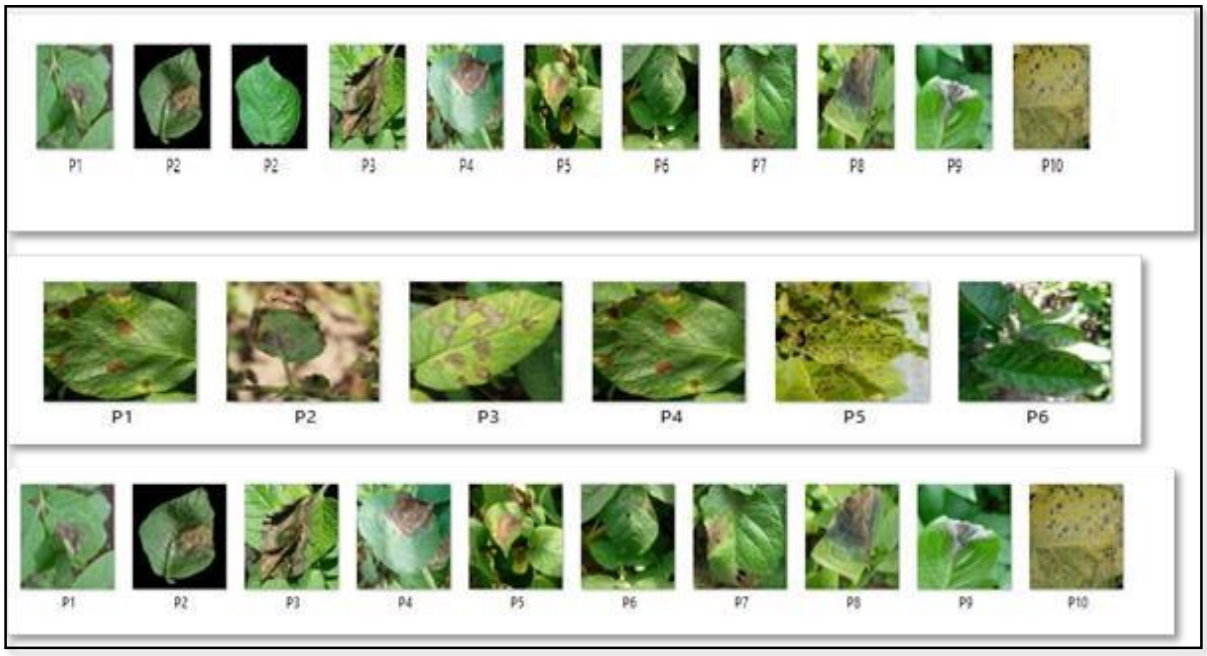

Fig 3. Sample Data set

B. Training and Testing Algorithm

The last step in our processing of the leaf phase is the testing of various images and identifying the diseases. The algorithm used in the classification program is CNN. CNN consists of a complex network chain that extracts the characters in the images and classifies them to get specified results related to the input. Neural networks build with many layers like the input layer, convolutional layer, output layer, and fully connected layer.

The Convolutional layer can add more layers to it. Firstly, we load the input data and create the convolution layer. Each layer consists of an activation function. Together with the convolutional neural network, we add a pooling function. Here five convolutional layers build, with corresponding pooling is added. At the end of each layer take the fully connected layer and give a softmax activation function. Finally, the regression layer is used for receiving the result and using the optimizer. Another important parameter is learning rate (LR) which represents the speed at which one learns the model. Here we set the learning rate as 1.e-3. After the model building, load the data in the model. Training data convert for x and y. x is the image and y defines the label. We use the variable for the model to represent healthy and unhealthy. Finally, give the data for the model and detect if it is healthy or diseased.

CNN algorithm is more efficient for dividing a huge amount of data and it can be described as an efficient machine learning algorithm. As it is building on finding solutions to classification and identification tasks. It can be learning characters automatically on the dataset. This algorithm analyses visual leaves more efficiently. The structures of this algorithm change dramatically. The quality and type of training data collectively impact the capabilities of the model. Classifier accuracy depended on the data. Classification is made with the nature of their primary causal agent, either infectious or healthy.

1) **Algorithm :**

Input: Providing an image of leaves localization
Output: classification of a review into healthy or diseased,it is diseased provides the remedies for overcoming the deficiency.
Step 1: Start
Step 2: prepare a database (healthy or diseased)
Step 3: preprocessing normalization
Step 4: Train CNN
Step 5: real images from Google or dataset
Step 6: pre-processing
Step 7: test network
Step 8: if the probability of healthy >probability of unhealthy display a healthy leaf, otherwise display a diseased leaf.
Step 9: go to the fourth step
Step10: stop.

V. CONCLUSION

Farmers are unable to detect crop diseases due to a lack of knowledge and old practices, which often result in soil nutrient deterioration and exhaustion. As a result, crop failure occurs. Growing only certain crops depletes the soil, and if the crops are harmed by illnesses, farmers are uninformed of how to recover such crops. Hence, the system developed will be capable to detect diseases of plant & suggest the proper remedy to it. Overall, this study is conclusive in demonstrating how CNNs may be applied to empower small-holder farmers in their fight against plant disease.

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