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# LEAF DISEASE DETECTION USING CNN

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**Abstract:** The major reason for minimizing crop productivity is various diseases in plants. To eliminate the disease-induced losses in plants during growth as well as to increase crop productivity, former disease detection and prevention on the crop are the most challenging factors. Thus, it is a suitable decision that can be taken by the farmers or villagers to avoid further losses. The project works on the technique of image processing which identifies the various diseases in plants. Here we use an efficient convolutional neural network algorithm (CNN) algorithm which can detect the type of diseases in various leaves. Our proposed paper includes implementation steps like datasets gathering, training, segmentation, feature extraction, testing, classification, using CNN to classify the leaves which are diseased or healthy based on data. This work implemented in giving the input leaf in real-time from the source of Google or dataset is trained under the system helps in disease detection and represents remedies for overcoming the deficiency. After the validation step, the project provides an accuracy of 99.5%.

**Keywords**: image processing, feature extraction, classification, detection, CNN

## I. INTRODUCTION

One of the major sources of yield in India is the production of crops. It is of enhancing the technological advancement in the fields related to crop productivity. Here farmers cultivate a maximum diversity of plants and crops. More studies are built with the important domain of qualitative and efficient farming is concentrated on enhancing the yield and food crop productivity at a minimum time with a greater outcome. The detection of plant disease by human visualization is a more difficult task and at the same time, less efficient, and it's done with a limited set of leaf images and takes more time. Whereas the automatic identification technique will take less effort and time and a more accurate program. Here we use image processing to detect the diseases. We can put the image into a system and a computer can perform various phases for identification and detect the related classes to which that image belongs. This work aims to make a leaf recognition technique based on the specific characteristics derived from images.

First of All, here import the packages like OpenCV, NumPy, tqdm, TensorFlow, matploatlib, etc., and define the functions for label images, and load training data. We classify the images into four categories depending on the code name of plant diseases. For training, phase loads the variety of images and it resizes with a resolution of 50*50. Then images and corresponding labels are appended to the list. The above steps are used for testing the data. For classification here, we use the CNN algorithm. It consists of several layers for efficient implementation. In each step, convolutional layer build and pooling are added. Finally, the regression layer is added to get the output. Another important parameter is learning rate (LR) which consists of how the speed at which learning the model. Here $1.e^{-3}$ set as LR. After the model building, load the data in the model. Here we use the variable consisting of a model name that

represents healthy or diseased. Then save the model on the folder to this variable name and put the data to this model and detect it.

Common diseases like viral, bacterial, fungal infections can be difficult to distinguish, and these symptoms can be represented in the difference in color, function, and shape in which plant responds to the pathogen. Smaller datasets are less efficient and affect the model performance. Training a large set of data can not only reduce overfitting but can enhance a model's overall performance. The quality and type of training dataset massively impact the model capabilities. The training data contains noise the classifier's accuracy becomes dependent on this composition. This topic of early detection is explored due to a limited number of datasets, and it consists of less accuracy and detection. This system avoids the gathering of more leaf inputs for studying them in the laboratory because preexisting images and datasets are taken and identify the plant diseases.it imparts a feasible functioning approach that can use not be costly and complex. It works by using CNN to detecting the leaf is healthy or diseased and if it is a disease it identifies the diseases like fungi, viruses, bacteria, black spots, powdery mildew, downy mildew, blight, canker, etc. and also provides remedies for recoverability of these diseases.

# II. RELATED WORKS

The implementation model was developed with a system consisting of higher system requirements. Here users have to give leaf images and the specified thing in this model is users must install the various packages like TensorFlow, Opencv, Keras, etc. The existing system consisting of users has detected the diseases which present in the plant leaves. But it does not provide the remedies for overcoming the deficiency.

Paper [1] proposed various methods for the automated identification of plant diseases. The disease can manifest in various parts of the plant such as root, stem, fruit, leaves, etc. As stated before this work concentrate, particularly on leaves.

Paper [2] presents the identification of diseased and healthy leaves from created sets of data. These are built with many strategies on feature extraction like the histogram of an oriented gradient (HOG).

