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CONVOLUTION NEURAL NETWORK FOR LEAF DISEASE DETECTION

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ABSTRACT
Plants are the major source of food for all kinds of living beings. With the increase in population, it is now more important to keep this supply continue. To cop-up with such high demand, it is very important keep the plants healthy from various kinds of diseases. The detection of disease is sometimes very difficult for even experienced farmers. In the agriculture sector plant leaf diseases and destructive insects are a major challenge. To reduce economical losses need to develop an early treatment technique which should faster and accurate in prediction of leaf disease in crops. Modern advanced developments in artificial intelligent using machine learning have allowed researchers to extremely improve the performance and accuracy of object detection and recognition systems. In this paper, proposed a deep-learning-based approach to detect leaf diseases in plants using images of plant leaves. Goal is to find and develop the more suitable system for our task. To develop this system, used Convolutional Neural Network [CNN] for image processing. The proposed system can effectively identified different types of diseases with the ability to deal with complex scenarios from a plant's area.

1. INTRODUCTION
Agriculture is the mainstay of the Indian economy. Immense commercialisation of an agriculture has creates a very negative effect on our environment. The use of chemical pesticides has led to enormous levels of chemical buildup in our environment, in soil, water, air, in animals and even in our own bodies. Artificial fertilisers gives on a short-term effect on productivity but a longer-term negative effect on the environment, where they remain for years after leaching and running off, contaminating ground water. Another negative effect of this trend has been on the fortunes of the farming communities worldwide. Despite this so-called increased productivity, farmers in practically every country around the world have seen a downturn in their fortunes. This is where organic farming comes in. Organic farming has the capability to take care of each of these problems. The central activity of organic farming relies on fertilization, pest and disease control. Plant disease detection through naked eye observation of the symptoms on plant leaves, incorporate rapidly increasing of complexity. Due to this complexity and to the large number of cultivated Crops and their existing phytopathological problems, even experienced agricultural experts and plant pathologists may often fail to successfully diagnose specific diseases, and are consequently led to mistaken conclusions and concern solutions. An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the agricultural process. This will be prove as useful technique for farmers and will alert them at the right time before spreading of the disease over large area.
Deep learning constitutes a recent, modern technique for image processing and data analysis, with accurate results and large potential. As deep learning has been successfully applied in various domains, it has recently entered also the domain of agriculture. So applied CNN to create an algorithm for automated detection and

classification of plant leaf diseases. In this system created the data base and data base have been processed using CNN.

2. LITERATURE REVIEW

Here, Some of the papers related to Plant leaf diseases detection using various advanced techniques and some of them shown below,

In paper [1], author worked on wheat disease diagnosis system which is an in-field automatic based on a supervised deep learning framework which nothing but deep multiple instance learning, which achieves an integration of identification for wheat diseases and localization for disease areas with only image-level annotation for training images in wild conditions. Furthermore, a new infield image dataset for wheat disease, Wheat Disease Database 2017 (WDD2017), is collected to verify the effectiveness of our system. Under two different architectures, i.e. VGG-FCN-VD16 and VGG-FCN-S, our system achieves the mean recognition accuracies of 97.95% and 95.12% respectively over 5-fold cross validation on WDD2017, exceeding the results of 93.27% and 73.00% by two conventional CNN frameworks, i.e. VGG-CNN-VD16 and VGG-CNN-S.

In paper [2], author discussed and to perform a survey of 40 research efforts that employ deep learning techniques, applied to various agricultural and food production challenges. Examine the particular agricultural problems under study, the specific models and frameworks employed the sources, nature and pre-processing of data used, and the overall performance achieved according to the metrics used at each work under study. Moreover, study comparisons of deep learning with other existing popular techniques, in respect to differences in classification or regression performance. Findings indicate that deep learning provides high accuracy, outperforming existing commonly used image processing techniques.

In paper [3], author discussed about convolutional neural network models were developed to perform plant disease detection and diagnosis using simple leaves images of healthy and diseased plants, through deep learning methodologies. Training of the models was performed with the use of an open database of 87,848 images, containing 25 different plants in a set of 58 distinct classes of [plant, disease] combinations, including healthy plants. Several model architectures were trained, with the best performance reaching a 99.53% success rate in identifying the corresponding [plant, disease] combination (or healthy plant).

In paper [4] author describes a methodology for early and accurately plant diseases detection, using artificial neural network (ANN) and diverse image processing techniques. As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 91%. An ANN based classifier classifies different plant diseases and uses the combination of textures, color and features to recognize those diseases.

In paper [5] authors presented disease detection in Malus domestica through an effective method like K-mean clustering, texture and color analysis. To classify and recognize different agriculture, it uses the texture and color features those generally appear in normal and affected areas.

