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Farmer Buddy-Web Based Cotton Leaf Disease Detection Using CNN

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Abstract

Agriculture is one of the important professions in many countries including India. As most part of the Indian financial system is dependent on agriculture production, the keen attention to the concern of food production is necessary. The taxonomy and identification of crop infection got much importance in technical as well as economic in the Agricultural Industry. While keeping track of diseases in plants with the help of specialists can be very costly in agriculture region. There is a need for a system which can automatically detect the diseases as it can bring revolution in monitoring large fields of crop and then plant leaves can be taken cure as soon as possible after detection of disease. The aim of the proposed system is to develop an application which recognizes cotton leaf diseases. For availing this user need to upload the image and then with the help of image processing we can get a digitized color image of a diseased leaf and then we can proceed with applying CNN to predict cotton leaf disease.

Keywords: GLCM, CNN

I. INTRODUCTION

We all know that most of the Indian land is used for agriculture purpose. It is also the back support for Indian financial condition. There are various diseases which obstruct the growth of crops in fields which may cause huge loss in the quality of products. Nowadays image processing is used a lot for detecting such diseases, Pests like the germ, fungus, and microorganisms are main cause of the disease to crops due to failure in excellence and extent of production. It is huge loss to the farmer.

This paper is based on a system which implements Convolutional Neural Network to detect cotton leaf diseases. It offers more capable ways to discover infection created by Bacteria and environmental effects. Disease detection at an early stage on crop is a challenging task for farmers where physical presence is a must. Disease detection and recognition on the crop are very important. There are various algorithms in image processing for disease recognition by image classification like KNN, SVM, Random Forest, Artificial Neural Network and CNN. Previously image classification algorithms like face recognition need to pay attention at where the face is located in an image this major problem is overcome by CNN as well as features of an image are deeply processed at each layer. Every disease on crop has different features which are extracted at each layer of the convolution network.

The goal of this application is to develop a system which recognizes crop diseases. In this the user has to upload an image on the system, Image processing starts with the digitized color image of the diseased leaf. Finally by applying the CNN plant disease can be predicted.

A. Purpose of Proposed System:
1. Developing a user-friendly web-based system for farmers
2. Recognizing Cotton leaf diseases accurately from input images
3. Providing corrective and preventive measures for the detected diseases

B. Cotton leaf diseases focused:
1. Alternaria Macrospora
2. Bacterial Blight

II. RELATED WORK

Siddharth Singh Chouhan et al.[1] gives Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases. Bacterial foraging optimization (BFO) method attains higher performance in terms of identification and classification of plant leaf diseases. The region growing algorithm increases the efficiency of the network by searching and grouping of seed points having common attributes for the feature extraction process.

Muhammad Waseem Tahir et al.[2] gives a novel fungus dataset for the detection of fungus using CNN and distinguish different types of fungus. The designed CNN architecture gives 94.8% accuracy with 5 fold validation.

Sukhvir Kaur et al. [3] provide a technique for the detection of disease from Soybean leaf images. A rule-based semi-automatic system using concepts of k-means is designed and

implemented to distinguish healthy leaves from diseased leaves. The experiment is performed on color features, texture features, and their combinations to train three models based on support vector machine classifier. Using SVM classify the proposed system classify the leaf disease in 3 classes like i.e. downy mildew, frog eye, and sectorial leaf blight etc. The proposed system gives maximum average classification accuracy reported is ~90% using a big dataset of 4775 images.

Ranjith et al.[4] provide smart irrigation system has been proposed which can control the irrigation automatically using an android mobile application. Apart from this, the photos of plant leaves are captured and are sent to the cloud server, which is further processed and compared with the diseased plant leaf images in the cloud database. Based on the comparison a list of plant diseases suspected is given to the user via the Android mobile application.

Adhao Asmita Sarangdharet al.[5] give Support Vector Machine based regression system for identification and classification of five cotton leaf diseases i.e. Bacterial Blight, Alternaria, Gray Mildew, Cercospora, and Fusarium wilt. After prediction of plant disease system can also recommend pesticides to the farmers using android app. Android App is also used to display the soil parameters values such as humidity, moisture, and temperature along with the water level in a tank. By using Android app farmers can ON/OFF the relay to control the motor and sprinkler assembly according to need.

III. METHODOLOGY

The proposed system classifies the leaf image using image classification algorithm CNN. It can automatically detect and recognize diseases based on extracted features at each convolution layer. Below figure shows the structural design of the planned system. The system used image processing technique for disease detection. The user needs to upload the cotton plant leaf image. The system can preprocess the uploaded image and then apply CNN technique. By using CNN technique system can test the image with trained dataset and extract the features.

