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DETECTING PLANTS LEAF DISEASES USING MACHINE LEARNING AND DEEP LEARNING

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ABSTRACT

It is common knowledge that a country's economy heavily depends on agricultural productivity. It's pretty normal for illnesses to affect plants. Therefore, identifying plant diseases is essential to raising agricultural productivity. When plants are not given the correct care, they might suffer major consequences that have an impact on the quality, quantity, or productivity of the plant's output. For instance, crop failure during The Great Famine (1845–1849) resulted in disease, widespread famine, emigration, and death. Later, biologists came to the conclusion that a natural occurrence called a potato blight was the cause of the famine.

Numerous people died, bringing the total to 100,000. Large-scale farms can apply automated disease detection methods on agricultural crops, which will lessen the need for manual crop monitoring and enable the early diagnosis of illness or its signs. This allows the right cure time to work. The application described in this article uses machine learning methods to analyse photos of tomato plant leaves to identify and categorize illnesses. Finding diseases on crops is a time-consuming and vital task in agricultural techniques. It takes a lot of labor, both expert and manual. In this study, computer vision and machine learning approaches are proposed as a smart and effective method for crop disease identification.

Keywords: Agricultural productivity, Plant diseases, Crop health, Crop yield, Plant illness consequences

1. INTRODUCTION

One of the oldest human cultures is the one based on agriculture. It continues to be the origin of all societies now and has played a significant role in the advancement of mankind. Despite being used for quite some time, farming equipment and methods including water systems, strip editing, compost, manures, pesticides, and so forth have greatly improved during the past century. In fact, farming methods had advanced enough by the late nineteenth

century to produce typically the highest yields per unit of land compared to the prior decades. Agribusiness is the exchange of seeds, soil, and agricultural synthetic compounds.

Because of this, the sustainability of the agrarian framework depends on the proper management and care of all viewpoints. The purpose of enhancing agricultural production without considering natural

1.2 SCOPE

In tomato plants (Solanum lycopersicum), a vast list of diseases are present. A rare and dangerous ailment that has ever existed is bacterial spot on tomato leaves. It demands a great deal of effort and work to contain because it spreads so quickly. The majority of the time, this illness deforms tomato plants to the point where their attractiveness is drastically diminished. A bacterium known as xanthomonas campestris pv is the cause of bacterial spots. Oily, sporadic, little checks on the underside of the leaves are the main sign of bacterial spot in tomato plants. These tiny specks start off looking dimly green, but subsequently turn purple and black.

For such prompt identification, there are currently no automated processes, hence regular professional monitoring is needed instead.

Lack of automation causes time and money to be wasted, which lowers the quality of fruits and crops.

Image augmentation is the process of adding new photos to our dataset by utilizing a variety of techniques, such as rotation, flipping, noise addition, shear, shifts, etc. There are two benefits to this method. When our dataset is tiny, image augmentation can assist us increase the number of images in our collection without manually adding new ones. Image augmentation reduces the issue of overfitting in deep learning, which helps a model perform better and be built into a superior model.

2. LITERATURE SURVEY AND RELATED WORK

2.1 K-MEANS AND AI FOR CROP DISEASE

Recognizable proof of a disease in a crop is a way of noting mishaps in the productivity and quantity of the plant item. These investigations of maladies include the overview of examples visible on it. Observing malady recognition affecting crops is of great importance for supportable horticulture. Screening of the illnesses with physical effort is quite tough that asks for a colossal measure of dedication. To make this task easier, it is established as a method which includes K-means clustering algorithm in conjunction to the neural networks to cause an automatic deduction of the diseases of leaves

The methodology for extraction features from images includes CCM. It includes the consideration of the texture of the image along with the color of the picture that will cause the deduction of some unique features defining a picture. The algorithm is instrumental in dividing the picture to form four clusters wherein they contain more than one of the diseases in cases that includes the leaf being plagued by many disease. Here the amounts of K values taken are more than one. The dataset used for the purpose of the training and validation are segregated in two

divisions; one is the training set that is responsible for the training of the NN model; whereas the testing features set is needed to testify for the exactness of the generated model.

