Leaf Diseases Detection System Using Machine Learning

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***Abstract*—Our country's main business is agriculture. The majority of people reside in rural regions and rely solely on agricultural products for their livelihood. The quality and yield of agricultural goods will decline in any plant that has the disease. Research and illness detection are therefore crucial. For disease to be successfully controlled and inhibited for practical cultivation and food preservation, genuine crop disease exposure and identification are essential. For farmers to succeed, early illness detection and diagnosis are essential.**

Keywords - Machine Learning, Plant Disease, Image Processing

I. INTRODUCTION

One of the main causes of a decrease in the quality and amount of food crops, particularly in leaves, is plant disease. Only the existence of pests in the crops and leaves causes a decrease in the quality and output of food. As a result, it causes difficulty, nutritional insecurity, and a higher death rate.

In the modern era, a wide variety of image-processing technology ideas have been adapted in order to identify plant diseases. Stopping the spread of pests that are affecting agricultural harvest is one of the main challenges facing agronomists. Aphids, fungi, gnats, flies, slugs, snails, caterpillars, and other familiar pests are frequently linked to plant diseases.

Nearly all agriculturalists are accustomed to systemically identifying pests through examination with their eyes, but this access is limited and requires some time.

If the disease isn't correctly recognized, applying disease control measures can be a waste of time and resources and increase plant loss. As part of our research, a machine learning-based model will be developed. It will be trained using images of crop leaves that are both healthy and diseased. By classifying images of leaves into unhealthy groups based on defect patterns, the model will succeed in achieving its objective.

II. LITERATURE REVIEW

This study[1] employed K-Medoid clustering and Random Forest classification techniques to identify foliage diseases. In this study, the leaf image is pre-processed before the clustering approach is used to identify the affected region. The Random Forest method and K-Medoid clustering are used by the system to identify disease in the leaf. This study used Random

The sort of disease is identified and classified using forest classification, which is less effective for image datasets. CNN is a better choice because deep neural networks can acquire useful features on their own in image problems.

Using Random Forest, the data sets generated in this study [4] are used to distinguish between healthy and sick leaves. The generated datasets of diseased and healthy leaves are merged and trained using Random Forest to distinguish between sick and healthy images. An oriented Gradient Histogram is used to derive visual characteristics (HOG).

An overview of the location and classification of cotton leaf infections is provided by Bhumika S. Prajapati [3]. Natural eyes have difficulty distinguishing exactly which type of leaf infection is present on the plant leaf. Accordingly, it may be possible to accurately identify cotton leaf sickness by using AI methods and image preparation techniques. The photographs used for this task were taken in the cotton field with a digital camera. This work only presents wide and disparate methodologies that classify and identify cotton leaf diseases and only presents division as a foundation expulsion technique.

III. SYSTESYSTEM DESIGN

The fundamental methodology of our project is that the user uploads a picture of a leaf with a uniform background to a website that we have integrated with our model using Flask. Next, the picture will undergo preprocessing. The model itself extracts features in order to correctly identify the disease. Once a disease is identified, it is marked with the appropriate treatment or fertilizer that would be needed to solve the issue and fend off the disease going forward.

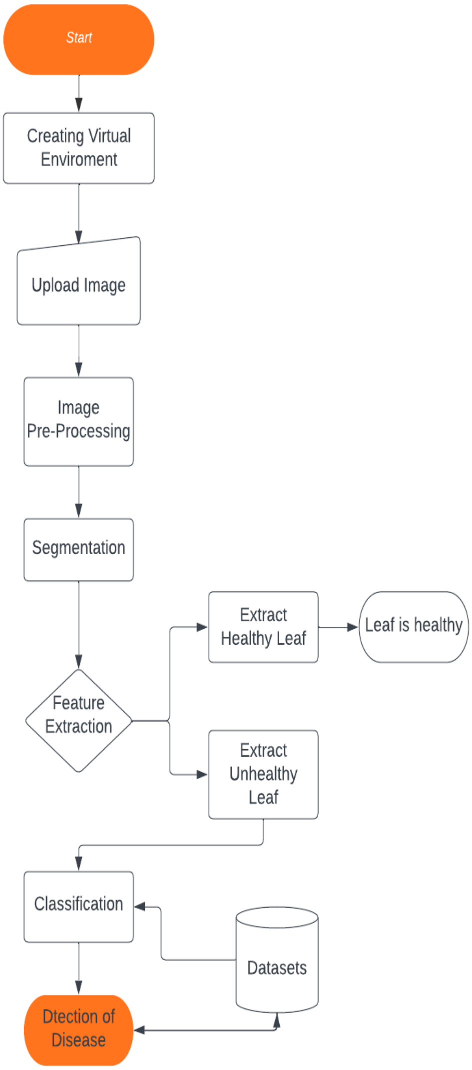

Fig. 1. Leaf disease detection system

IV. IMPLEMENTATION

A. Dataset

There are a total of 10,000 training photos in each category, with each photograph consisting of just one leaf.

B. Data Preprocessing

To read images from source files, convert them to Float32 tensors, and spread them across our network, we built data generators. We have one generator for our test cases and a different one for our validation instances. Using our generator, 224x224 images will be produced in groups. To make it simpler for neural networks to process data, data entering the network should be standardized in some manner. In this case, we'll preprocess the pictures in our dataset by changing the pixel values to the [0,1] range (typically, the pixel values range from 0 to 255)

C. Pre-Trained Models

The GoogLeNet engineering comprises 22 layers (27 layers including pooling layers), and a piece of these layers is an aggregate of 9 inception modules. A kind of convolutional neural network based on Inception architecture is called GoogLeNet. By utilising Inception modules, the network is able to select between various convolutional channel sizes in each rectangle. These modules are stacked on top of one another using an Inception network, which divides the grid's resolution into stride 2 periodic max-pooling levels.

D. Experimentation

We divided the images from the dataset used for this research into two sets: the training set and the testing set. For each architecture model we have employed, we first train the model using the images in the training set before evaluating the model using the images in the testing set once we have obtained perceptible results.

V. CONCLUSION

In order for this project to accurately identify and categorize plant diseases through image processing of plant leaves, various Deep Learning methods, and approaches were investigated. The method begins with gathering the images needed for training, testing, and validation. Next, image augmentation and preprocessing are done, and finally, the accuracy of various pre-trained models is compared. Finally, our model identifies and differentiates between a healthy plant and various diseases, then suggests appropriate treatments to treat the condition. This study created a system that uses plant leaf images to identify various tomato crop diseases and make recommendations for the right fertilizer.

VI. FUTURE WORK

The system successfully translates a variety of diseases and is also able to recommend fertilizers for each disease. Additionally, by including more image datasets with broader variations, such as multiple leaves in a single image, this system can be strengthened. Additionally, an app could be created for the end endeavor to facilitate the farmers' work. They could directly submit an image to the app, and it would immediately identify the disease and provide a remedy. This would cut down on the work. This project is currently restricted to a single crop, but more commodities and even a dataset of flowers could be added in the future to make it useful for all agricultural needs. It's possible to combine and test out newer versions with

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