IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 2, March 2022
Impact Factor: 6.252

Leaf Disease Classification Using Machine Learning

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Abstract: *Agriculture production is extremely important to the economy of our country. Plant illnesses are fairly common, hence early diagnosis of diseases in plants is critical. The detection of these illnesses using an automated approach is advantageous because it decreases the amount of labour required to monitor vast farms of crops, such as those owned by MP farmers and Panjabi farmers, and it detects disease signs at an early stage. It first locates and captures the contaminated area before doing picture pre-processing. In this study, we are focused on a method that can assist farmers who cultivate potatoes who face significant financial losses each year due to a variety of illnesses that harm potato plants. The most common illnesses are Early Blight and Late Blight. Early blight is caused by fungus, but late blight is caused by certain microorganisms, and farmers may save a lot of waste and money if they discover the illness early and treat it properly. Because the treatments for early blight and late blight are slightly different, it's critical to correctly identify the disease in that potato plant. We'll employ Convolutional Neural Network - Deep Learning to diagnose behind the scenes. This will help farmers to gain the required result in very short span of time. This Will help in saving their time and money and also it will save the wastage of harmful pesticides on the farming land.*

Keywords: Classification, Convolutional Neural Network, Deep Learning, Machine Learning, FAST API.

I. INTRODUCTION

Food security and nutrition improvement are some of the significant challenges faced by the agricultural sector and Potatoes become one of the staple foods that are expected to be able to suffice these needs in terms of quantity and quality. They are rich in nutrients, most notably vitamins C and B6 and the minerals, potassium, magnesium, and iron [1]. Besides being a popular staple food in Indonesia, potatoes are the fourth most consumed vegetable crop in the world. Potato agricultural products in Indonesia have developed rapidly in this decade. Every year, the amount of production can reach around 850,000 tons. The amount is produced from an area of about 60,000 hectares. The area of planting and production has increased by approximately 10% per year, making Indonesia the largest potato producing country in Southeast Asia. However, potatoes can be affected by many diseases which affect both pre and post-harvest stage of the plant [2].

The presence of disease during this growth period can reduce the quality and quantity of agricultural products. Also, it can lead to harvest premature and harvest failure. These problems are mostly caused by the late identification of diseases in potato plants and mistakes in disease diagnosis.

Plant disease detection and prevention are big challenges for agronomists. As a result, early detection of plant diseases is critical in order to minimise future agricultural losses. It is critical to detect illnesses once they have infected the plants. This research focuses on not only detecting and diagnosing the sort of illness that has afflicted the plant, but also on offering cures and preventing future assaults. Neural Networks are the notion we're working with here. Neural Networks are a set of algorithms that identify correlations in data in a manner similar to how the human brain functions.

Agriculture is India's principal employment. India is the world's second-largest producer of agricultural products. Farmers in India raise a diverse range of crops. [3]

Crop production is influenced by a variety of elements such as meteorological conditions, soil conditions, numerous illnesses, and so on. The current approach for detecting plant diseases is by naked eye inspection, which necessitates more manpower, adequately equipped laboratories, costly technologies, and so on. In addition, incorrect disease detection can lead to unskilled pesticide use, which can result in pathogens developing long-term resistance, diminishing the crop's capacity to fight back and lowering soil fertility. Plant disease detection may be done by looking for a spot on the diseased plant's leaves.[4]

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The suggested study technique employs a Deep Learning strategy to classify and identify healthy and disease-infected leaf states. In this study, a Convolutional Neural Network was chosen as the architecture. We can examine beneficial aspects for identifying illnesses through leaves thanks to the architectural layer.

II. Literature Review

Many researchers worked on numerous crops, including potatoes, in the previous few decades; their concentration was not on a specific potato crop disease [5-6]. The models were trained using a dataset from a specific location (Plant Village [7]), which was created in the United States. And Switzerland. Because of the differences in leaf structure, potato diseases differ from those in other countries.

[8] Shapes, variations, and environmental conditions are all important considerations. Pandian and Geetharamani [9] suggested a deep CNN model can distinguish between healthy and diseased leaves from a variety of plants crops. The Plant Village dataset, which contains 38 distinct varieties of plants, was used to train the model. Crops featuring photos of diseased leaves, healthy leaves, and background images.

Using the convolutional neural network (CNN) technique, Sladojevic et al. [10] developed a new strategy to recognise illnesses in five types of plants and 13 distinct types of diseases. This research yielded an average accuracy of 96.3 percent. Erika Fujita et al. [11] used the Convolutional Neural Network approach with the AlexNet architecture to create a disease diagnostic system in cucumber plants utilising the same method but with a different design.

