Leaf Disease Detection using Deep Learning

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Abstract— *The early detection of diseases is important in agriculture for an efficient crop yield. The bacterial spot, late blight, septoria leaf spot and yellow curved leaf diseases affect the crop quality of tomatoes. Automatic methods for classification of plant diseases also help taking action after detecting the symptoms of leaf diseases. This paper presents a Convolutional Neural Network (CNN) model and K-means clustering algorithm based method for tomato leaf disease detection and classification. The dataset contains 500 images of tomato leaves with four symptoms of diseases. We have a modeled CNN for automatic feature extraction and classification. Color information is actively used for plant leaf disease researches. In our model, the filters are applied to three channels based on RGB components. The k-means has been fed with the output feature vector of convolution part for training the network. The experimental results validate that the proposed method effectively recognizes four different types of tomato leaf diseases*.

I. INTRODUCTION

The primary occupation in India is agriculture. India ranks second in the agricultural output worldwide. Here in India, farmers cultivate a great diversity of crops. Various factors such as climatic conditions, soil conditions, various disease, etc affect the production of the crops. The existing method for plants disease detection is simply naked eye observation which requires more man labor, properly equipped laboratories, expensive devices, etc. And improper disease detection may lead to inexperienced pesticide usage that can cause development of long term resistance of the pathogens, reducing the ability of the crop to fight back. The plant disease detection can be done by observing the spot on the leaves of the affected plant. The method we are adopting to detect plant diseases is image processing using Convolution neural network (CNN).

The user is to select a particular diseased region in a leaf and the cropped image is sent for processing. This paper intends to study about the prediction of the plant diseases, at an untimely phase using k-mean clustering algorithm. Specifically, we concentrate on predicting the disease. It would be useful for identifying different diseases on crops. It provides various methods used to study crop diseases/traits using image processing and data mining. In addition, the infected area and affected percentage is also measured. Back Propagation concept is used for weight adjustment of training database.

The aim of the project is to identify and classify the disease accurately from the leaf images and provide the solution for it. It shows the affected part of the leaf in percentage. The steps required in the process are pre-processing, training, identification and solution providing.

II. LITERATURE REVIEW

Detection and Classification of Plant Leaf Diseases by using Deep Learning Algorithm

M. Akila, P.Deepan

Plant leaf diseases and destructive insects are a major challenge in the agriculture sector. Faster and an accurate prediction of leaf diseases in crops could help to develop an early treatment technique while considerably reducing economic losses. Modern advanced developments in Deep Learning have allowed researchers to extremely improve the performance and accuracy of object detection and recognition systems. In this paper, we proposed a deep-learning-based approach to detect leaf diseases in many different plants using images of plant leaves. Our goal is to find and develop the more suitable deep-learning methodologies for our task. Therefore, we consider three main families of detectors: Faster Region-based Convolutional Neural Network(Faster R-CNN), Region-based Fully Convolutional Network (R-FCN),and Single Shot Multi box Detector (SSD), which was used for the purpose of this work. The proposed system can effectively identified different types of diseases with the ability to deal with complex scenarios from a plant's area.

Plant Disease Detection and Classification by Deep Learning

Mohammad Hammadsaleem, J.Potgieter, Khalid Arif

Plant diseases affect the growth of their respective species, therefore their early identification is very important. Many Machine Learning (ML) models have been employed for the detection and classification of plant diseases but, after the advancements in a subset of ML, that is, Deep Learning (DL), this area of research appears to have great potential in terms of increased accuracy. Many developed/modified DL architectures are implemented along with several visualization techniques to detect and classify the symptoms of plant diseases. Moreover, several performance metrics are used for the evaluation of these architectures/techniques. This review provides a comprehensive explanation of DL models used to visualize various plant diseases. In addition, some research gaps are identified from which to obtain greater transparency for detecting diseases in plants, even before their symptoms appear clearly.

Rice Blast Disease Recognition Using a Deep Convolutional Neural Network

Wan-jie Liang, Hong Zhang, Gu-feng Zhang, Hong-xin Cao

Rice disease recognition is crucial in automated rice disease diagnosis systems. At present, deep convolutional neural network (CNN) is generally considered the state-of-the-art solution in image recognition. In this paper, we propose a novel rice blast recognition method based on CNN. A dataset of 2906 positive samples and 2902 negative samples is established for training and testing the CNN model. The evaluation results show that the high-level features extracted by CNN are more discriminative and effective than traditional hand-crafted features including local binary patterns histograms (LBPH) and Haar-WT (Wavelet Transform). Moreover, quantitative evaluation results indicate that CNN with Softmax and CNN with support vector machine (SVM) have similar performances, with higher accuracy, larger area under curve (AUC), and better receiver operating characteristic (ROC) curves than both LBPH plus an SVM as the classifier and Haar-WT plus an SVM as the classifier. Therefore, our CNN model is a top performing method for rice blast disease recognition and can be potentially employed in practical applications.