CCM is a part of the process for extracting characteristics from photos. It takes into account the image's texture as well as its color, leading to the deduction of some distinctive traits that define a picture. When a leaf is affected by many diseases, the algorithm is crucial in splitting the image into four clusters, each of which contains more than one disease. In this case, more than one K value was taken. The dataset used for training and validation is divided into two parts: the training set, which is used to train the NN model, and the testing features set, which is used to verify the accuracy of the model.

2.2 IMAGE PROCESSING FOR SMART FARMING

The non-uniform and unpredictable fluctuations in the climate have a significant impact on harvests, which prompts a decrease in agricultural productivity. This affects the rural economy globally. Additionally, when the crops are contaminated by any ailment, the situation becomes considerably more extreme. Additionally, ranchers struggle to increase production due to the growing population. Here is where modern rural strategies and frameworks are anticipated to differentiate and foresee the yields from being impacted by different diseases. Here, a web-based technology is utilized to assist farmers in recognizing any fruit illness by uploading a picture of the affected fruit to the system.

2.3 FUNGAL DISEASE IDENTIFICATION IN CROPS

The development of computers has significantly altered our way of life. Through the use of strong and adaptable tools, they have had a profound influence on all facets of society. Horticulture and agriculture follow standard practices. A shift toward computer vision is being made in agriculture and horticulture. As a result of exposure to diverse pathogens, many diseases manifest in general terms as wilt, mold, rust, and other symptoms on the stem and leaves. As a result, it discusses the visual cues that are utilized to distinguish between different forms of fungal diseases in agricultural plants and to identify them. In this publication, symptoms of fungi diseases are listed as follows: Fruit crops were impacted by anthracnose, powdery mildew, and downy mildew. These are further divided into kinds based on how severe the condition is. Partial, moderate, severe, and normal intensities are all included. GLCM and GLRLM are used to gather statistical features. They categorized pictures into severity types using the k closest neighbors method.

2.4 SVM BASED DETECTION OF DISEASES IN LEAVES.

In India, grape is a crucial food crop, and it dominates the fruit market. A plant's stem and leaves can become infected, which affects the crop's general health and productivity. Bacteria, viruses, fungus, and other organisms cause diseases in leaves. Such illnesses significantly reduce fruit output and may even make them incurable. These illnesses must be promptly detected in order to treat the plant and get rid of them. The theory paper addresses grape

leaf diseases and their categorization using Support Vector Machine (SVM) technology. K-means clustering is used to find the diseased leaf region in order to do this.

Immediately following clustering, color and texture fields are Color and texture fields are generated following clustering. Finally, classification is carried out to comprehend and identify the kind of sickness that has affected the leaf. As a result, the accuracy of this method of classification in identifying the leaf disease is 88.89%.

2.5 STRATEGIES FOR LEAF DISEASE DETECTION

India is a country that prioritizes agriculture. Ranchers can choose from a wide range of affordable foods made from ground crops. The development of cures for ailments using distorted images of specific locations on leaves is built up through research. A portion of the leaf spot is used to characterize the reason for training and testing after pictures shot with a computerized camera portable and processed using picture developing. The method incorporated within the framework is used to process complicated computations and digital images.

The following document lists the many ways for recognizing leaf sickness. Speed and accuracy are key elements of contamination disclosure. In this way, the process of disclosing the condition of infected people is improved, successful, quick, and exact.

2.6 DETERMINATION OF SEVERITY IN LEAF DISEASES

A fairly common disease that manifests as leaf spots in sugarcane plants is caused by fungi growths. Plants carry out the crucial process of photosynthesis, but when they are covered in spots, their effectiveness is greatly reduced, which lowers the quality of the end result. The plant will suffer serious consequences if the disease continues and spreads to a certain extent. When pesticides are used excessively, the groundwater becomes contaminated and leaves a residue on the plants. The manual eye observation method is typically employed to gauge the severity of illnesses in the workplace, however precise measurement of the illness is impossible. The timing of treatment is crucial; if it is postponed, it could If delayed, it could result in a substantial loss. Pesticide overuse frequently results in contamination of many different types and must be avoided at all costs. To accomplish this, one must concentrate on the areas that are diseased, apply the appropriate amount of pesticide, and combine it with image processing to determine the severity of the sickness.

