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Plant Leaf Disease Detection and Fertilizer Suggestion using CNN

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Abstract: *In India, agriculture contributes 17% of the GDP. Plants can develop a variety of illnesses, including rot, bacterial wilt, blight, and more. Some of these illnesses are invisible to the naked eye. Serious economic repercussions from the vast range of diseases include production losses and market decreases. Implementing machine learning techniques, convolutional neural networks, image processing, and deep learning models for plant disease detection can be highly advantageous as it lowers a significant amount of monitoring work in large crop farms and can identify disease symptoms at an early stage. Studies based on several methods of plant disease detection are covered in this suggested system.*

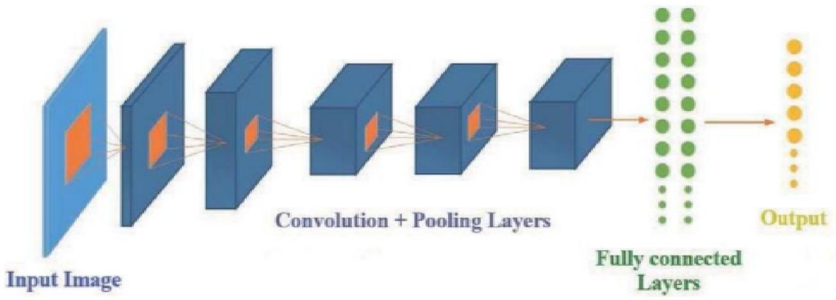
Keywords: Image Processing, Disease, Convolutional Neural Network, Fertilizer Suggestion

I. INTRODUCTION

Any country's economic development depends heavily on agriculture. It is a sector that has a significant impact on a nation's GDP. About 16% of India's GDP is contributed by the agricultural sector. The type and quantity of crops grown are influenced by a number of factors. These plants are susceptible to a variety of illnesses because of local climatic variations and other factors. And if these illnesses are untreated, they could result in significant losses. Around 15 to 25 percent of crops in India are lost to diseases, pests, and weeds. We might also think of the occurrence in Georgia (USA), when plant diseases caused a loss of about 540 USD in 2007. With the development of new technologies, the sector of agriculture gains in importance because it is employed in numerous applications in addition to providing food for a large population. Plants are incredibly important to our existence since they provide as a source of energy and help to combat global warming. These days, there are a variety of illnesses that harm plants, some of which have disastrous effects on the economy, society, and environment. Therefore, it is crucial to identify plant diseases accurately and promptly. Plant diseases can be broadly categorized according to whether their primary cause is infectious or not.

Main goal of this system was to propose improvements in current classification techniques for plant leaf disease detection using machine learning. The main objective that was focused on in this system was to study different types of diseases that are found in plant leaves as well as to study and analyze different techniques for plant leaf disease detection using image processing technique.

II. CONVULUTIONAL NEURAL NETWORK



Profound learning is a subsection of Artificial Intelligence consciousness what's more, AI that utilizes artificial neural networks (ANN). Preparing the profound learning models separates the highlight extraction and concentrates its elements for arrangement. There are a few uses of profound realizing which incorporate PC vision, picture arrangement, rebuilding, discourse, video analysis. A convolutional brain network with ostensible cycle can basically distinguish and order. It is productive in assessing graphical pictures and concentrates the fundamental highlights through its multi-layered structure.

III. LITERATURE SURVEY

The principal intention was to lessen the utilization of pesticides and in this manner yield a decent harvest and increment the creation rate. Plant illness can be distinguished utilizing picture handling. Infection recognition follows a few stages like pre-handling of the picture, highlight extraction, characterization, and expectation of ordered illness. Hence making an acknowledgment framework can assist in assessing high accuracy with imaging of the plant for legitimate fix and further counteraction [1]. Profound learning strategies were utilized to recognize illnesses. Profound learning design choice was the central question for the execution. So that, two different profound learning network designs were tried first AlexNet and afterward SqueezeNet. For both of these profound learning networks preparing and approval were finished on the Nvidia Jetson TX1. Tomato leaf pictures from the Plant Town dataset has been utilized for the preparation. Ten unique classes including solid pictures are utilized. Prepared networks are additionally tried on the pictures from the web.