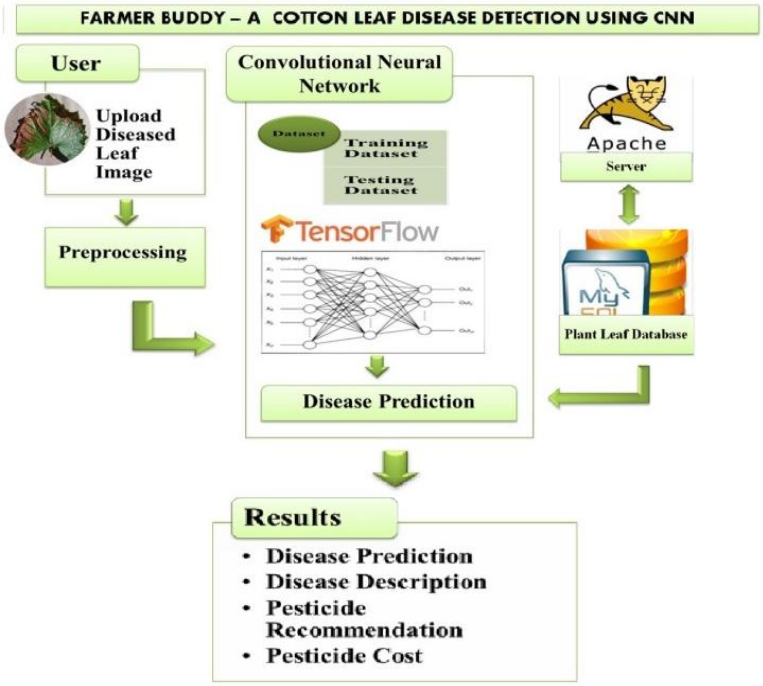

Fig.1. System Architecture

A. Project Description:

The techniques of machine vision are extensively applied to agricultural science, and it has great perspective especially in the plant protection field, which ultimately leads to crops management. The proposed system for plant leaf disease detection is based on the infected images of various plants. Images of the infected plants are captured by digital camera and processed using image growing, image segmentation techniques to detect infected parts of the plants.

1. Image Acquisition:

In this phase, raw image is taken as input from the user and converted into equivalent gray scale image. Also the image is resized into size of 128*128.

2. Convolutional Layers:

After the alteration of captured image, the processed image further passes through three different hidden layer in which feature extraction, pooling and flattening layer are also performed.

3. Disease Prediction:

After applying CNN, using Softmax layer the leaf image is predicted with disease which is gaining highest probability of occurrence.

B. Algorithm:

Traditional feature learning methods rely on semantic labels of images as supervision. They usually assume that the tags are evenly exclusive and thus do not point out towards the complication of labels. The learned features endow explicit semantic relations with words.

We also develop a novel cross-model feature that can both represent visual and textual contents. CNN itself is a technique of classifying images as a part of deep learning. In which we apply single neural network to the full image.

i. Accepts a volume of sizeW1×H1×D1
ii. Requires four hyper parameters:
   - Number of filters K
   - Their spatial extent F
   - The stride S
   - The amount of zero padding P
iii. Produces a volume of size W2×H2×D2 where:
   a. W2=(W1-F+2P)/S+1
   b. H2=(H1−F+2P)/S+1(i.e. width and height are compu ted equally by symmetry)
   c. D2=K
iv. With parameter sharing, it introduces F*F*D1 weights per filter, for a total of (F*F*D1)*K weights and K biases. In the output volume, the d^{th} depth slice (of size W2*H2) is the result of performing a valid convolution of the d^{th} filter over the input volume with a stride of S, and then offset by d^{th} bias.
v. A common setting of the hyper parameters is F=3, S=1,P=1

However, there are common conventions and rules of thumb that motivate these hyper parameters.

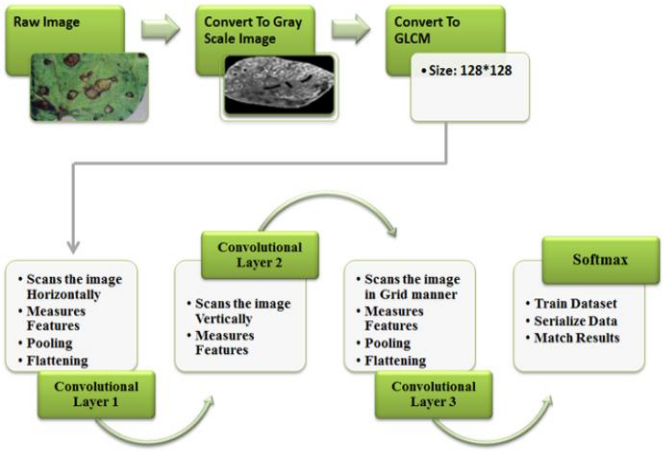

Fig.2. Algorithmic Flow

C. Implementation Details

Eclipse 3.3 Indigo IDE is used for overall development as a standard platform. JSP is used to design GUI of the Web Application. The database is basically used for storing user details like usernames, disease details, pesticide information and pesticide costs. We used the MYSQL database as the data to be stored was mostly structured. The tool used for DB functionalities was MYSQL GUI Browser.

