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COTTON LEAF DISEASE DETECTION USING ARTIFICIAL NEURAL NETWORK

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Abstract: It is difficult for farmers to observe disease in the naked eye. Different types of plant disease reduce the plant life cycle. The presence of disease in plants can be observed by the symptoms present in the leaf, stem or infection occur in the fruit. Our proposed system gives an effective way for the detection of disease in the plant through the infection occurs in the leaf. The first step in disease detection is capturing cotton leaf disease through the device. In the second step, cotton leaf images are pre-processed through image segmentation. in the third step, RGB components i.e., red, green, and blue are removed from the image of the leaf, then it is converted to an HSV image. In the fourth step, white and black images of the cotton leaf are made; defective parts in the images are indicated by white colour. In the next step, an artificial neural network is trained to distinguish the disease and healthy leaf. By using our proposed system disease can be detected at the early stage with an accuracy of 85%. Disease or infection should be identified at the initial stage otherwise it leads to lossof crops.

Keywords: ANN(Artificial neural network), image processing, HSV (Hue SaturationValue), CNN (Convolutional Neural Network).

I. INTRODUCTION

Agricultural is the main occupation in India. Most of the people depend upon agriculture. They have a wide variety of crop choices that farmers can choose the crop that is suitable for their farm. We can't visually diagnosis the disease present in the leaf because the disease is microscopic in nature. Nowadays within the area of research, a major concern is the identification of the symptoms of the disease employing image processing. The farmers are struggling during their lifestyle for a way to affect the disease of the cotton leaf. They are a requirement for a disease diagnosis system this will support farmers. This technique focuses on disease identification by Processing acquired digital images of leaves of the plant.The main part or advantage of our project is we provide a solution for disease and give the information on which pesticide or insecticides are suitable for that disease. That can help farmers to stop the disease from spreading and crops give better results when we give a proper treatment of these crops. The following sample images from our dataset. We are using different algorithms to detect the disease in the leaf-like support vector machine (SVM), artificial neural network (ANN)[1]-[11].

From the 1960s to the years to till now there is wide elaborations and Development in technology. Also, we have seen tremendous growth in the worldwide technologies mention in the fields like medical, manufacturing areas across the agricultural system and remote sensing applications, and so on. The vision of the computer is nothing but a novel technology used for acquisition and analyzing the image and these images are then processing to obtain the information regarding the particular image. Computer vision helps us in image capturing, image processing, and image analyzing to provide the main objectives or the content of the image with effective visual quality. Automation is the technique that is moving with high speed in the current generation. Computer vision is the advanced technology that is successfully used for the plant's classifications leaves identification and diagnosis the certain plant diseases.

Agricultural is the major occupation in the Indian country. Most of the people depend on agriculture for their livings. Across the world, Indian ranks second in farming which means the farm output. India yields wide varieties of crops across many states and has a piece of specific knowledge about the crops, seasons, and many things about agriculture. Because of the efficient crop yielding the agriculture plays a vital role in the economic development of the country. Also, agriculture is identified as the second-largest economic sector development in India. There are certain most essentials are there to cultivation the crops such as humidity, rainfall, quality of the soil, environmental conditions on climate, and so on and if there are any failures in these essentials then there should be a total loss of the crops. Also, the Diseases occurring in the plant are the major reason for the failure of the crop. For the farmers detecting the disease present in the plant and identifying the solutions to overcome within the disease is the major problem or an issue that has to be facing till now. To overcome these problems to farmers we used computer vision systems that would help the farmers. Most

commonly we call cotton the "King of Fibers". Cotton has the enrich value in the country among the crop grown to sell or to get the profit. Cotton is primarily used raw material in the textile industry. It renders income to farmers in developed as well as developing countries. Cotton is grown in a warm climate so it requires continuous water supply naturally or it should get water from the rain periodically.

II. LITERATURE SURVEY

[1] The paper consists of 4 main stages. In the first stage we extract the leaf of the image which has RGB colors, also create various parameters of the transformation, and then, we translate the representation of a color from one basis to another which is called color space transformation, and apply this method to color transformation structure. Then the image of the leaf is segmented in the second stage and the unwanted part (green color area) is removed. In the third stage, we estimate the features of the infected object which is segmented. In the fourth stage, the features which are extracted are skilled and trained in the artificial neural network earlier. The feature vector of input images is compared with the database. The category with which minimum distance is obtained is identified, class. The classifier utilized in this is often the Euclidean distance classifier. The system is developed to detect cotton disease spots. The system effectively segments the diseased portion of the image of the leaf sample using thresh holding-based region extraction (diseased spots).