Two unique models in[3], Quicker R-CNN and Cover R-CNN, are utilized in these techniques, where Quicker R-CNN is utilized to distinguish the sorts of tomato illnesses and Veil R-CNN is utilized to identify and fragment the areas and states of the tainted regions. To choose the model that best fits the tomato illness location task, four unique profound convolutional brain networks are consolidated. Information are gathered from the Web and the dataset is partitioned into a preparation set, an approval set, and a test set utilized in the examinations. The trial results demonstrated the way that their proposed models can precisely and immediately recognize the eleven tomato sickness types and fragment the areas and states of the tainted regions. The principal objective of this framework is to precisely identify messes in tomato plant utilizing IoT, AI, Distributed computing, and Picture Handling [4].

In framework, they utilized the convolutional brain organization (CNN), through which plant leaf illnesses are ordered, 15 classes were characterized, including 12 classes for sicknesses of various plants that were distinguished, like microorganisms, parasites, and so on, and 3 classes for sound leaves. Subsequently, they got amazing precision in preparing and testing, they have an exactness of (98.29%) for preparing, and (98.029%) for testing for all informational collection that were utilized. [5] An outline of picture division involving K-implies grouping and HSV subordinate arrangement for perceiving contaminated piece of the leaf and element extraction utilizing GLCM. The proficiency of the proposed strategy can distinguish and arrange the plant infections effectively with a precision of 98% when handled by Irregular Woodland classifier. [6]

Proposed a coordinated profound learning structure where a pre-prepared VGG-19 model is utilized for highlight extraction and stacking outfit model is utilized to distinguish and characterize leaf sicknesses from pictures in order to lessen creation and financial loses in horticulture area. A dataset comprising of two classes (Tainted and Solid) and a sum of 3242 pictures was utilized to test the framework. Their proposed work has been contrasted and other contemporary calculations (KNN, SVM, RF and Tree). [7].

A CNN for programmed include extraction and characterization was proposed. Variety data is effectively utilized for plant leaf infection explores. In model, the channels are applied to three channels in light of RGB parts. The LVQ has been taken care of with the result include vector of convolution part for preparing the organization [8].

IV. IMPLEMENTATION DETAILS OF MODULE

The image dataset, were taken from Kaggle and include pictures of both healthy leaves and various kinds of damaged ones. Applying pre-processing techniques, such as converting a picture from RGB to greyscale, and enhancing it with filtering algorithms to eliminate noise from the image are the first two steps. The image is split after it has been edge detected using edge detection techniques. Segmentation is the next phase, and feature extraction turns the segmented image into a set of images. Here, specific visual features of interest are found and represented for additional processing. The resulting representation can then be used as an input to a variety of pattern recognition and classification techniques, which will then recognize or categorize the semantic contents of the image.

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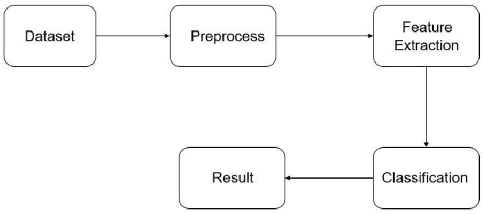

Step 1: Convolution Operation

The convolution operation is the first component of our strategy. We will discuss feature detectors in this phase because they essentially act as filters for neural networks. Additionally, we'll talk about feature maps, their parameters, the levels of pattern detection, and how the results are laid out.

Step 1(b): ReLU Layer

The Rectified Linear Unit, or ReLU, will be used in the second portion of this stage. We will discuss ReLU layers and examine the role of linearity in convolutional neural networks. Although it's not necessary to comprehend CNN's, it wouldn't hurt to take a quick lesson to advance your knowledge.

Step 2: Pooling

We'll discuss pooling in this section and learn exactly how it typically operates. But max pooling will be the central concept in this situation. However, we'll discuss a variety of strategies, including mean (or total) pooling. This section will conclude with an interactive visual example that will undoubtedly clarify the entire idea for you.

Step 3: Flattening

This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

Step 4: Full Connection

In this part, everything that we covered throughout the section will be merged. By learning this, you will get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

V. CONCLUSION

The deep feed-forward artificial neural network known as the convolution neural network is used to detect leaf disease. We only consider one leaf per image because it will be challenging to precisely diagnose the surrounding leaves, which could have the same or a different condition. The proposed method involves several phases, such as data pre-processing to increase detection accuracy and other image processing techniques to increase the accuracy of our results. If this strategy is fully adopted, the sickness can be discovered at an early stage, reducing the expense and time required for human labor.

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