By comparing different classification algorithm we come to know that CNN is a feed-forward neural network that is used to analyze visual images by processing data. CNN can give a higher accuracy in the prediction on plant disease due to different advantages. We detect whether the plant is having some disease or not and what pesticides are needed for recovery from that disease with the help of CNN. The datasets are divided into Training and testing datasets in the ratio 70:30 and cross-validation is applied to achieve better accuracy.

For building CNN Python 3.6 is used along with libraries such as OpenCV for image processing and TensorFlow for Machine learning. Using libraries allows us to extend the functionalities for using it on larger database. CNN consists of three Hidden layers i.e. Convolution layers; each convolution layer consists of Pooling and Relu layers. Relu is the activation function used to remove the negative weights. MaxPooling is used in the pooling layers. 64 different filters are applied in each layer for extracting features. Convolving window size is 3*3 and stride size is 4.Softmax layer at the end linearize the probabilities of the diseases in a single dimensional matrix to choose maximum probability.

Xampp server is used to deploy the Web Application on local computer. Server handles the request and response to system user.

IV. RESULTS AND DISCUSSION

The goal of this application is to develop a system which recognizes crop diseases and displays user the results as detected disease, pesticides recommended and cost of pesticides recommended, and for that user have to upload an image then, Image processing starts with the digitized color image of the diseased leaf. Finally by applying the CNN plant disease can be predicted.

The dataset contains two types of diseased leaf images that are Alternaria Macrospora and Bacterial Blight and also Healthy Leaf images. The training dataset consists of total 513 images while the testing dataset consists of 207 images. The accuracy of training is 80% whereas the accuracy of testing is 89%.