Detection of Plant Leaf Diseases Using Image Segmentation and Soft Computing Techniques

Vijaisingh, A.K.Misra

Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. For instance a disease named little leaf disease is a hazardous disease found in pine trees in United States. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases i.e. when they appear on plant leaves. This paper presents an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using genetic algorithm.

Identification and Recognition of Rice Diseases and Pests Using Convolutional Neural Networks

Chowdhury R.Rahman, preetom, S.Arkomohammed, E.Alimohammad, A.Iqbal Khansajid , H.Aponfarzananowrin, Abuwasif

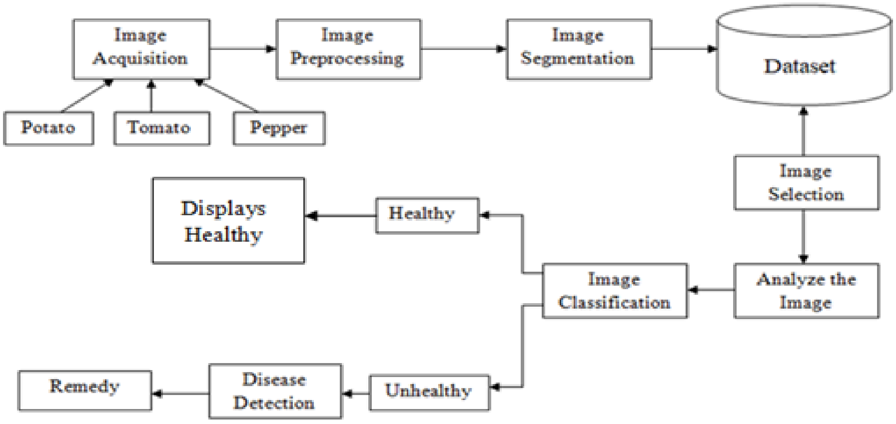
Accurate and timely detection of diseases and pests in rice plants can help farmers in applying timely treatment on the plants and thereby can reduce the economic losses substantially. Recent developments in deep learning-based convolutional neural networks (CNN) have greatly improved image classification accuracy. Being motivated by the success of CNNs in image classification, deep learning-based approaches have been developed in this paper for detecting diseases and pests from rice plant images. The contribution of this paper is twofold: (i) State-of-the-art large scale architectures such as VGG16 and InceptionV3 have been adopted and fine tuned for detecting and recognising rice diseases and pests. Experimental results show the effectiveness of these models with real datasets. (ii) Since large scale architectures are not suitable for mobile devices, a two-stage small CNN architecture has been proposed, and compared with the state-of-the-art memory efficient CNN architectures such as MobileNet, NasNet Mobile and SqueezeNet. Experimental results show that the proposed architecture can achieve the desired accuracy of 93.3% with a significantly reduced model size (e.g., 99% smaller than VGG16).

III. PROPOSED WORK

The aim of the project is to identify and classify the disease accurately from the leaf images. A color based segmentation model is defined to segment the infected region and placing it to its relevant classes. Disease detection involves steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. It detects the affected part of the leaf by the way of percentage. We propose an enhanced k-mean clustering algorithm to predict the infected area of the leaves. It provides the accurate solution for the plant diseases

Advantage

- More accuracy in classification
- Easily find out the plant disease
- Reduce the man power



- First we are collecting the leaf images such as Pepper, Potato, Tomato.
- The images can be pre-processed, segmented and final dataset will be prepared.
- The image can be selected from the dataset and image analyzation is done.
- Then it classifies the image whether it is healthy or unhealthy.
- If the leaf healthy, shows healthy otherwise shows unhealthy and detects the disease and it provides remedy.

IV. METHODOLOGY

4.1 Leaf Data Collection

1. Collecting the data from public repository.
2. In our project, we are collecting three different plant leaf images. That are,

- Pepper
- Potato
- Tomato

4.2 Leaf Data Pre-processing

- Fetching and loading the images
- Transform the Image Labels using Label Binarizer
- Labels are transformed into separate classes
- RGB color image to Grey scale image conversion
- Images are converted numpy