Paper [3] Mr. Ashish Nage and Prof V.R Raut discussed with identification of diseases in leaves. They suggest an android application that helps farmers for identifying plant diseases by uploading images on the computer. This program builds with a set of algorithms that identifies the disease type. User-given input undergoes several processing steps to detect the disease and results are returned to the user with the android application.

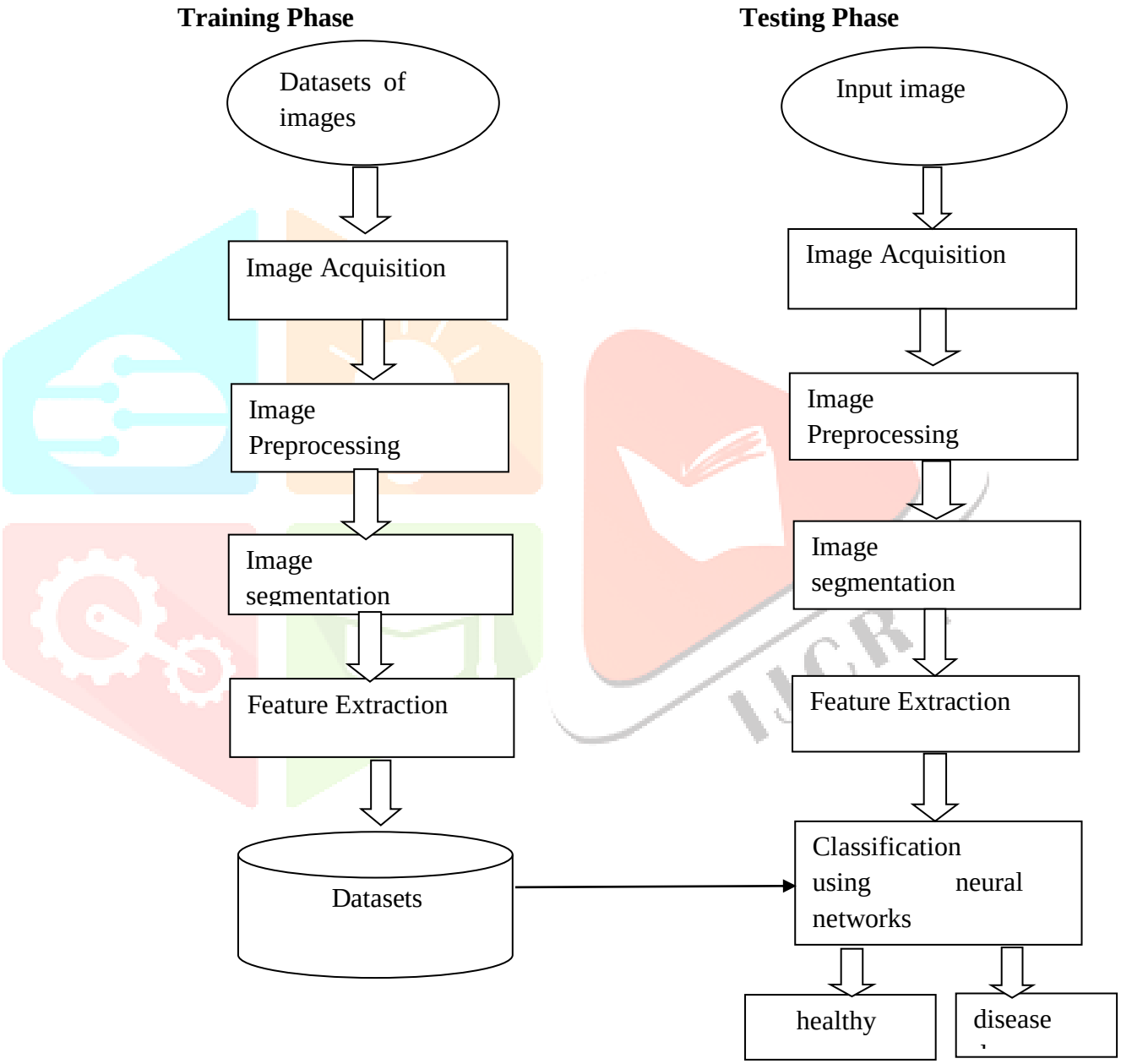
Paper [4] uses image processing to identify unhealthiness in plants and detect downsides in the tomato leaves from images. For detection here consider the features like color, bound and texture to give the brisk and decrease the losses for farmers and ensure productivity. Here, KNN (K- nearest neighbors) algorithm is used for classification. Which is guided and implemented to find solutions for classification and regression problems.

