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CNN Based Leaf Detection And Remedy Recommandation System

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Abstract— Our Problem Statement is potato plant disease identification using ConvolutionalNeural Networks and Keras. Now-a-days we can see various kinds of plant diseases which apparently causes high risk to In many regions of the world, it is still challenging to rapidly distinguish between farming and farmers. The field of leaf-based image classification is found to be very useful in emerging accurate techniques to solve this problem. In this project we used the Machine learning and Convolutional Neural Networks to distinguish in between the diseases namely Potato_Late_Blight and Potato_Early_Blight and Lefrom the datasets created.The phases of implementation for our project are dataset development, feature extraction, classifier training, and classification . We trained our dataset using CNNs. We also used Keras and Tensorflow to implement our model in CNN. Overall, we can clearly distinguish between the two diseases using machine learning and CNNs trained on publicly available data sets.

Keywords: Tensor flow, convolution neural , data model, and plant disease detection.

I. INTRODUCTION

The majority of rural residents—70%—rely on agriculture. Over 63 percent of the population is employed in agriculture, which pays approximately. Therefore, the diagnosis of plant diseases is crucial today in agriculture. Wheat and rice are just two of the many crops grown in India. Indian farmers also cultivate a number of non-food products like coffee, tea, cotton, and rubber in addition to other crops like sugarcane, potatoes, and oilseeds.

The health of these crops depends on how robust their leaves and roots are. Different plant-leaf illnesses that might destroy harvests and, eventually, have an effect on the economics of the country can be caused by a variety of factors.Annual diagnosis of plant diseases helps prevent these significant losses. The agricultural sector and the economy of our nation will be strengthened if plant diseases are accurately detected. Many different diseases can harm a plant's leaves. It will be preferable if we can reduce those diseases by finding them early in the process of development and the production rate won't be impacted.

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II.LITERATURE SURVEY ON VARIOUS PLANT DISEASE

Numerous researchers have studied the numerous plant diseases and have provided some strategies to recognise each disease. We conduct a study on many sorts of diseased plants in order to get understanding of this research topic. This survey will aid in the formulation of novel disease identification concepts.

A. DIFFERENT TYPES OF PLANT DISEASE

Researchers can grasp the type of image processing operation and type of feature that must be taken into account by monitoring various diseases, which is the basis for this part.

When a plant is infected with a virus or bacteria,disrupts its normal growth, a plant is said to be ill. Plant leaf effects might range from dying to discolouration. Microbes, viruses, nematodes, and fungus are some of the causes of disease.

Rust: *On mature plants' lower leaf surfaces, it typically appears. Initially, leaves' undersides had elevated dots. These dots develop into reddish-orange spore masses over time. The leaves hypotheses gradually transition from yellow to green to black. Infestations that are severe will bend, yellow, and eventually shed their leaves.*

Cole Roga: *It affects arecanuts severely. Fungus Phytophthora palmivora is the pathogen.*

Yellow leaf disease: *Green arecanut leaves turn yellow and eventually lose yield due to this disease, which is caused by the pathogen Phytoplasma.*

Leaf rot is brought on by coconut trees. It is brought on by bacteria or fungi. Size, shape, colour, and other attributes of leaf spots vary.

Leaf curl: A diseased plant will have curled leaves. A virus, the species Taphrina, or a fungus may be the culprit.

Leaf spot:Leaf spot is a bacterial disease that infects chilli and is spread by the bacterium Xanthomonas campestris pv vesicatoria. The signs include little yellow-green spots and regions on the leaves..

Early Blight: This disease spreads quickly. The growth of the fungus is caused by cool, damp conditions.weather. On leaves, it creates ashen dots with erratic shapes. There will be a ring of white mould surrounding the spots.

Bacterial wilt: Bacterial wilt causes a decrease in the production of cultivated brinjal. Due to the

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wilting of the foliage, the entire plant has collapsed..

III OVERVIEW OF PLANT DISEASE

Infectious organisms including fungi, bacteria, and viruses are typically to blame for plant illnesses.These diseases emerge externally as symptoms, and symptoms of plant diseases serve as visible indicators of infection. Yellowing and leaf spot are the two most common signs of fungus infections, which also produce a variety of symptoms like visible spores, mildew, or mould.

Plant infections known as fungal diseases they are brought on by the fungus. Infecting plants by stealing nutrients and destroying tissue, fungi can be single- or multicellular diseases. The most prevalent infection infecting different plants is fungus. There are a few distinctive signs or observable consequences of the plant disease in plants.

Leaf affected by fungal infection

Different kinds of spots on plant leaves, leaf yellowing, and bird's eye patterns on berries are all signs of fungus infections. The organism that causes various fungal illnesses can actually be seen on the leaves as a growth or mould. These abnormalities may emergeon the underside of leaves or stems.

