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DconvNET BASED COTTON PLANT DISEASE PREDICTION

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ABSTRACT:
In this research, identification and classification of cotton diseases is done. The pattern of disease is important part where some features like the colour of actual infected image are extracted from image. There are so many diseases occurred on cotton leaf so the leaf color is different for different diseases. This paper uses k-mean clustering with Discrete Wavelet Transform for efficient plant leaf image segmentation and classification between normal & diseased images using neural network technique. Segmentation is basic pre-processing task in image processing applications and it is required to extract diseased plant leaf from normal plant leaf image and image background. Image segmentation is necessary to detect objects and borderlines in images. Even though different methods are already proposed, it is still hard to accurately segment a random image by one specific method. In last years, additional attention has been given to merge segmentation algorithm and feature extraction algorithm to enhance segmentation results. The use of deep learning models to identify lessions on cotton leaves on the basis of images of the crop in the field is proposed in this article. Its cultivation in tropical regions has made it the target of a wide spectrum of agricultural pests and diseases, and efficient solutions are required. Moreover, the symptoms of the main pests and diseases cannot be differentiated in the initial stages, and the correct identification of a lesion can be difficult for the producer. To help resolve the problem, the present research provides a solution based on deep learning in the screening of cotton leaves which makes it possible to monitor the health of the cotton crop and make better decisions for its management. For this approach, Automatic classifier CNN will be used for classification based on learning with some training samples of that two categories. Finally the simulated result shows that used network classifier provides minimum error during training and better accuracy in classification.

1. INTRODUCTION

In this research, identification and classification of cotton diseases is going to be done. The pattern of disease is important part where some features like the colour of actual infected image are extracted from image. There are so many diseases occurred on cotton leaf so the leaf color is different for different diseases. For efficient plant leaf image segmentation and classification between normal & diseased images using neural network technique. Segmentation is basic pre- processing task in image processing applications and it is required to extract diseased plant leaf from normal plant leaf image and image background. Image segmentation is necessary to detect objects and borderlines in images. Even though different methods are already proposed, it is still hard to accurately segment a random image by one specific method[1].

Distinct diseases in cotton crops is a serious alert that affects financial as well as commercial influence. The disease should be correctly diagnosed and identified early for further action to save the crop. Advancements in technologies are leading as we are surrounded by the huge volume of smart sensors and intelligent system (IS), interconnected through Internet and cloud platforms. Cotton is one of the most crucial crops in Maharashtra. Numerous diseases obstruct the growth of the plant in fields which may cause a massive loss in the quality of products. Cotton crops are damaged due to early fall off leaf or leaf will be infected due to diseases. Plant diseases are generally affected by various climatic conditions like scorching temperature in the crop filed and also some pesticides will be required within a time. There are multiple systems to detect and restrain the diseases on cotton leaf through soil

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monitoring in classification and identification of numerous diseases like bacterial blight, Alternaria, and many more[2].
After disease detection with its possible solutions, it is provided to the farmers using various machine learning algorithms and IoT-based system. To face problems like Maintainable Environmentalism, unwanted reduction, and topsoil optimization; requires numerous and heterogeneous variables gathering agricultural data and perform analysis for developing production techniques.[3] Deep learning is a very popular technique due to the accuracy of results when trained with huge data. It takes more time for training as compared to testing phase due to a number of parameters[4].
Different deep learning model architectures such as AlexNet, VGG Network, GoogleNet, ResNet are the ones that use hundreds even thousands of these residual layers to create a network and then train, ResNeXt is the current technique for object recognition, RCNN (Region- Based CNN) used to solve the object detection problem, YOLO (You Only Look Once). Deep Learning (DL) is also named as deep structured learning or hierarchical learning, i.e., one of the parts of machine learning methods is basically worked on artificial neural networks. Learning can be differentiated into supervised, semi-supervised, or unsupervised. The word "deep" in "deep learning" depicts data is transferred through a number of layers. The main advantages of deep learning are to extract appropriate features automatically[5].