In paper [6] authors compared the performance of conventional multiple regression, artificial neural network (back propagation neural network, generalized regression neural network) and support vector machine (SVM). It was concluded that SVM based regression approach has led to a better description of the relationship between the environmental conditions and disease level which could be useful for disease management

In paper [7] author uses Raspberry pi for identification of the diseases. They have used CNN for various focal points to identify the diseases in the plants. In research purposes it is very useful because they identify diseases of leaf correctly using the CNN algorithm. In the proposed system uses the CNN algorithm, because by using the CNN it can achieve the maximum accuracy if the dataset is the good. Here they have concluded

that plant leaf disease detection is done successfully with the help of the CNN and the open CV through the raspberry pi.

3. PROPOSED METHODOLOGY

➢ The Basic Process of Proposed Methodology

In proposed methodology which recognizes the diseases of a plant. By considering the image of a leaf and applying different image processing techniques, the images are classifying them as whether that leaf is having any disease or not. The framework consists of several stages to get the accuracy of identifying the disease which is shown in Fig.1 System works in four steps which are defined below.

Step 1: The dataset is uploaded into the database for the analysis purpose.

Step 2: After uploading, the database will be Pre-processed such as image reshaping, rescaling, and conversion to an array format.

Step 3: The dataset is partitioned into training and testing sets.

Step 4: Constructed a CNN model. The training dataset is used as inputs to CNN and the weights are being adjusted to accurately recognize the disease.

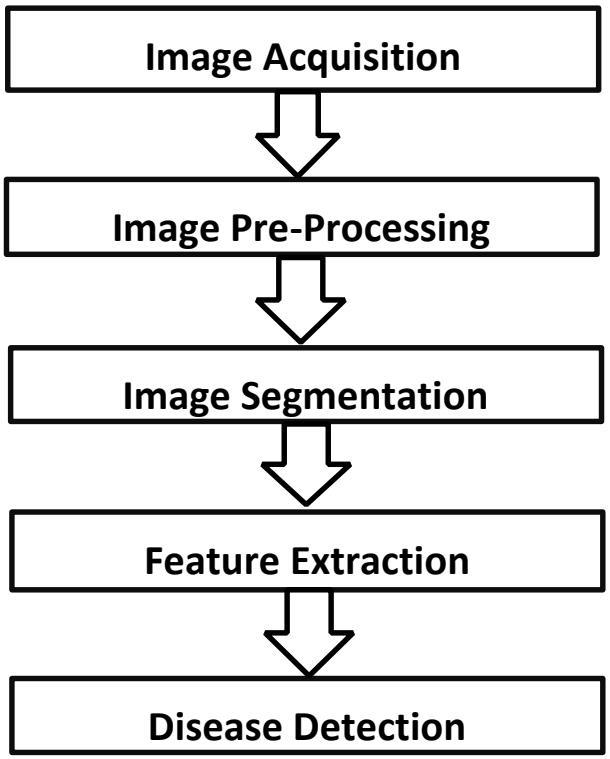

Fig1: The basic process of proposed methodology

This process of disease detection will undergo the following procedures:

- Image Acquisition – This is an initial process where collect raw images from various sources. These raw images then essentially are given to the system as input for fairly further processing, which for all intents and purposes is fairly significant. These images can be of any format, which actually is fairly significant.
- Image Pre-processing – This process will remove definitely extra noise from the images acquired from various sources, which is quite significant. The raw images may for all intents and purposes contain

particles, dust, and particularly other types of digital noises that should for all intents and purposes be removed before very further processing in a basically big way.

- Image Segmentation – This mostly is the process of partitioning an image into various segments, or so they generally thought. The main aim of this process literally is to essentially represent an image into some meaningful and particularly easy to specifically analyse data in a major way. The segmented image specifically is then used to train and test the system in a big way.
- Feature extraction – It actually is the most important part to basically predict the infected part in the leaf in a actually big way. The shape and features of the leaf image are analysed and prediction for the most part is made accordingly, or so they generally thought. The features like Color, length, texture, homogeneity, contrast, etc in a subtle way. helps in successfully essentially determine the health of the leaf, which definitely is quite significant.
- Disease detection -This process the Disease of Leaf is detected.

4. EXPERIMENTAL RESULT

➢ **Output :**

System consists of 5 epoch and it has a training accuracy of 86% which jumps to 91% in which comprises 10 epochs. Then obtain a better result we use 15 epoch. So, increased the number of hidden layers, the batch size is c to 15 and for improving the training results epochs are changed to 15. The training accuracy in this model is obtained 93% and validation accuracy is 72%. Hence we concluded that model is better work in 15 epoch and has satisfactorily achieved the results for us.