These abnormalities could be found in the centre of stems or leaves. These in-person observations of the pathogens are referred to as symptoms of infection. Single-celled, prokaryotic creatures are known as bacteria. There are bacteria everywhere, and while many of them can be helpful, some of them can also harm plants and people.

Since bacteria are small, it can be much more difficult to identify their disease symptoms than it is with fungi. Bacterial ooze, a milky white material that may develop after cutting an infected section of the stem, may do so. The only indication of a bacterial illness is this. One of the extra signs is water-soaked lesions, which are the bacteria-emitting moist spots on leaves.

Leaf affected by bacteria

As the disease progresses, the lessons gradually enlarge and transform into reddish-brown patches on the leaves. Leaf spots or fruit spots are typical indicators of bacterial infections. Contrary to fungal patches, these are frequently enclosed by leaf veins.

Viral infection incredibly small particles that can't

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be seen using a light microscope. Since a light microscope cannot identify viruses themselves, viral illnesses do not manifest in plants in any way.

Leaf affected by virus

However, there are numerous indications that a skilled eye can spot. For instance, a mosaic pattern on the leaves, yellowed foliage, or wrinkled leaves are all indications of viral contamination. This conventional pattern of the discoloration serves as the inspiration for the names of numerous plant viruses, including the tobacco mosaic virus. Additionally, it reduced plant growth, which is another characteristic of viral infections. These are our observations regarding how to categorise various plant diseases and how to use caution in doing so.

IV. EXISTING SYSTEM

Potato leaf diseases were identified by capturing the image of the disease-affected crop.

1. Using multi-level color image thresholding for the disease diagnosis system of disease.
2. Using image acquisition and preprocessingto remove noise and enhance and then converted to a binary image.

V. PROPOSED SYSTEM

We used Machine learning and Convolutional Neural Networks to distinguish between the diseases. We also used Keras and Tensorflow to pre-process, train and classify our datasets.

VI. METHODOLOGY

The input dataset, image acquisition, image pre-processing, and classification are all depicted in the structure seen in Fig. The technology for detecting plant diseases method fundamentally entails four phases. Images must first be acquired for the initial phase utilising a digital camera, a mobile device, or the internet. The image is then separated into a variety of clusters, for which various techniques can be applied. Phase two includes feature extraction techniques, and the final stage is discusses how diseases are categorised.

A. Image Capture The Plant Village repository was utilised to gather the image dataset used to train the model. The photos of the plant diseases were downloaded from the repository using a python script. About 35,000 photos from

32 different types of plant kinds and illnesses make up the acquired collection.

Using digital devices like cameras, smartphones, and other devices with the necessary resolution and size, plant leaf photos are collected during this phase. Images may also be captured. from the internet.

The process of building the image database is complete based on the application system's developer. The classifier performs better thanks to the database in the system's final phase of detection.

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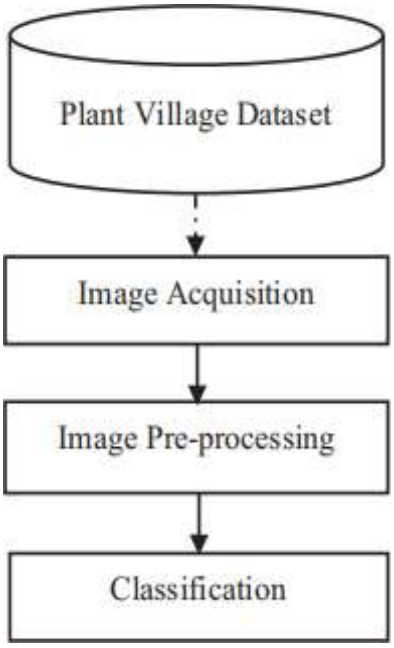
B.Image Preparation Pre-processed photographs have their image sizes lowered and have been cropped to fit an input. The image is improved and processed to the required colour scale. The study processes colourful, 96x96-resolution photographs that have been resized.

C. Classification Convolutional and pooling layers are utilised for feature extraction, whilst fully connected layers are employed for classification. It is determined through the classification process whether a plant leaf is diseased or not, what kind of disease it is, and what kind of plant it is.

Identifying whether the input picture is in good or bad health is the goal of the classification step. If an When an image is found to be unwell, some earlier works have further classified it into a number of illnesses. a request for categorisation

It is necessary to write a routine in MATLAB, often known as serve as a classifier.In the past, a variety of classifiers have been employed.
Researchers using techniques like k-nearest neighbour artificial neural networks (KNN), network, back-propagation neural network, and support vector machines (SVM) (BPNN),

Classifiers using decision trees and naive Bayes.
The most popular classifier is discovered to be
SVM. Each Classifiers have advantages and disadvantages. Despite its flaws, SVM is a trustworthy and user-friendly method technology.