2. METHODOLOGY
This part of the report illustrates the approach employed to classify the leaves into diseased or healthy and if the leaf is diseased, name of the disease is mentioned along with the remedies. Our methodology primarily revolves around the following five steps.

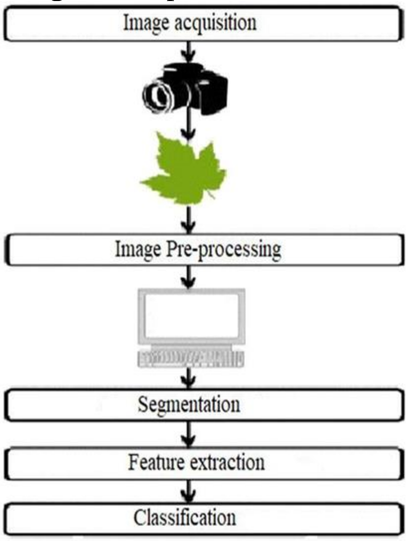

Figure 1: System Architecture

Algorithm written below illustrated the step by step approach for the proposed image recognition and segmentation processes:
(1) Image acquisition is the very first step that requires capturing an image with the help of a digital camera.
(2) Pre-processing of input image to improve the quality of image and to remove the undesired distortion from the image. Clipping of the leaf image is performed to get the interested image region and then image smoothing is done using the smoothing filter.
To increase the contrast Image enhancement is also done.
(3) Mostly green colored pixels, in this step, are masked. In this, we computed a threshold value that is used for these pixels. Then in the following way mostly green pixels are masked: if pixel intensity of the green component is less than the precomputed threshold value, then zero value is assigned to the red, green and blue components of the this pixel.

(4) In the infected clusters, inside the boundaries, remove the masked cells.
(5) Obtain the useful segments to classify the leaf diseases.

Image Acquisition

The initial process is to collect the data from the public repository. It takes the image as input for further processing. We have taken most popular image domains so that we can take any formats like .bmp, .jpg, .gif as input to our process. The image is captured, scanned and converted into a manageable entity. This process is known as image acquisition. During a test-phase, we acquire a series of color images using a digital scanner so as to acquire a single image of leaf. The color images were digitized to produce RGB digital color images.

Image Pre-processing

As the images are acquired from the real field it may contain dust, spores and water spots as noise. The purpose of data pre-processing is to eliminate the noise in the image, so as to adjust the pixel values. It enhances the quality of the image.
The main aim of Pre-processing is to suppress unwanted image data and to enhance some important image features. It includes RGB to Gray conversion, image resizing and median filtering. Here color image is converted to gray scale image to make the image device independent. The image is then resized to a size of 256*256. Then median filtering is performed on the image to remove the noise. The digital version of the rotten leaf sample consists of about 30% of leaf area and rest 70% is the background. Thus the redundant background requires high disk storage space and utilizes CPU time in the segmentation process. In order to have efficient disk storage and achieve fast processing speed the digital image of the leaf sample is cropped into a smaller dimension of size 16x20sq, cm. Thus the pre-processing step introduced saves about 30% of disk storage space and increases the CPU processing 1.4 times. The cropping process does not introduce any loss in the region of interest, i.e. the selected leaf sample. After preprocessing stage, the digital version of the sample leaf image consists about 70% of leaf area part and rest 30% as background. In case of noise such as salt and pepper, a median filter can be used. Weiner filter can be used to remove a blurring effect. In case of the images captured using high definition cameras, the size of the pictures might be very large, for that reduction of image size is required. Also, image reduction helps in reducing the computing memory power.

Segmentation

Image segmentation is the third step in our proposed method. The segmented images are clustered into different sectors using Otsu classifier and k-mean clustering algorithm. Before clustering the images, the RGB color model is transformed into Lab color model. The advent of Lab color model is to easily cluster the segmented images.

Feature extraction

In the proposed approach, the method adopted for extracting the feature set is called the Color Co-occurrence Method or CCM method in short. It is a method, in which both the color and texture of an image are taken into account, to arrive at unique features, which represent that image.