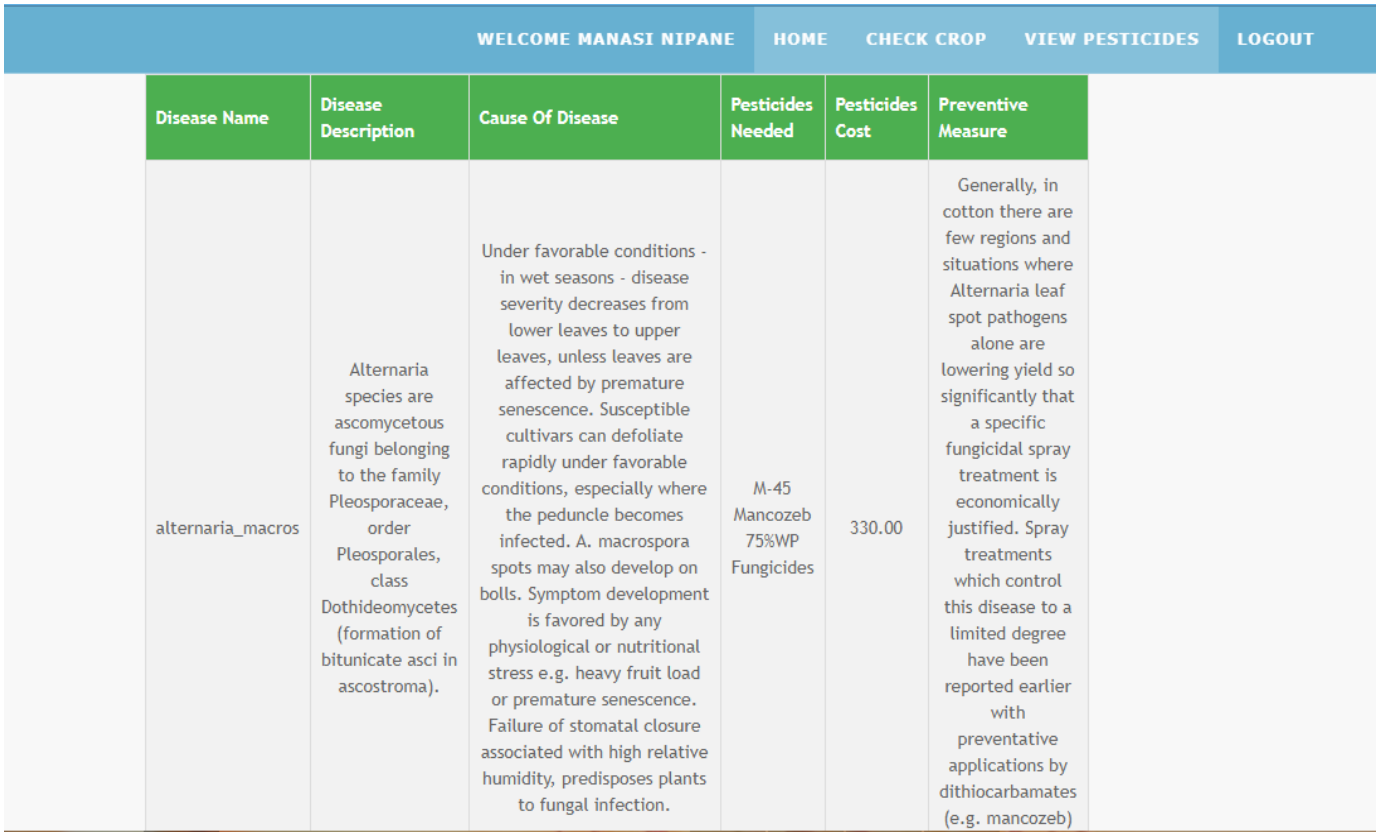

Fig.3. Output after prediction

Above figure show the actual output that is obtained after classification of the disease. Also the disease description, cause of disease, pesticides needed, pesticides cost and the preventive measures are describes.

V. CONCLUSION AND FUTURE SCOPE

A web-based system has been successfully implemented for crop disease detection for cotton leaves using Convolutional Neural Network. Two diseases viz. Alternaria Macrospora and Bacterial Blight are successfully being detected by system with training accuracy 80% using training dataset of 141 images for each disease. Healthy leaf image set of 141 images is also used for detecting healthy images. Convolutional neural network has been developed with three hidden layers to classify the cotton leaf disease images. System successfully takes image input from user and provides input in the form of disease detected, preventive measures, corrective measures, pesticides required and probable cost for suggested pesticides.

System can be extended to any other crops having availability of enough large dataset for that crop. Number of other diseases can be included for detection. System also can implement hardware using IOT for Image capturing in fields. The Web interface can also involve a forum for formers to have discussions regarding the current trends they are facing in different diseases.

REFERENCES

[1] S. Chouhan, A. Kaul, U. Singh, S. Jain," Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases: An automatic approach towards Plant Pathology", 2017.

[2] M. W. Tahir, N. A. Zaidi, A. A. Rao, R. Blank, M. J. Vellekoop and W. Lang"A Fungus Spores Dataset and a Convolutional Neural Networks based Approach for Fungus Detection",IEEE TRANSACTION ON NANOBIOSCIENCE, MAY 2018.

[3] S. Kaur , S. Pandey, S. Goel"Semi-automatic leaf disease detection and classification system for soybean culture",The Institution of Engineering and Technology 2018.

[4] Ranjith, S. Anas, I. Badhusha, Zaheema OT, Faseela K, M. Shelly"Cloud Based Automated Irrigation And Plant Leaf Disease Detection System Using An Android Application",International Conference on Electronics, Communication and Aerospace Technology ICECA 2017.

[5] A. A. Sarangdhar, Prof. Dr. V. R. Pawar "Machine Learning Regression Technique for Cotton Leaf Disease Detection and Controlling using IoT",International Conference on Electronics, Communication and Aerospace Technology ICECA 2017.

[6] H. Waghmare, R. Kokare," Detection and Classification of Diseases of Grape Plant Using Opposite Colour Local Binary Pattern Feature and Machine Learning for Automated Decision Support System", 2016 3rd International Conference on Signal Processing and Integrated Networks (SPIN).

[7] R. Sarkar, A. Pramanik," Segmentation of Plant Disease Spots Using Automatic SRG Algorithm: A Look Up Table Approach", 2015 International Conference on Advances in Computer Engineering and Applications (ICACEA) IMS Engineering College, Ghaziabad, India.

[8] Prof. U. Gawande , Mr. K. O. Hajari, Ms. K. R. Gavhale, "Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques", International Conference for Convergence of Technology – 2014.

[9] P. M. NesaRanil, T. Rajesh and R. Saravanan," Development of Expert System to Diagnose Rice Diseases in Meghalaya State", 2013 Fifth International Conference on Advanced Computing (ICoAC).