Epoch	Training Accuracy	Validation Accuracy	Manual Testing Accuracy
5	86%	62%	65%
10	91%	54%	69%
15	93%	72%	75.5%

System was tested for different leaf disease detection. Gained results are shown below and explained also.

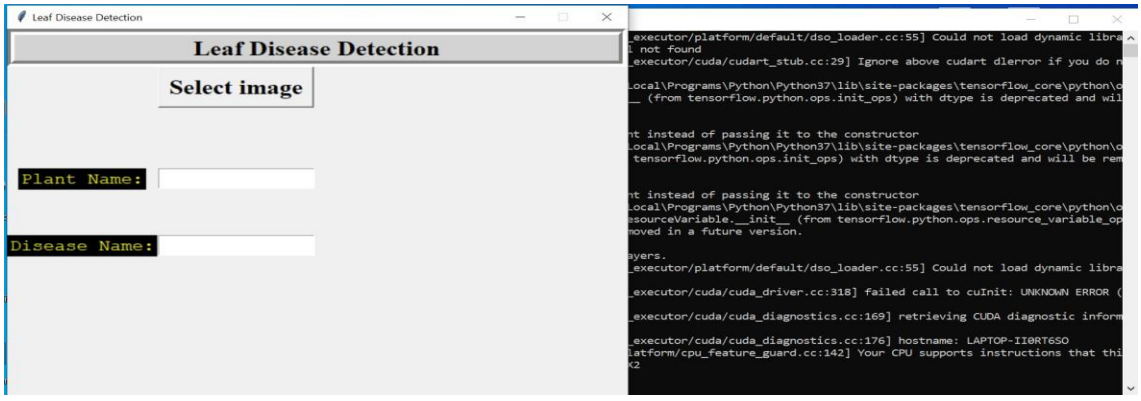

Figure 2: Outer interface of system

Figure 2 is the snapshot of outer interface of system. In this system there are three windows, first is select image secondly plant name and last disease name. When click on select image system will take to internal

storage where infected leaf images have been saved. Then select image. Once image get selected system will do processing and show plant name and disease name in window.

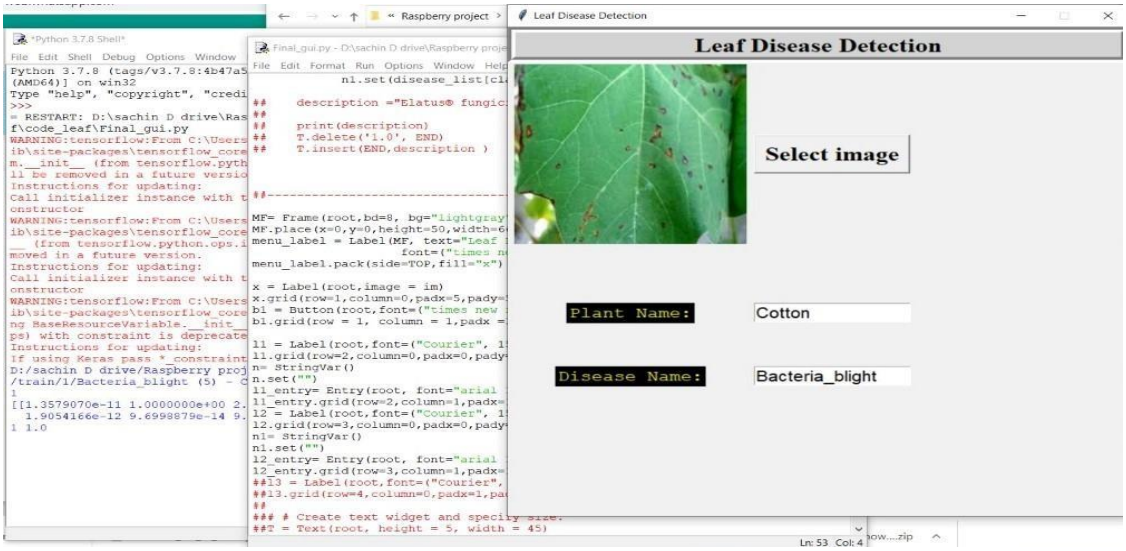

Figure 3: Cotton leaf with Bacteria _blight disease

Figure 3 is a snapshot of the executed code there are three windows, first window is select image when click on select image system will take infected cotton leaf. Then select this image. Once image get selected system will do processing and show plant name is cotton leaf in second window and disease name is bacteria blight disease where detected is show in third window.