Paper [5] focus on finding plant diseases and reducing losses. For building the model here using deep learning techniques for leaf identification and important hierarchy of neural networks like Faster region basis convolution neural network (Faster R-CNN), region-based fully CNN(R-CNN), and single-shot multibook detector (SSD). After validation, it produces the results consisting with an accuracy of 94.6% which depicts feasibility on the CNN and finding deep learning solutions.

Paper [6] aims to rice leaf identification model using machine learning approaches. The algorithm used for this purpose is KNN (K Nearest Neighbor), J48(decision tree), Naïve Bayes and Decision tree algorithm, Logistic Regression, etc. Higher accuracy was found in this paper by the use of efficient algorithms.

# III. PROPOSED METHODOLOGY

This area includes the implementation steps and methods consisting of creating and deploying identification, classification techniques. For classification, here we use efficient convolutional neural networks (CNN) algorithm. Here we have two folders train and test. Training used for building the system on plant leaves and test consists of testing the system and detecting the accuracy of the work. First of All, import the necessary packages like OpenCV, NumPy, TensorFlow, tqdm, matploatlib, etc. Here defining the first function for label images. The developed model builds with four classes of classification. Next, create a function for loading the training data. Training data load images from our folder then resize it. Here resizes the image with a resolution of 50*50. After resizing append the images and corresponding labels to the list. Testing data build with same as mentioned above.




**Dataset:** This is a set of images for specified purposes. We use a plant leaf dataset and each of them is divided for preprocessing and classification. The Leaf dataset consists of more than 1000 images of various plants. This contains both healthy and diseased leaves. The diseased class includes in name of the specified disease and provides remedies for overcoming the deficiency. Here we train the large dataset and detect the disease present on each leaf.

