Accuracy of Machine Learning Models for Plant Disease Detection

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ABSTRACT

Agriculture is the backbone of a nation. India has about 96 million hectare of irrigated land. With the amount of land that is cultivated as farmland, detection and prevention of diseases in crops is paramount. When diseases affect plants, particularly through their leaves it effects the production of agricultural produce and decreases profitability of a given crop. Timely identification of these diseases is very challenging in affected plants. A reliable and fast way for the detection of diseases is necessary. Detecting disease may be a key to stop agricultural losses. The aim of this is to develop a software system that is able to efficiently find and classify diseases occurring in plants. The pictures of leaves can be used for detecting the plant diseases. Therefore, use of image process technique to find and classify diseases in agricultural applications is useful.

Keywords: *Machine Learning, Models, Plant Diseases*

1. INTRODUCTION

Indian economy is highly dependent on agricultural productivity. A majority of the country's workforce is dependent on farming to provide employment. Over 70% of rural homes depend on agriculture. India exported about 38.49 billion dollars' worth of agricultural and processed food in the year 2019 alone. It contributes to about 17% of India's GDP. Therefore, early detection of diseases in crops plays a very important and instrumental role. The losses due to diseases can be reduced if the disease detection can be done early before it spreads uncontrollably throughout the crops and severally affects production from the fields. Most plant diseases cause visible changes to the leaves of the crops. We can use this to our advantage for early detection of diseases in these crops. A farmer needs a fast way to detect all types of diseases that can occur in plants. The traditional method of detection of diseases in plants though very accurate can be tedious and time consuming. By the time the disease is classified it may already be too late to save the crops at that stage. Therefore, using a digital method of disease detection we can reduce the

turnaround time. It can help salvage the crops before they are completely affected.

2. PLANT DISEASE TYPES

There are three main types of plant diseases. The diseases can occur because of bacteria, virus or fungus.
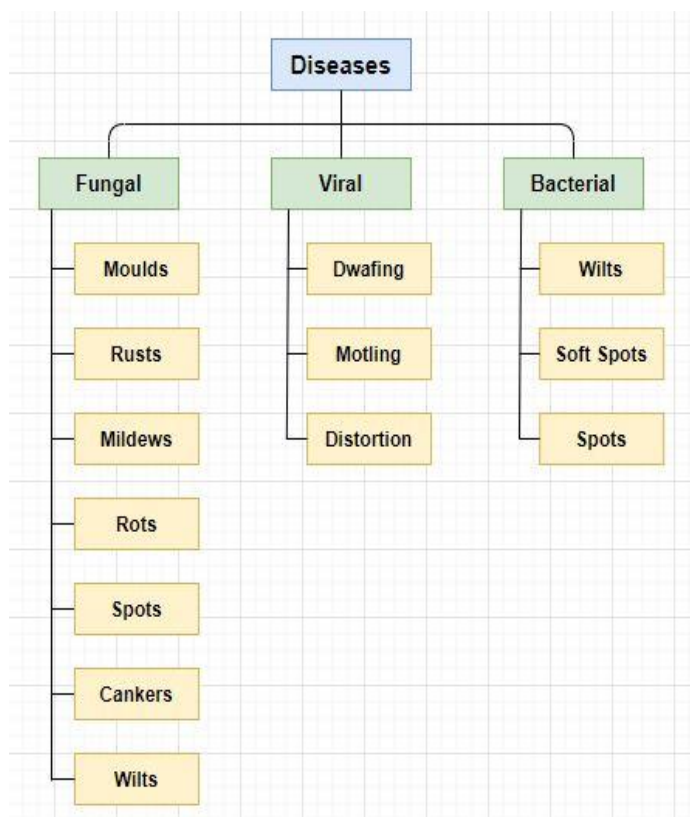

Fig. 1: Diseases in crops

Each disease has their own unique discoloration patterns. We can use these patterns to our advantage to classify these diseases. Each disease produces a unique pattern in how they

affect the plant. We can train a neural network model to recognize these patterns. Using the model, we will be able to predict and classify what disease that plant might have. We can use the images of leaves to perform the classification on. Leaves were chosen because it is one of the first parts of a plant to show signs of disease. Some diseases specifically target leaves. Therefore, using leaves to classify diseases is a very reliable technique. The traditional method of detecting diseases in crops is a very tedious process, which can take a week or two to be completed. Therefore, a digital method of classifying diseases is very helpful. Hence increasing the classification accuracy of the models is very important so that the models can be deployed. In this paper we can take a look at some methods we can use to increase the accuracy of these models.

3. METHODS OF INCREASING ACCURACY

a) **Increasing the Training Data**: Increasing the size of training can directly help increase the accuracy of the model. The more data the model can be trained with, more is the chance of it being very accurate classifier.

b) **Modifying Weights**: Modifying the weights of a   CNN model is very important to improve the accuracy. There is no set method to assign weights to a model. Trial and error is the only method to add weights. A number of iterations are needed to find the perfect weights to gain the required accuracy.

c) **Choosing the Right type of Neural Network**: Choosing the right type of neural network is very important. It can determine if a model will perform as expected or will have a number of drawbacks. Using a CNN (convolutional neural network) for images is recommended, as it is very efficient in processing three-dimensional data.

d) **Assigning the right Parameters**: Choosing the right parameters are very essential as it can make or break the model. The right type of parameters must be chosen to improve the accuracy of the model. If the wrong parameters are chosen for the model, the model can show false positives, which show high accuracy but in reality the accuracy of the model can be very low.

e) **Implementing the right amount of layers**: The number of layers determines how the model trains from the provided training data. The density of the layers also determines how well the model is able to learn from the data. The amount of layers and the composition of the layers depend on the kind of data being used.

f) **Data Augmentation**: Data augmentation is a very helpful tool for creating CNN models. Data augmentation is the process of increasing the diversity of data available for training models, without actually collecting new data. Shifting and rotating the images can do this. Data augmentation is useful especially if the size of the dataset is very small. The more data a model has to learn from more accurate the model will be.

4. CONCLUSION

A method of using image processing to detect diseases in crops can reduce the losses incurred by farmers due to diseases in crops. Therefore increasing the accuracy of the models used to classify the diseases is paramount. A high accuracy of the Machine Learning model means that images of leaves can be used to reliably predict the disease a given crop is suffering with.

5. REFERENCES

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