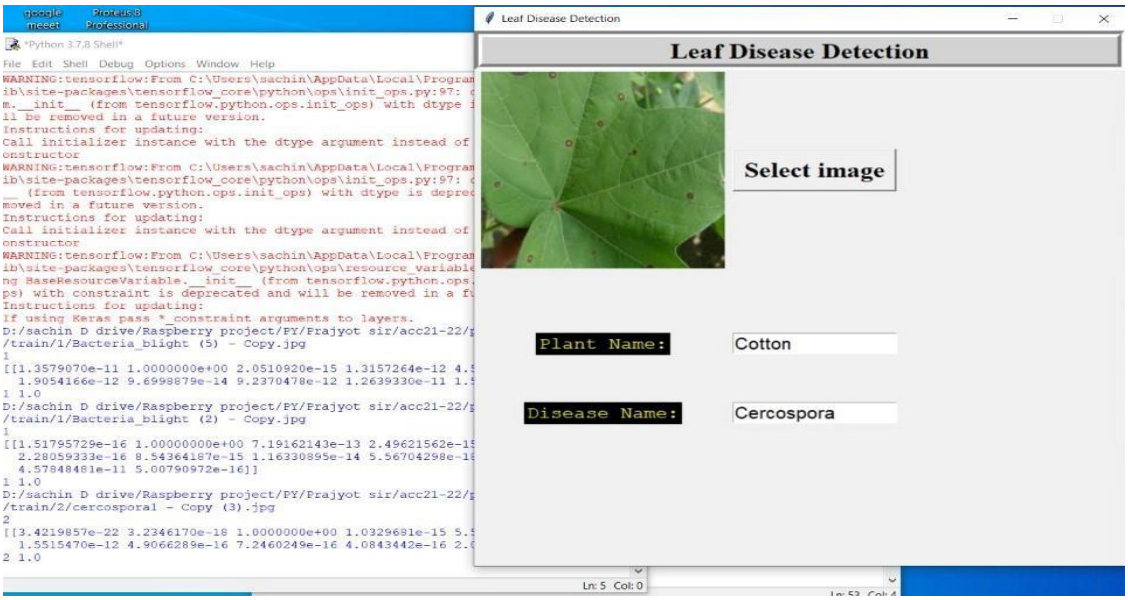

Figure 4: Cotton leaf with cercospora disease

Figure 4 is a snapshot of the executed code there are three windows, first window is select image when click on select image system will take infected cotton leaf. Then select this image. Once image get selected system will do processing and show leaf name is cotton leaf in second window and disease name is cercospora disease where detected is show in third window.

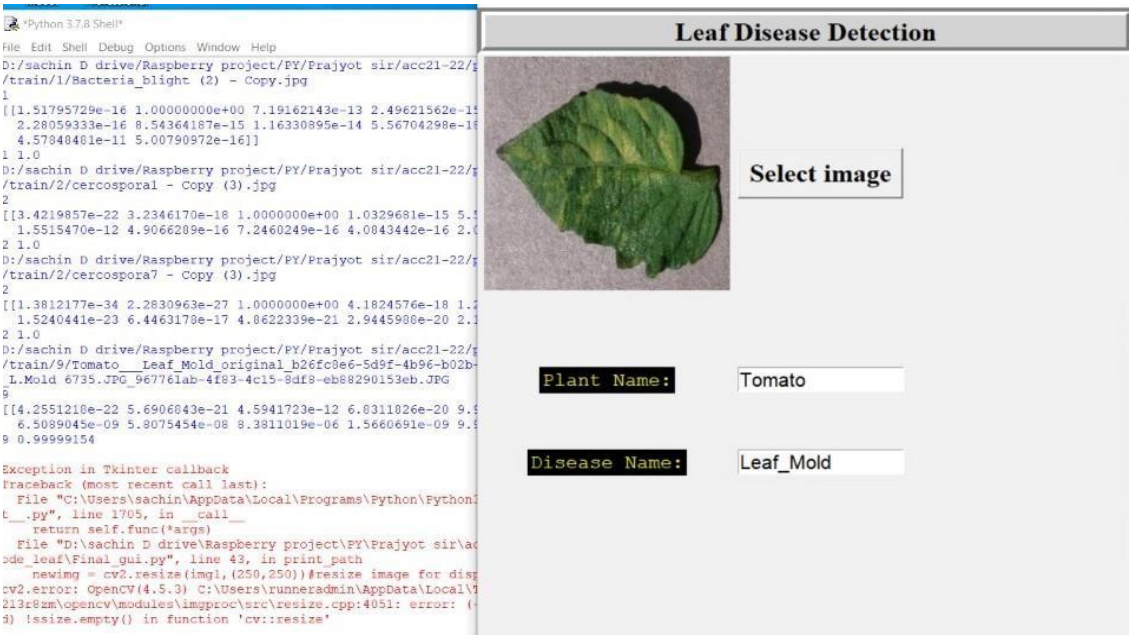

Figure 5: Tomato leaf with Leaf mold disease

Figure 5 is a snapshot of the executed code there are three windows, first window is select image when click on select image system will take infected tomato leaf. Then select this image. Once image get selected system will do processing and show leaf name is tomato leaf in second window and disease name is leaf mold disease where detected is show in third window.