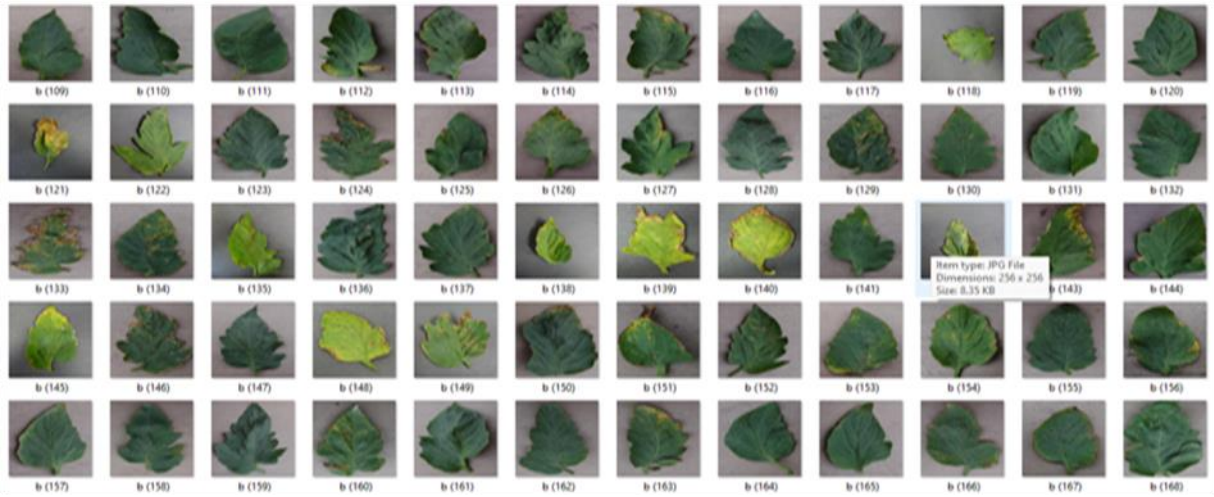


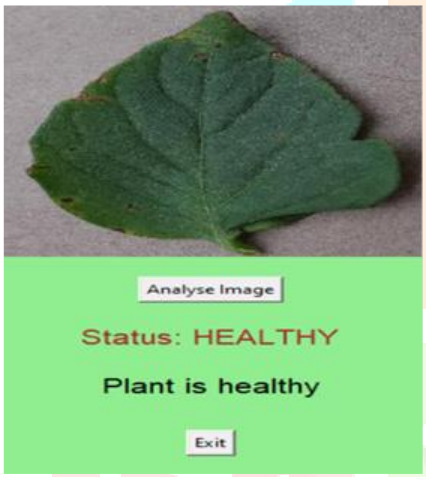
**Image acquisition:** To put the desired leaf image from the dataset or real-time source from Google is also established, the sampled images of the diseased and healthy leaves are gathered and used in training the system for acquisition.

**Image preprocessing:** preprocessing of leaves is bringing all the image sizes to be reduced uniform size like 50*50 resolution. The main motive of this step is to remove the noise or other unwanted objects from the image.

**Segmentation:** segmentation is a phase of image processing it segments the leaves into several parts and derives useful and meaningful information from the data. It derives the leaves based on leaf perimeter, shape, region edge, threshold, feature, and model. There are different types of segmentation techniques are available here we use neural network-based segmentation.

**Feature extraction:** CNN contains various layers which provide feature extraction and further classification of images. The key role of feature extraction in plant disease identification is to learn the features automatically. The basic geometrical features are derived in this step. Feature extracted based on the parameters like diameter, width, leaf area, leaf perimeter, morphological features, shape, texture, rectangular, etc.

**Classification:** classification is a process of placing each of the images under specified classes. The classification is a step in which it compares various values received after the feature extraction, and it classifies the input leaf is diseased or healthy, to establish efficient relation analysts use data. Here, we classify four categories as leaf images. If the resulting status of the leaf is diseased it provides the remedies for removing the deficiency.



# IV. ALGORITHM DESCRIPTION

The last step in our processing of the leaf phase is the testing of various images and identifying the diseases. The algorithm used in the classification program is CNN. CNN consists of a complex network chain that extracts the characters in the images and classifies them to get specified results related to the input. Neural networks build with many layers like the input layer, convolutional layer, output layer, and fully connected layer. The Convolutional layer can add more layers to it. Firstly, we load the input data and create the convolution layer. Each layer consists of an activation function. Together with the convolutional neural network, we add a pooling function. Here five convolutional layers build, with corresponding pooling is added. At the end of each layer take the fully connected layer and give a softmax activation function. Finally, the regression layer is used for receiving the result and using the optimizer. Another important parameter is learning rate (LR) which represents the speed at which one learns the model. Here we set the learning rate as 1.e-3. After the model building, load the data in the model. Training data convert for x and y. x is the image and y defines the label. We use the variable for the model to represent healthy and unhealthy. Finally, give the data for the model and detect if it is healthy or diseased. CNN algorithm is more efficient for dividing a huge amount of data and it can be described as an efficient machine learning algorithm. As it is building on finding solutions to classification and identification tasks. It can be learning characters automatically on the dataset. This algorithm analyzes visual leaves more efficiently. The structures of this algorithm change dramatically. The quality and type of training data collectively impact the capabilities of the model. Classifier accuracy depended on the data. Classification is made with the nature of their primary causal agent, either infectious or healthy.

**Training and Testing Algorithm**

Input: providing an image of leaves localization

Output: classification of a review into healthy or diseased, it is diseased provides the remedies for overcoming the deficiency.

Step1: Start

Step2: prepare a database (healthy or diseased)