[2] The processing of an image is done by the technique called image pre-processing. Where we can detect the diseases of a leave accurately and fastly. The entire pre-processing technique may first lead to the process called image acquisition through some wed followed by enhancing the image and finally segmenting the defected parts of a leaf by doing segments method. It enhances the defective part visually effectively thus helps us to extract more information about the leaf. Lastly, the process of feature extraction and classification can also be applied. We used the k-means clustering algorithm method for the classification in the feature extraction process and also the neural network as recognize. The step-by-step procedure is shown below,

1) Firstly, RGB (red, green, blue) of image acquisition.
2) By using histogram equalization for the image pre-Processing.
3) Image re-sizing for better performance.
4) For segmenting the image and for applying the feature Extraction we have to go through the k-means Algorithm.
5) Feature extraction computation
6) Then, apply neural networks for classification and Recognition.
7) Analyzing the process statically.

[3] We studied and also diagnosis by using MATLAB that helps us to suggest the vital remedies that have to be implementing while detecting the disease on the cotton leaf plant. By using the k-means clustering method the recognition of the disease rate is very accurate and the corresponding Euclidean distance is 89.56%. Hence by using the k-means clustering method using Euclidean distance is an excellent choice for the detection of disease in a cotton leaf where it is more accurate and works efficiently with relatively minimum errors.

[4] This system consists of two phases 1) Assessment of digital image and extracting the feature of cotton leaf 2) Implementing the back proportion method of artificial neural network in machine learning. This process consists of five steps- acquisition, enhancement, segmentation, and extraction of the feature. MATLAB tool of ANN is used for cotton leaf quality classification. Identification of quality is done based on RGB and hue saturation lighter components of the leaf image. ANN tool works on neurons of the hidden layer. Artificial neural networks tool consist of a back-propagation process. The outcome of this process can be predicted randomly using the ANN process. The above method can predict the output with less error. This method can identify cotton leaves with or without defects from the leaf image.

[5] For the detection of disease in cotton leaf. The classification method is used which is based on vector machine and it can do multiple support. The vector machine is developed by A.Jenifa, Dr.R.Ramalakshmi, and V. Ramachandra. The picture of crops at every stage is used automatically by the designed algorithm. Processing the picture of cotton leaves at the earliest stage is used to detect the disease very early which can overcome farmer's income and goods.SVM algorithm which is multiple support is made to observe from human beings and Robert machine by giving the data. This Multi-SVM in comparison to CNN'S has many advantages. But the multi SVM is unique. And also the convolution neural network has disadvantages of local minima. Multi-SVM complexity doesn't rely on the dimension size of all possible inputs while CNN does. Multi SVM performs better than convolution neural networks because it is likely to over-fits less.

[6] This system classifies the leaf image using the image classification algorithm CNN. It can automatically detect and recognize diseases supported by extracted features at each convolution layer. The system used an image processing technique for disease detection. The user must upload the cotton leaf image. The system can pre-process the uploaded image then apply the CNN technique. By using the CNN technique system can test the image with the trained dataset and extract the features. This technique is based on images of various infected plants. An image of the plants is captured through the camera the process uses the technique which identifies the object present in an image for easy identification of the part which is affected by the disease.

[7] To identify the edges of the homogenize technique like Sobel and canny filter has been used by P. Revathi and M. Hemalatha.

[8] The extracted edge features have been used in the Identification of the disease spots and also the diagnosis process of a plant. These processes elaborated lucidly by Mr. Viraj Gulhane et.al.

[9] Web technology-based diagnosis intelligent system for cotton disease control has been developed in BP neural network and considered it as a decision-making system to establish a diagnosis mode.

[10] Dheeb AI Bashish. et.al developed a neural network classifier based on SC [Statistical classification] and successfully detect the disease in the cotton leaf.

III. PROPOSE SYSTEM

In a purpose system, we use a real-time dataset that contains various images of cotton disease like bacterial blight, bronze wilt, curly lift, fouler fungal disease. We have given some images for training and some are testing. Initially, we take the images from the real-time dataset and give them to the model for identifying the cotton disease. As we give the images to our system, it shows the result in the form of probability. The methodology to detect the disease in cotton leaf based on the image processing consists following steps:

1) **Image pre-processing:** In these phases, we require better-resolution images and with better quality. All these images are resized in a specific manner and resolution. In these images, we remove noise content and rotate the images using a data augmentation process.

2) **Image segmentation:** Image segmentation it's a process of dividing a digital image into various sections. Its use to remove the region of the pixel in the infected leaf and easily identified the model which part is infected.

3) **Feature extraction:** In this feature extraction process, we extract some important features of the defected leaf.It can create a colored structure and convert the color value from RGB components of defective parts of cotton leaf image. The feature we can use to train our neural network.

