Disease Detection in Agricultural Crops Using AI

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***Abstract*:** India is a country whose population depends on the agriculture majorly as its primary source of income. Production of crops is one of the major problems and to detect the disease of the leaf which is infected. Manual detection of disease in crops at early stage is highly difficult. To avoid difficulties in disease detection, Machine learning methods are highly used to protect the leaf from diseases. In this project our system works on pre-processing, leaf image extraction and using CNN the disease is detected and by using Random Forest we recommend the useful pesticide for the leaf diseases. The dataset is of potato, tomato corn and grape leaves collected from the village. Pesticide recommendation is updated version from all the previous cases.

***Keywords*: Leaf Disease, CNN, Random Forest, Pesticide**

1. Introduction

India is the land of agriculture and nearly almost 68% of the Indian population is dependent on it. The agricultural contribution towards the growth of the Indian economy is only about 18-20%, because of a very harsh climatic conditions, lack of the periodicity in rainfall, infectious crop diseases, invasion of the crop pests etc. Among all these problems, crop diseases alone contribute to the major loss of the agriculture productivity. Hence, it is very much necessary and important to identify the leaf disease in its early stages of infection so that we can prevent the further spread of the disease and loss in the yield of the crop.

Here in this project image processing and CNN algorithm is used for disease detection in Potato, Tomato, Corn, Grapes. Usually, disease can be detected using crop leaf, stem and fruit. In our project we mainly focus on the crop leaf. The system work implemented by us is image processing and CNN algorithm for the detection of disease present in the leaf. After disease detection recommending the proper pesticide will help in increasing the productivity of the crops. Monitoring of plant's health and early disease identification is main key for the sustainable farming. Manual Monitoring on the crops and early disease detection is very difficult. It requires a large amount of practical knowledge in the field and should be expert in disease detection and requires a lot of time. Thus, image processing technique can be used to predict disease of the leaf and the main part is the proper recommendation of the pesticide which is needed for the proper growth and to increase the productivity.

2. Methodology

Methodology is nothing but the systematic and the theoretical analysis method that are applied in the field of the study. It also includes methods of theoretical analysis of the body and principles that are very much associated with the branch of knowledge. Presently, there are many methods in disease detection but most effective is Artificial Neural Network and K-means. In this project we proposed our system work using Convolution Neural Network for disease detection. In this project we also recommend the pesticide for the diseased crops. In this proposed system work we mainly check the leaf is healthy or unhealthy. If it is unhealthy then name of the disease that has infected the leaf has to be displayed and using other remaining parameter the pesticide is recommended for the proper growth of the crop.

As Farmers monitor their crops daily which will help is early detection of the disease and not applying or spraying hazardous chemicals or pesticides. If some leaves are prune to disease, then applying the recommended pesticide from the application can help to cure the disease and help to increase the productivity of the crops.
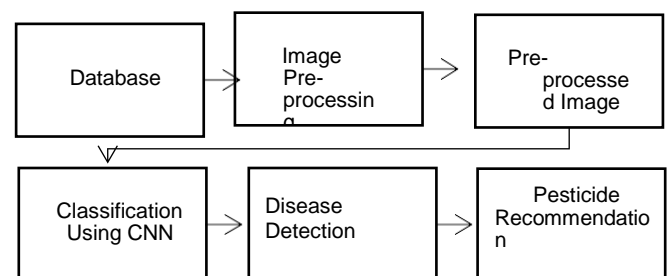

Fig. 1. Block diagram of disease detection.

Figure 1 depicts the Block diagram of the project. When the leaf image is fed to the system then the system performs all the required task and will display the result which is nothing but the leaf disease status and also help in solution for the disease that is the pesticide which may be useful in curing the disease of the crop and increasing the crop yield.

The Step for identification and classification of the diseased leaf using image processing is shown in the Figure 2.
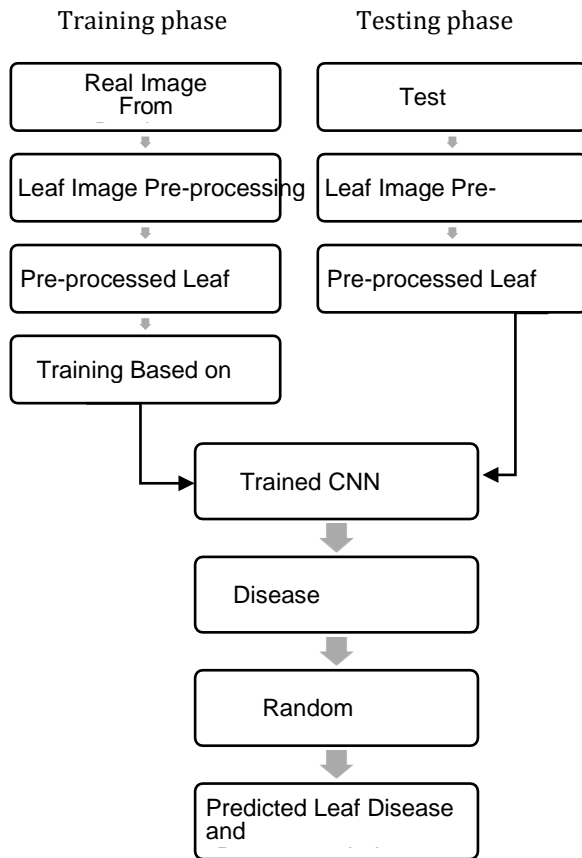