4.3 Leaf Classification

- Classifies the images into two types. That are,
- Healthy

- Unhealthy
- If image is healthy, shows healthy otherwise shows unhealthy

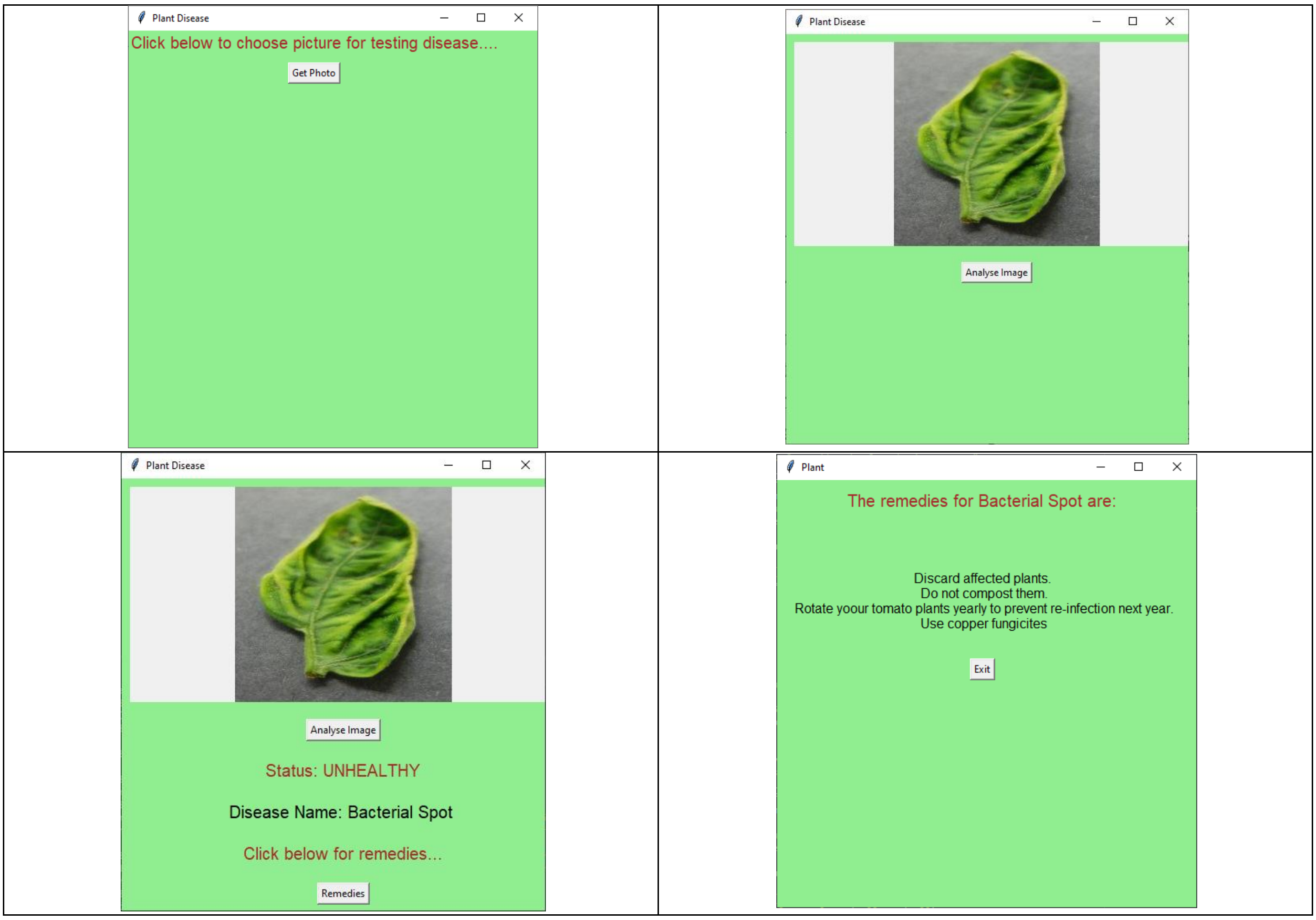
4.4 Leaf Disease Detection

- Train and Test image comparison
- Disease Detection

4.5 Remedy

- Analyze the disease
- Provides remedy

V. IMPLEMENTATION



VI. CONCLUSION

Thus a model built for the identification of disease affected plants and healthy plants is done and this proposed work is focused on the accuracy values during the real field conditions, and this work is implemented by having Ten number of plant disease classes. Overall this work is implemented from scratch and produces an accuracy of 86%. The future work is to increase the number of classes present in the open database (Plant Village) and to modify the architecture in accordance with the dataset for achieving better accuracy. The other condition is that field condition; this means that our model has tested with the images taken from the real world conditions (land). Since the lighting conditions and background properties o the images are totally different when we take samples from the real field, there is a chance that our model to produce a very low accuracy, when comparing to the accuracy values acquired during the lab conditions. So to overcome this impact, we had an idea of having a mixed variety of images during the training phase (heterogeneity).

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