Classification

Convolutional neural networks are used in the automatic detection of leaves diseases. CNN is chosen as a classification tool due to its well-known technique as a successful classifier for many real applications.
CNN architectures vary with the type of the problem at hand. The proposed model consists of three convolutional layers each followed by a max-pooling layer. The final layer is fully connected MLP. ReLu activation function is applied to the output of every convolutional layer and fully connected layer.

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The first convolutional layer filters the input image with 32 kernels of size 3x3. The output of this layer is given to Softmax function which produces a probability distribution of the four output classes. Gray Level Co-occurrence Matrix is created from gray scale images and used to describe the shape feature. The Gray Level Co-occurrence Matrix is based on the repeated occurrence of gray-level configuration in the texture. The spatial gray dependence matrix is used for texture analysis. A spatial gray dependence matrix is created based on hue, saturation and intensity. Run Length Matrix (RLM) is another type of matrix. Same gray pixel values are the part of run and those gray values forms a two dimensional matrix.
Example, RM- Q(x, y) x represents gray values and y represents run length.

3. SYSTEM ARCHITECTURE

Image is given as an input to the system. Image processing is carried out on the image. Image analyser consists of 4 phases. Image enhancement is done to improve the interoperability or perception of information in images for human reader and providing better input for other authorized automated image processing technique. Image contains unwanted noises which are needed to be removed to get a clear Image. This process of removing noise is called as Noise Reduction. It is an important step.

After this image segmentation is done on image in which visual image is divided into segments to simplify image analysis. Segments represents object or a part of the object can comprise set of a pixel or super pixel. Image segmentation sorts pixels into large component eliminating need to consider individual pixel as a unit of observation. The next step is feature extraction. Many machine learning practioner believe that properly optimized feature extractions is necessary for effective model construction. Database used in this system contains images of affected crops. Database cleaning is performed on this database to get required data. After this one of the ML algorithms is used to detect the disease of crop which will provide best accuracy and 100% result. Then the features extracted from image are compared with resultant database and this algorithm will help us to detect whether disease is present or not. If crop is affected then appropriate solution will be provided and if crop is not affected with disease message will be displayed.

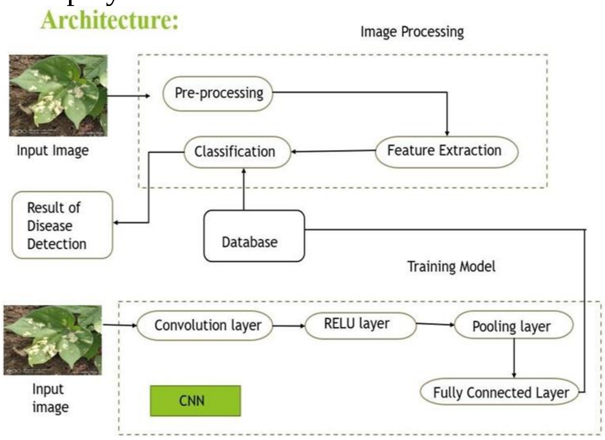

Figure 2: System Architecture

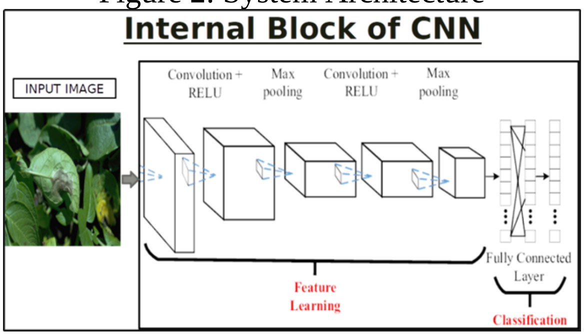

Figure 3: Internal Block Of CNN

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DATA FLOW DIAGRAMS

A data flow Diagram is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated.