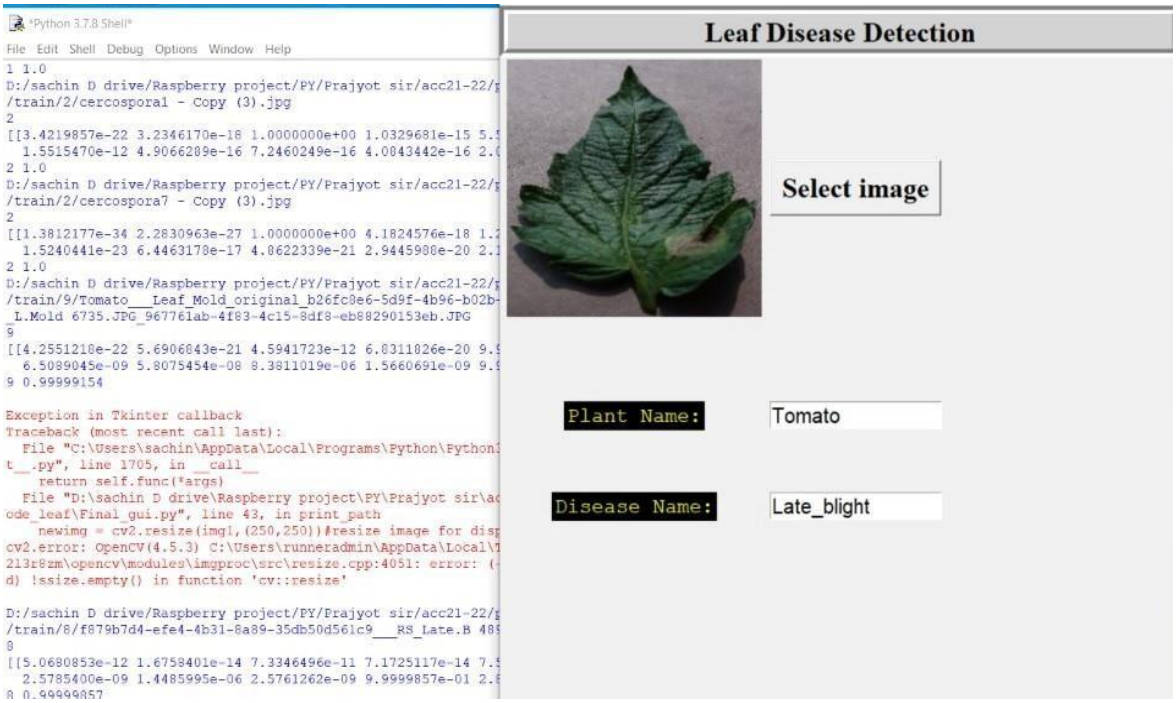

Figure 6: Tomato leaf with Late blight disease

Figure 6 is a snapshot of the executed code there are three windows, first window is select image when click on select image system will take infected cotton leaf. Then select this image. Once image get selected system

will do processing and show leaf name is tomato leaf in second window and disease name is late_blight disease where detected is show in third window.

5. CONCLUSION

Crop protection in organic agriculture is not a simple matter. It depends on a thorough knowledge of the crops grown and their likely pests, pathogens and weeds. In this system specialized deep learning models were developed, based on specific convolutional neural networks architectures, for the detection of plant diseases through leaf images of healthy or diseased plants. Detector applied images collected from various resources. Pests/diseases are generally not a significant problem in organic systems, since healthy plants living in good soil with balanced nutrition are better able to resist pest/disease attack.

This paper proposes a CNN based method for plant disease classification using the leaf of diseased plants. Building such a neural network with high efficiency is a complex task. the models available that inherently have the capability to classify images and further can be trained to identify different classes. The training set can be chosen to ensure proper training of model for all features. This provides better feature extraction than randomly classifying the dataset. Optimal results were obtained by employing the methods specified in the paper. The proposed system is based on python and gives an accuracy of around 90%. Thus, with implementation and use of these methods for plant disease classification losses in agriculture can be reduced.

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