Step 3: preprocessing normalization

Step4: Train CNN

Step5: real images from Google or dataset

Step6: preprocessing

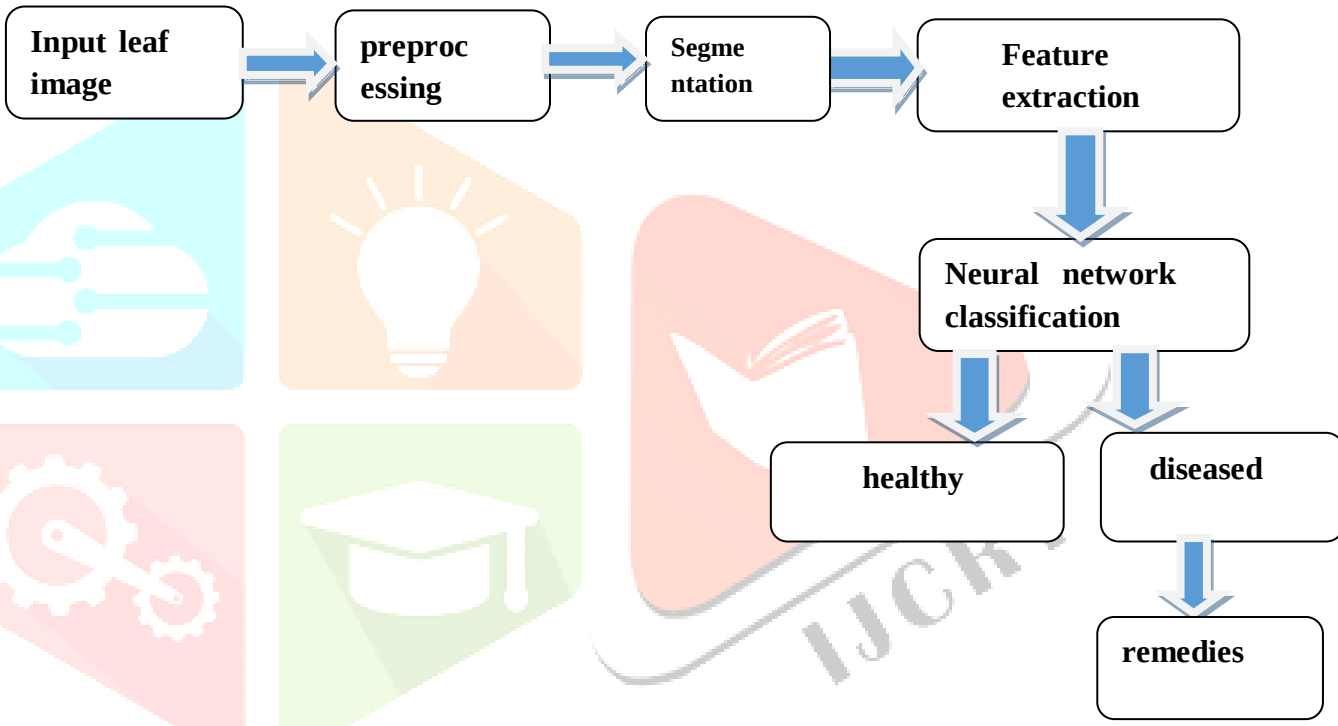
Step7: test network

Step8: if the probability of healthy > probability of unhealthy display a healthy leaf, otherwise display a diseased leaf.

Step9: go to the fourth step

Step10: stop

**Block diagram:**




# V. CONCLUSION

maximizing the production of crops consisting of efficient leaf disease identification and further derivation is a major thing. This can be activated using an automatic leaf disease identification model building the concept of image processing strategy. This work addressed extracting the characters of individual images and further classifying them in two ways are, healthy or diseased. After the classification which provides it is diseased leaf and as well as the remedies for recovering the deficiency. Here we use a convolutional neural network (CNN) algorithm. Which contains a hierarchy of layers that helps for efficient detection purposes. The overall phases are outlined, it starts with the large collection of datasets that are used for training and testing to the preprocessing phase and further training the method for CNN and optimization. With these image processing strategies, we can accurately recognize and classify a variety of leaf diseases. Here we put the images for detection in both ways, real-time from the Google or trained datasets. In this project, we built the model with proper methods and implementation steps. The proposed system is computationally more accurate than the pre-existing one and provides easier and faster results corresponding to the input image.it aims to make helping the farmers and avoid loss.

Overall, this work is conclusive in demonstrating how CNN applied to empower farmers in their fight against leaf disease. Soon work should be focused on diversifying training datasets and also on testing with similar web applications in

real-life situations. Without such practical developments, the struggle against plant diseases will continue to exist.it causes many losses are happening in crop productivity.

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