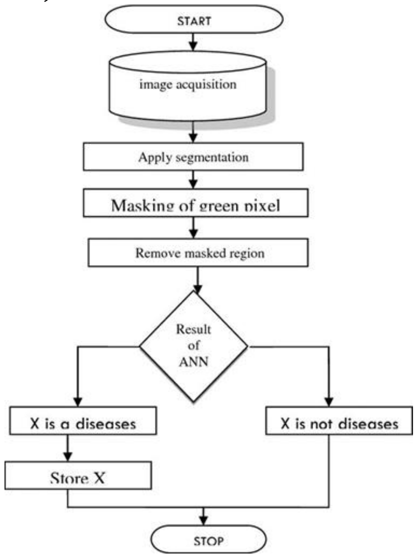

Figure 4: Flow chart for leaf classification

USE CASE DIAGRAM

Use case diagram is a graphic depiction of the interactions among the elements of a system. Use cases will specify the expected behaviour, and the exact method of making it happen. Use cases once specified can be denoted both textual and visual representation.

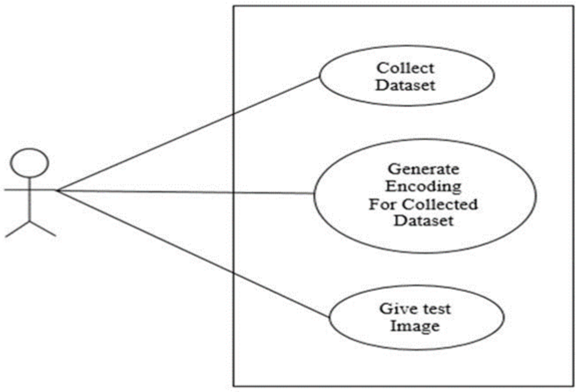

Figure 5: Use case diagram case diagrams

- Requirements (external), required usages of a system under design or analysis - to capture what the system is supposed to do.
- The functionality offered by a subject – what the system can do.
- Requirements the specified subject poses on its environment - by defining how environment should interact with the subject so that it will be able to perform its services.

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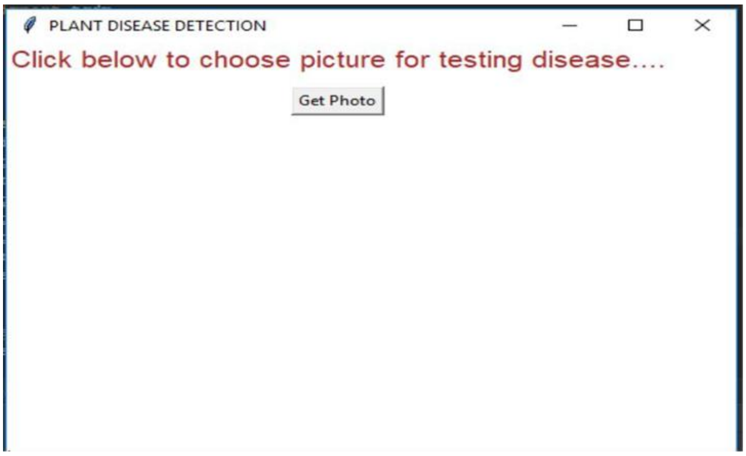
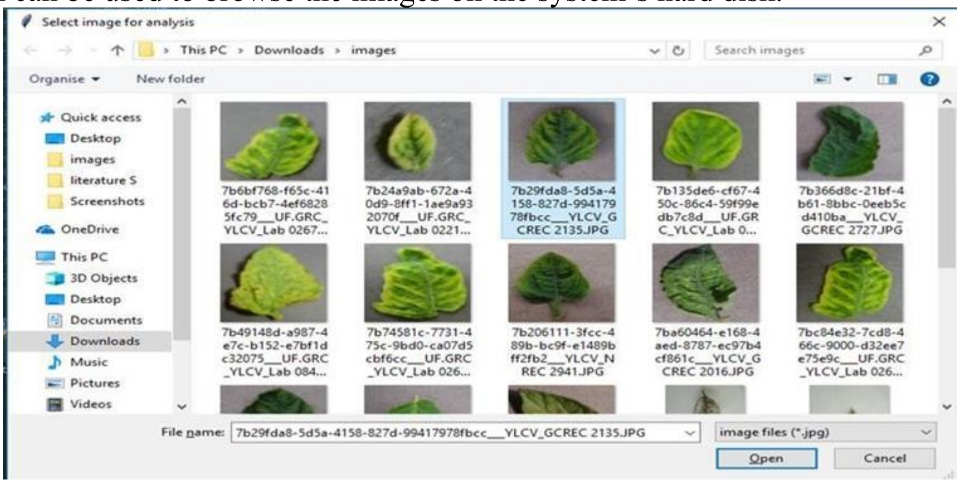
4. RESULTS