To categorise disease kinds in pepper plants, Jobin Francis et al. [12] used the Backpropagation Neural Network technique and GLCM (Gray Level Co-occurrence) for feature extraction phase of extraction There are a variety of illnesses that can affect pepper plant. Berry Spot Disease, a fungal illness, was discovered found in pepper, as well as Rapid Condition, a disease induced by mineral shortages (nitrogen, magnesium, and potassium) potassium. The identical procedure was employed by Eftekhar Hossain et al.

[13]. Alternaria Alternata, for example, is classified as Alternaria Alternata. Anthracnose, Bacterial Rot, Leaf Spot, and Plant Leaf Cancer are all diseases that affect plants.In this case, the KNN illness detection algorithm performed well.The correctness of the paper is 96.76 percent.

[14] developed a self-build CNN (SBCNN) model for detecting early blight, late blight, and healthy classes of potato leaf diseases. The model, which is for a specific location, was also trained using the PlantVillage dataset. They didn't test their model using previously unseen test data. Tiwari et al.

[15] extracted features using a pre-trained model VGG19 and classified them using several classifiers KNN, SVM, and neural network. The algorithm was also trained to detect early and late blight disease in potato leaves using the PlantVillage dataset. They didn't test their model with data they hadn't seen before. Lee et al. [16] used a CNN model to identify early and late blight illnesses in potato leaves, as well as healthy leaves.

In 2006, Esker presented a conference report on identifying Stewart's disease on maize, scientifically known as "Pantoea stewartii subsp." They employed three different prediction models to detect the stewartia corn disease: "Stevens," "Stevens-boewe," and "Iowa state." The Stewart's disorder leaf blight phase is found in one of these three models called "Stevens-boewe." In Pakistan, Umair Ayub presented a presentation at an international conference on crop disease detection using data mining in 2018[17].

III. Methodology

We can reduce the attack of pests by using proper pesticides and remedies. We can reduce the size of the images by proper size reduction techniques and see to it that the quality is not compromised to a great extent. We can expand the projects of the earlier mentioned authors such that the remedy to the disease is also shown by the system. The main objective is to identify plant diseases using image processing. It also, after identification of the disease, suggest the name of the pesticide to be used. It also identifies the insects and pests responsible for the epidemic. Apart from these parallel objectives, this drone is very time-saving. The budget of the model is quite high for low-scale ferrying purposes but will be value for money in large-scale farming. It completes each of the processes sequentially and hence achieving each of the output.

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Figure 1: (Leaf Miner disease)

Leaf miners are the larval stage of the insect family. They eat on the leaf's upper and lower halves. The plant has been seriously harmed as a result of the large number of insects that have infested it. As a result, we may create a robot that uses image processing to detect faulty plants or leaves, classify them, and apply cures to them.

In general, whatever observations we make about a condition are only utilised to make a choice regarding the sickness. A visible effect of illness on the plant is a sign of plant disease. Color changes, form changes, and functional changes in the plant as a result of diseases, insects, and other factors can all be symptoms.