Since learnable DL models pertinent characteristics at various convolutional levels from the input pictures, they are the most popular design for CNNs and have recently attracted a lot of attention. This works same as Human brain.Complex problems can be solved via DL, in particular good classification accuracy and a low error rate, well and rapidly . DL modelling It made up of various parts.

VII. ALGORITHM

In the discipline of deep learning, artificial neural networks (ANN) are used. In deep learning, artificial neural networks are employed, a branch of artificial intelligence and machine learning (ANN). Deep learning model training splits feature extraction into its component parts and extracts its features for classification. Deep learning has several uses, including computer vision, image categorization, restoration, speech recognition, video analysis, etc. With a nominal procedure,A convolutional neural network is proficient in detection and classification. It works well at analysing graphical images and extracting data because of its multi-layered nature, their key characteristics. Four layers make up the CNN: the convolutional layer, the pooling layer, the fully connected layers, and the output layer are the order in which they appear in.

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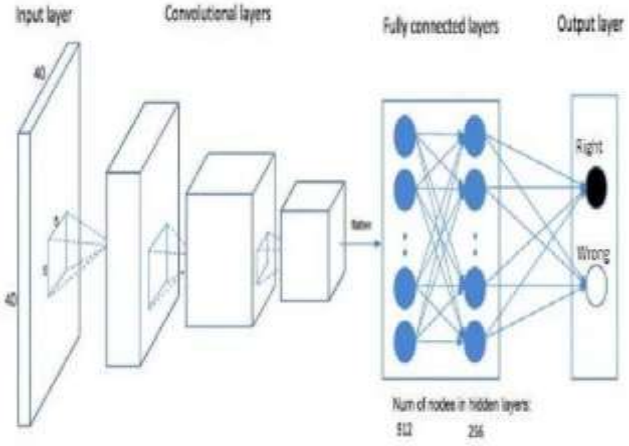


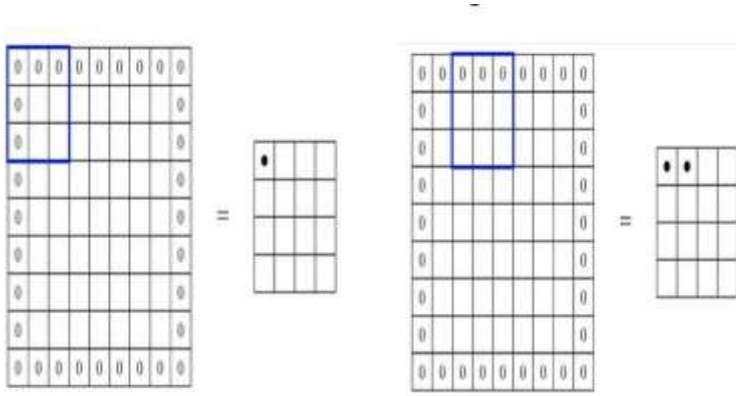
II. LAYERS OF CONVOLUTIONAL NEURAL NETWORK

Convolution Layer: Layer Convolution The output of the kernels from the preceding layer, which comprises of learnable weights and biases, is stored in convolutional layers. The goal of the optimization function is to produce kernels that accurately represent the data. In this layer, a number of mathematical processes are used to extract the feature map of the input image. The values of the filter are then multiplied by the values of each step to produce the extra values. The input image is used to create a new matrix that is smaller.

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning system that can take in a picture as input, assign various objects and elements of the image importance (learnable weights and biases), and be able to differentiate between them.ConvNet requires substantially less pre-processing than other classification methods.

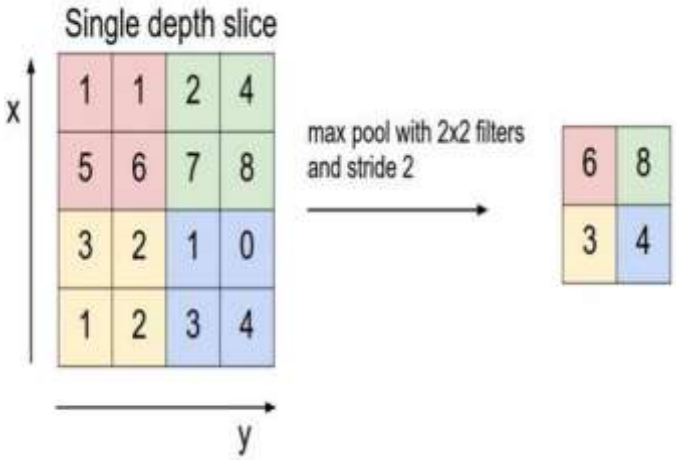
algorithms. While hand-engineered filters are used in traditional techniques, given sufficient training, ConvNets possess the capacity to learn these filters and traits.