Fig. 2. Flow chart of Disease Detection System

The proposed system is used for the disease detection in crops like Potato, Tomato, Corn, Grapes. This system is going work by capturing and processing the image to improve its quality and appearance. The system consists two set of database one is training and other is for validation. Extraction takes place on both the set of database. Both the extracted and permanent features are compared to each other while testing.

Image Acquisition:

In training phase, the image required for the system work is collected from the database. In Real time, during the testing phase the image can be fed through the gallery which they have captured from their camera. The captured leaf image usually will be in the form of RGB. We suggest the farmers to more precisely focus the camera at the diseased part of the leaf for good results.

Image Pre-processing:

Image pre-processing is technique used to resize the leaf images in proper dimension. In this pre-processing we resize our leaf images to 150 x 150 dimensions. It is usually done so that all the images are in the single dimension which will help the algorithm to process effectively. The images fed to the algorithm is usually a colored image so no need for the color conversion. After all this, the image will be sent to CNN model for training and validating purpose.

Convolutional Neural Network:

After the pre-processing of image is done, Convolutional Neural Network is used for training the leaves. After the training we get the trained model of leaf diseases.

In this Convolutional Neural Network, we use some layers to train the model and they are

- Convolutional layer (Conv2D)

- Pooling layer (MaxPooling2D)

- Dropout layer

- Flatten layer

- Dense layer

- Dropout layer

- Activation layer (relu and softmax)

Tensor flow is the one that helps in writing the CNN. After the pre-processed image it is sent to the trained model. The possible outcomes are healthy leaf or unhealthy leaf. If the leaf is unhealthy then it will also display the disease which the leaf has been infected.

Pesticide Recommendation:

Pesticide can be recommended using the data about the crop, humidity, rain, ph, N, P, K values. The crop disease and remaining parameters are used in the random forest algorithm to recommend the useful pesticide to the crops.

Random Forest:

Random Forest is the supervised method of machine learning algorithm which is based on the ensemble learning method. Ensemble learning is joining of different algorithm types or the similar algorithm more times so as to form a most accurate prediction model. It is basically learning method for the classification and problems related to regression.

Advantages:

- The algorithm used is not a biased one and the multiple trees present here are trained each on a subset of data.

- The algorithm used is very much stable and if there are any additional entries of data then the algorithm is not affected.

After completing the whole process that is training and

Pesticide that are recommended for the diseased leaves are given below:

Name of the Disease	Name of the pesticide
Early Blight of Tomato	Azoxystrobin
Late Blight of Tomato	Mandipropamid
Early Blight of Potato	Metconazole
Late Blight of Potato	Bordeaux mixture + mandipropamid and azoxystrobin
Bacterial spot of Tomato	Copper Oxychloride
Corn Blight	Picoxystrobin
Common rust of Corn	Pyraclostrobin
Gray leaf of Corn	Pyraclostrobin + Strobilurin
Black Rot of Grapes	Imidacloprid
Leaf Blight of Grapes	Propiconazole

Table 1: Diseases and their pesticide

3. Conclusion

The algorithm which we have developed is to identify the diseases in crops like potato, tomato, corn and grapes. CNN algorithm is mainly used for the disease classification. The overall efficiency achieved in disease detection is 97% using CNN. A better image enhancement technique will definitely help in increasing the efficiency of disease detection of the crop. After the identification of the disease, recommending the pesticide for the diseased leaf is the main solution to the farmers. This is the conclusion we have drawn from this method.

In this system work, the training dataset includes 2000-3000 images of one particular disease. If we increase the images in the dataset then the efficiency in disease detection can be increased. The solution which is been provided in this system frame work is common for all the farmers irrespective of the regions. By considering all the surrounding parameters like humidity, ph, rainfall, N, P, K values we can increase the productivity as more expected from the farmers.

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testing, the system work provides the most accurate result about the disease and also proper recommendation of pesticide. After training the model of crops like Potato, Grapes, Tomato, Corn the efficiency is 99,98,98,98 respectively.

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