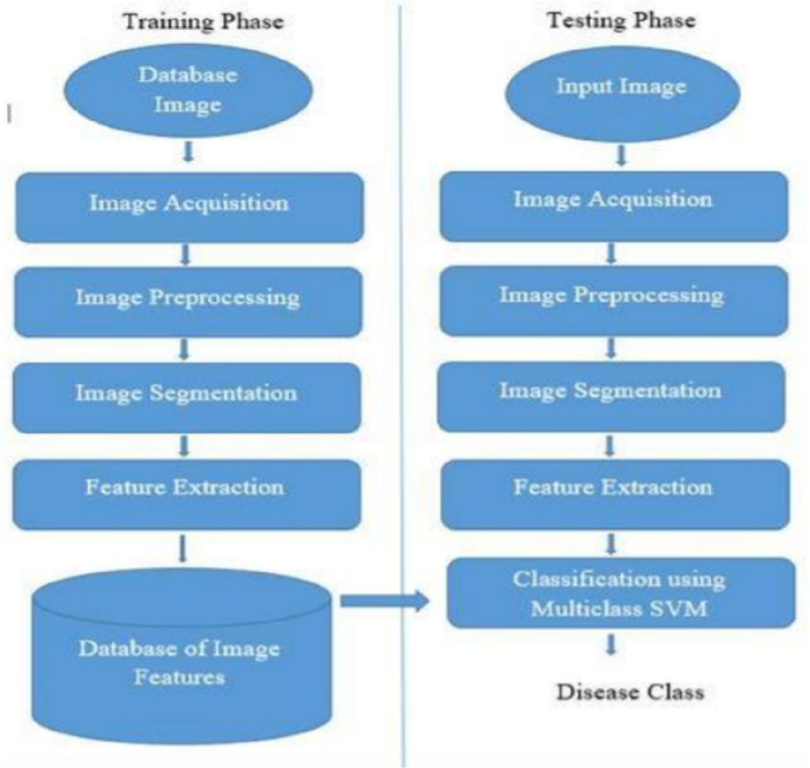

FIG: ML Model with Two phases

In this paper, we have implemented a deep learning model for potato disease classification. The dataset which we used was taken from Kaggle. [18]

For Training our model, we have used CNN in which the network structure is described in the following diagram.

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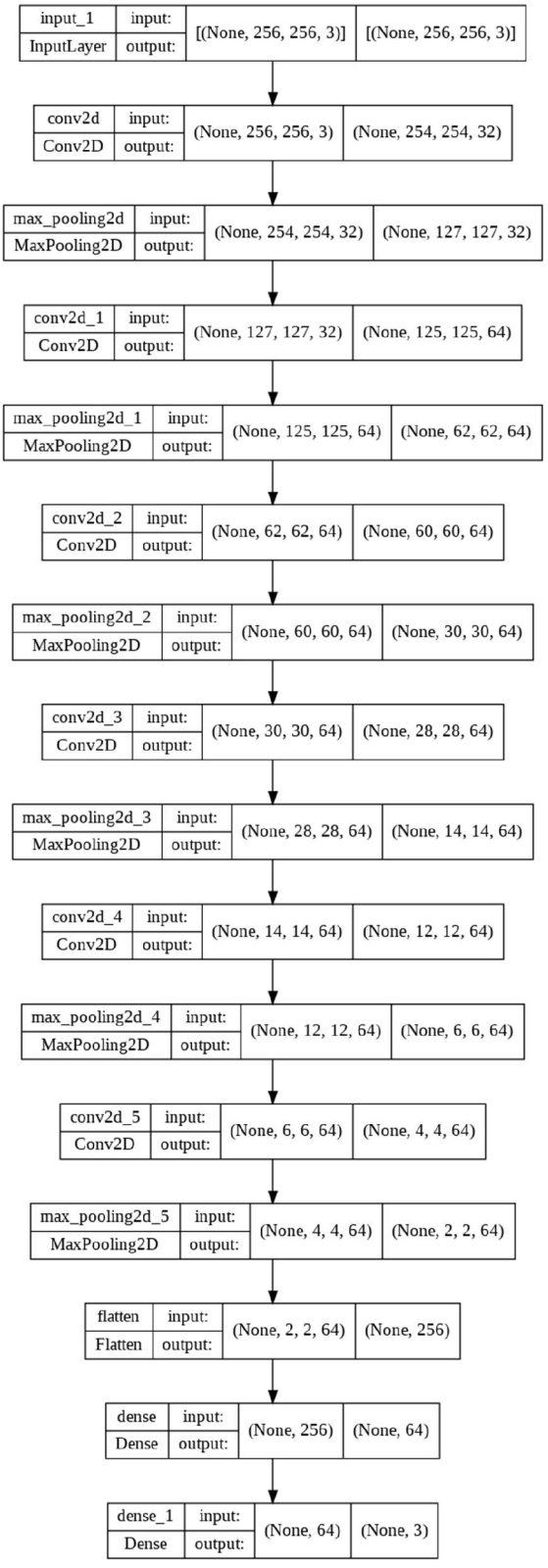

DOI: 10.48175/IJARSCT-2867

IJARSCT
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IV. Conclusion

Crop protection in organic farming is a difficult undertaking. This requires a thorough understanding of the crop being farmed as well as potential pests, diseases, and weeds. A new deep learning model based on a special architectural convolution network has been designed in our system to detect plant illnesses using photos of healthy or diseased plants leaves of a plant The above system can be modified to a real-time video entry system that permits unattended admission. Take care of your plants. An intelligent system that heals detected problems is another feature that can be introduced to certain systems. Using this system farmers can save their time and money by saving expensive fertilizers. This system is quite user friendly to be used by anyone like farmers and uneducated people. This system is giving us an accuracy of upto 99.0 percent with the help of this one can trust the system and take the further decision accordingly. From the above architecture we can conclude that the system must be efficient decision. Plant disease management has been shown in studies to enhance yields by up to 50%.

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