When all processes are done then we give the train and test data to the model and apply the CNN algorithm.In the Following Flowchart, you can see how the model is working.

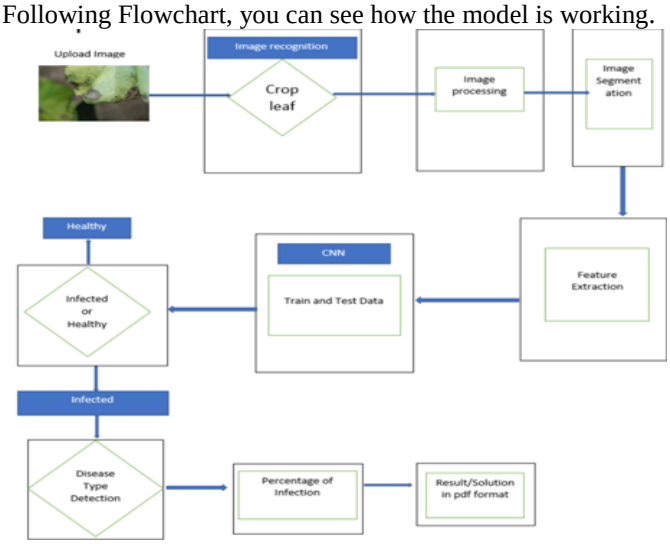

Figure 1. Flow Chart

IV. GOOGLE COLAB

We have used various data science-related libraries like Keras, tensor flow, sklearn, OpenCV, matplotlib, NumPy, etc. For building the Keras model we have used the sequential modeling technique. The architecture of the model consists of two conv2D layers. Each conv2D layer is followed by an activation layer named 'relu' and a max-pooling layer. Maxpolling is that the highest value they can catch and declare. Once the data is available at the final max-pooling layer, it is subjected to a set of fully connected neurons as they are in ANN. For this purpose, flattening is done and dense layers are added. Flatten is convert the output to in one-dimensional array that work is done by flatter. This creates the architecture of the deep learning model which will be trained using the data which was uploaded earlier.

The data is available on the collab server. Path variable will read the images from the path one by one. Each image is read using the OpenCV library. Subsequently, the images are resized with dyadic image processing. The paths of the images also tell about the Class of each image which is extracted and stored in a variable called a label.

The data and label lists are converted into NumPy arrays to train the model. The data train: test split ratio is 75:25. Runtime data augmentation during training is also made available to the optimizer. For building the model, the classifier is notified that the image dimensions are 128*128*3 along with 4 classes. We have used categorical cross-entropy for measuring the losses during the training process which are monitored continuously. We have used Adam optimizer which is the latest optimizer that SGD. The training process gives a trained model which can further be used for testing purposes. For testing, we have uploaded the .zip file that contained test images. The performance is checked for images from this .zip file after unzipping it.

CNN uses the layers for image processing. If the image having more than one object then the CNN recognizes the edges and classifies the image accordingly. Pixel is the small portion of the image. One single image contains the number of pixels. These pixels group together it makes an entire image. CNN uses a feature detector. A feature detector is used to detect significant features of image data to provide detection. It is the smallest matrix of weights. To reduce the bigger images into smaller images strides are used. Stride is the number of pixels by which we slide our filter matrix over the input matrix. This process is called convolution. By this, the shape of the input image is modified feature detection thereby detecting the feature information and getting the input image particular information is called a feature map. A large image takes a lot of time. It is easier to process small images in a faster manner.
For image identification, we use TensorFlow.Keras layer like input layer, dense layer, convolution 2D layer, Maxpool2D layer, activation layer and Flatten. Keras modeling is a different technique but we use sequential modeling. In these sequential modeling, we tell that execute the step by step layer and all network are made. We use the LeNeT class to classify the width, height, and depth of the image. Softmax classifier can give us the probability to the result whether these images are powdery disease or foliar disease or other disease and out of 100% what the probability of the disease they can give us if the probability is 90% so the model is good. We can split the path and set the string through labels. The raw pixel intensities to the range to [0, 1] and in greyscale image maximum value

are 255 and minimum value is 0. So we divide 255 to 255 minimum value is 1 so it can be normalized. We take the 25% data to test and 75% data to train.

Figure 2

V. CONCLUSION

Recognizing the disease is the main purpose of our proposed system with less computational effort. One methodology gives a total of 80% accuracy to detect disease present in the cotton leaf. The system is robust with approximately 85% to 90% detection accuracy. Our paper addresses the detection of disease present in the cotton leaf also the analysis of these diseases can be detected effectively in the early stage before it will damage the whole plant. The model implemented in this paper can able to detect the disease of cotton leaf more accurately compare to the other classifiers.

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