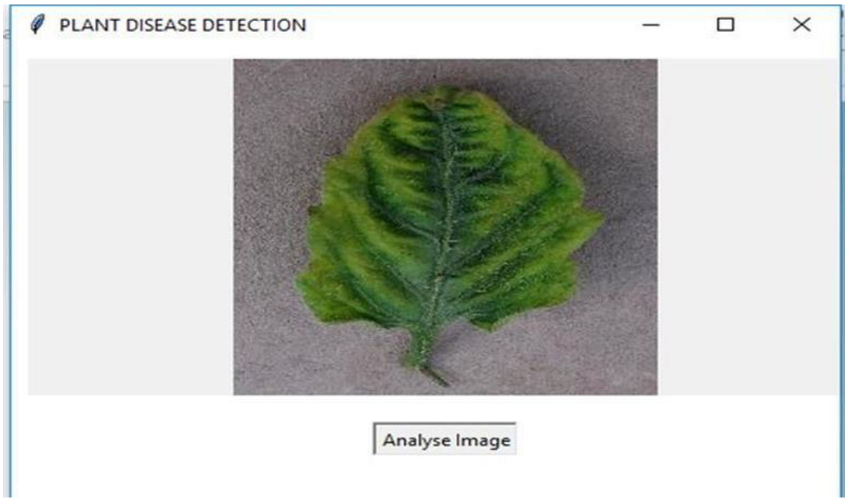
Screenshot 7: Home Page

Figure 7 depicts the first look of our front end. We have a text message called "click below to choose picture for testing" so that a user can understand to click the below button. It has a button called "Get Photo" which can be used to browse the images on the system's hard disk.



Screenshot 8: Selecting input from dataset

FIG. 8 shows the popup which appears when user clicks on 'get photo' button. The popup window will be having number of input images to be selected, this action should be confirmed with a double click or an open button.



Screenshot 9: Analysing input data

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FIG. 9 shows the selected image from the system directory, there will be a button provided called as 'Analyse Image' for analysing the input image to detect the condition of the leaf.

Screenshot 10: Result after analysis of input data

FIG. 10 displays the status of leaf i.e. Healthy or Unhealthy, if it is unhealthy it displays the particular disease name. Here is a button called 'Remedies' by clicking this button it displays the Remedies for particular diseases.

Screenshot 11: Remedies window

FIG. 11suggest the Remedies for the disease found in the leaf.

5. CONCLUSION

A web-based system has been successfully implemented for crop disease detection for cotton plant. The System successfully processes input from the user and provides output in the form of disease detected. Provided sufficient data is available for training, python programming is capable of recognizing plant diseases with high accuracy. Therefore, we conclude that one can be able to predict whether the cotton plant leaf is healthy or not.

There are number of ways by which we can detect disease of plants and suggest remedies for them. Each has some pros as well as limitations .On one hand visual analysis is least expensive and simple method, it is not as efficient and reliable. Image processing is a technique which is most spoken for very high accuracy and least time consumption are major advantages offered. The applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that effect on plant leaves. Recognizing the disease accurately and efficiently is mainly the purpose of the proposed approach. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort. Alongside the supply of cultivation tools, the farmers also need access to accurate information that they can use for efficient crop management and there is no better way than providing them a service that they can use through the software.

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