3. IMPLEMENTATION

The system recognizes disease in a plant leaf image and displays the accuracy value and the proportion of predicted to actual disease, which simply serves to demonstrate the system's effectiveness. But not the actual illness in the plant's leaf. The model's accuracy is inefficient, and loading data and running the model both take more time. Darknet and Normal Vgg19 are both displaying less accuracy. Losses keep becoming worse as eras pass. This model's accuracy declines continuously as the number of epochs rises.

4. PROPOSED METHOD AND ALGORITHM

The difficult aspect of our approach is not just dealing with the model's accuracy and detecting the actual sickness; it also strives to provide the specific sort of disease each leaf has so that we can be prepared for it. Our model has a 92% accuracy rate. The architecture of the Vgg19 has been customized. Because the accuracy in the standard VGG19 is 32%. This model has good accuracy for both training and validation. With more epochs, training and validation losses become less significant.

In this project, we concentrate on developing a simple fix for the issues with leaf disease detection. We have gathered a sizable dataset with pictures of both healthy and ill leaves. Based on a photo of the crop leaf, we create an iPhone app that can identify the ailment it is suffering from. A leaf's illness will be analyzed and predicted by the app using ML techniques. It will make use of a model that was trained using pictures of previously detected sick leaves. Any newly discovered diseased leaf will be recognized by its disease based on this. An image can be uploaded or taken using a phone's camera as the input. The name of the ailment that has been associated with it will be the output. As a result, it is possible to classify and identify the disease. There will also be an option to check for treatments for the illness. A Rest Api service that runs a website that permits inputting an image name and displaying its output class is also provided as an additional front-end option.

BENEFITS

1. Offers a practical, simple method for locating leaf diseases.
2. Lessens the dependence on people for disease detection and treatment.
3. Farmers can efficiently identify crop leaves and fix them.
4. Improves the yield and quality of crop output.
5. It speeds up and simplifies the detecting procedure.
6. Offers a precise and dependable identification model.
7. Offers user-interface options.
8. Can be utilized even without an internet connection to find uploaded images.

5. METHODOLOGIES

MODULES

1. Training the dataset and creation of model
2. Testing the model

FUNCTIONALITIES

1. Training the dataset and creation of model: -

We loaded the dataset and created a CNN. The data was trained over the NN and the result saved as a model with. pth extension. The first 2 layers of the NN used here are based on the Le Net CNN architecture-proposed by Yann Lecun in 1998. The NN has 2 Conv layers and 3 FC layers. Relu and Softmax activation functions are used. Prediction is done over 7 classes of Tomato leaf images for a dataset of 7000 images.

2. Testing the model: -

The saved model was checked with multiple test images to check the accuracy of the predictions.

6. RESULTS AND DISCUSSION SCREEN SHOTS

Fig 1: Predicting Leaf Disease

7. CONCLUSION AND FUTURE SCOPE

This project proposes a CNN model to enable the detection of the disease that has affected a given leaf image. A neural network was built and trained upon the data set. The generated model was saved and tested. The model is further deployed in 2 ways as an Ios app and as a Rest API. Python was used to develop the model. The dataset consisted of 7 classes of images, each of size 256x256. In total, there were 7000 images in the data set. The project model can be used to aid farmers in identifying the diseases that plague their crop/leaves and lead to a timely and convenient detection process. It is beneficial for botany students and people who take gardening as a passion. These people can get real- time disease detection and remedy solutions provided to them. Farmers can utilize the project model to help them identify the illnesses that afflict their crops or leaves and to speed up and simplify the

identification procedure. Students studying botany and those who love gardening will benefit from it. These patients can receive real-time disease detection and treatment options. Both time and money are greatly conserved. It helps educate individuals on how to care for their plants as quickly as possible. It can occasionally be too late to start a cure after calling an expert, which can result in significant crop loss. We must be aware of a specific disease before treating it because diseases in leaves are now widespread as a result of climate change and pollutants.so that we can handle it appropriately. Our model accurately detects the illness in leaves. We forecast the type of disease and its prevalence rate.

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