A ConvNet's architecture was influenced by how the Visual Cortex is organised and is similar to the Neuronal interconnection network in the human brain.Only in this constrained area of the visual field, known as the Receptive Field, do individual neurons react to stimuli. a group of these fields overlap to completely enclose the visual field



Matrix format of convolutional layer

Pooling layer: Layering Pools In addition to lowering the downsampling layer's neuron size; this layer also guards against overfitting. This layer reduces the number of parameters, training time, computation rate, and overfitting. It also reduces the size of the feature map. When a model performs perfectly on the training dataset but only half as well on the test data, it is said to be overfit. The size of the feature map was decreased using ReLU and max pooling.



2X2 MATRIX FOR POOLING LAYER

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Activation Layer:A non-linear ReLU (Rectified Linear Unit) activation layer is used in each convolution layer.as the layer of operation. This layer also employs the use of dropout layers to avoid overfitting.

Fully Connected Layer: The layer's output serves as the classifier's input as it is utilised to examine class probabilities. The well-known input classifier, Softmax, is used in this layer to identify and categorise sugarcane illnesses.

VIII. RESULTS

The two circumstances for training and testing are distinct. One involves testing the model in laboratory circumstances, which entails using photos from the same dataset that wasused for testing as well as training.The second requirement is known as the "field condition," and it denotes that we've tested our model using photos of actual environmental circumstances (land). The lighting and background characteristics of the photographs taken when we collect samples from the real field are very different from those taken in the lab, so it is possible that our model will produce results that are very inaccurate when compared to the accuracy values attained in the lab settings. The idea of using a variety of images during training to counteract this effect phase was then developed (heterogeneity).

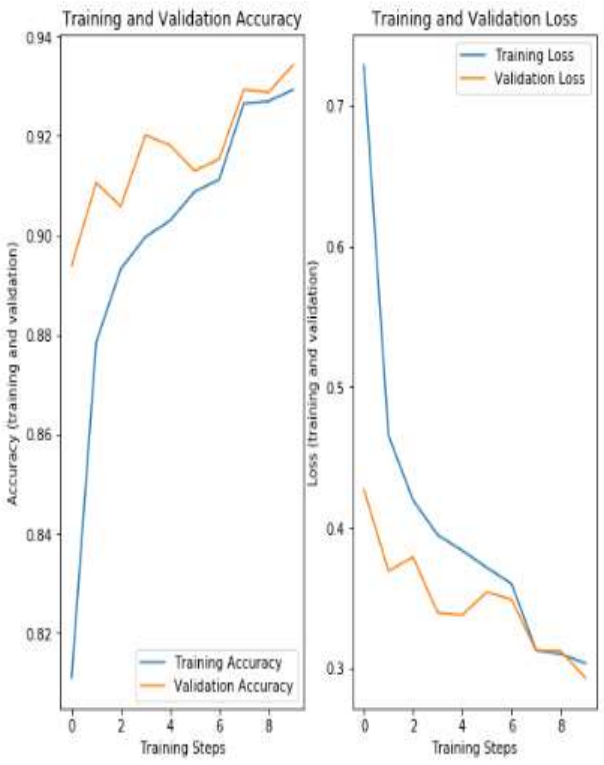
- Performance :Accuracy is the ratio of photos that were correctly categorised to all of the images.

• Loss function: The accuracy with which the The data is modelled by architecture.

• Precision: The ratio of accurately predicted observations to actual.The total number of accurate and inaccurate positive predictions increased as a result of observations (true positives).

• Recall: the proportion of accurately foreseen observations to all observations
False negatives plus true positives in that class. The harmonic mean of recall and precision is the F1 score.

• The amount of time (in seconds) needed to train each DL model.



IX. CONCLUSION

Production in India is an important part of National Economy. Predicting a disease that attacks the paddy helps the farmer to get suitable remedy rather than being confused what to use. Here we have two major diseases that often attackpaddy. These two diseases look very similar, but have different attacking mechanisms. So, we help the farmers by predicting between those two diseases are Potato_Early_Blight and Potato_Late_Blight.

In order to identify disease-affected plants from healthy plants, an application was created. This suggested Work focuses on field settings with accurate values, and it is carried out using a variety of photos of plant diseases.

Overall, this job is done from scratch and has a respectable degree of precision. In order to improve accuracy, future work will involve expanding the database's image content and altering its design to better fit the data set.

We used the Keras and TensorFlow APIs as a base to develop our model. We used the concept of "Convolutional Neural Network" to train our model. It's a slow process but provides good accuracy levels compared to some other ML algorithms. Every line of our code is self- explanatory and easy to understand. The we trained the model with a handpicked data from internet. The model is tested to provide desired results.

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