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CHARACTERIZATION OF PLANT DISEAESE PREDICTION USING CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT: Agriculture is one of the main factor that decides the growth of any country. In India itself around 65% of the population is based on agriculture. Due to various seasonal conditions the crops get infected by various kind of diseases. These diseases firstly affect the leaves of the plant and later infected the whole plant which in turn affect the quality and quantity of crop cultivated. As there are large number of plants in the farm, it becomes very difficult for the human eye to detect and classify the disease of each plant in the field. And it is very important to diagnose each plant because these diseases may spread. Introducing the artificial intelligence based automatic plant leaf disease detection and classification for quick and easy detection of disease and then classifying it and performing required remedies to cure that disease. The suggested model will help the farmers to correctly detect and classify the disease by scanning the leaf and alert the farmers about the disease before it starts spreading. In these process the product of crops increases in agriculture. It follow several steps i.e. image collection, image preprocessing, segmentation and classification.

INTRODUCTION :

Agriculture plays a very important role in the economic growth of any Country. It is the field which highly affect the GDP of the countries. Agriculture sector contributes around 16% of GDP of India. There are various factors that affects the quality and quantity of crops cultivated. Due to different weather and local conditions these plants are exposed to various diseases. And if these diseases remain undetected may cause some serious losses. In India itself around 15-25 percent of crops are lost due to diseases, pest, weeds. Also, we can take reference of the incident of Georgia (USA) in 2007 in which there was loss of around 540 USD due to plant diseases. As the cultivational fields are quite large and have very large number of plants in that, hence it becomes very difficult for the human eye to properly detect and classify each and every plant. And doing so is very important as even single infected plant can spread the disease. Also, most of the farmers does not have proper knowledge of those diseases and actual cure for that disease. Hiring experts may cost them heavily and use of pesticides without knowledge will harm the land. Hence in order to solve this problem we have developed the Artificial Intelligence based solution. Accuracy and speed are the two main factors that will decide the success of the automatic plant leaf disease detection and classification model. The suggested model will help the farmers to correctly detect and classify the disease by scanning the leaf and alert the farmers about the disease before it starts spreading. The model is mainly divided into four steps or phases. In first one, we collect the dataset of different plant leaves infected as well as healthy. These all images will be color images. In second step, noise from the images is removed then we will create color transformation structure for the images. In third step we segment the

images using clustering techniques available. This step is performed to easily extract the foreground that is leaf. Now the image set of leaves with black background is obtained. In final step, different machine learning and deep learning algorithms like logistic regression, KNN, SVM and CNN are trained and compared on the basis of accuracy

and the algorithm that performs best in training as well as testing is taken in account.

LITERATURE SURVEY :

"Plant Diseases Detection And Its Solution Using image Classification" literature followed by Saradhambal.G, Dhivya.R, Latha.S,R.Rajesh in 2018.In their prespective they collect 75 images of different diseased plant leaves such as Bacterial Blight and more. There were total of 5 classes that include 4 disease classes and one normal healthy leaf class. Removal of noise is done with some image preprocessing and then conversion into lab color model was done. They segmented the image with clustering and Otsu's method. After that some feature extraction is done on the basis of which class is determined. They have not discussed the accuracy that they have achieved as well as dataset was small [1]."Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm" literature followed by MelikeSardogan, Adem Tuner, YunusOzen in 2018 .It clarifies that they have used CNN model for the leaf disease m classification. In their methodology they have used a dataset of 500 images divided into 400 training and remaining 100 testing. Total classes for classification were 5 including one healthy class as well. Images size used was quite well that is 512*512. Three matrixes for R, G, B channels were used as input to CNN model and the output was feed into neural network known as LVQ (Learning Vector Quantization). Average accuracy of around 88 percent was achieved. Their proposed model was only for tomato related diseases [2]. "Plant Disease Classification Using Image Segmentation and SVM Techniques" followed by K. Elangovan, S. Nalini in 2017. In their methodology image was converted into another color space. After that image was cropped and with image preprocessing techniques noise was removed and smoothening was done and converted into greyscale images. Segmentation was also performed and then features were extracted. They considered color, morphology and texture as features and they were used for classification. They also does not mention about the accuracy of their suggested modelA Brief Review on Plant Disease Detection using Image Processing India is the agriculture based country, since it contributes 7.68 percent of total global agricultural output. In India, agricultural sector contributes about seventeen percentage of total Indian gross domestic product (GDP). Effective growth and improved yield of plants are necessary for increment of farmer's profit and economy of India. For this purpose farmers need domain experts for manual monitoring of plants. But manual monitoring will not give satisfactory result all the time. Moreover, domain experts are not available at all regions and are expensive as farmers have to pay fees including travelling charges. Hence, it requires developing an efficient smart farming technique which will help for better yield and growth with less human efforts. In this paper, we provide a review on methods developed by various researchers for detection of diseases in plants, in the field of image processing. It includes research in disease detection of plants such as apple, grapes, pepper, pomegranate, tomato etc.Plant Leaf Disease Detection and Classification Using Image Processing Techniques These days, Computerized imaging innovation needs in the farming field. It can help agriculturists to create early discovery and classification of leaf plant disease. In the agribusiness field, there are a few sorts of the infection that can attack and appear through the leaf. In case the disease isn't identified early, it can

be provide a few influences to the sum and quality of the generation. Leaf plant disease can be identified and classified utilizing advanced image processing. Leaves of the plant are utilized to decide the type of diseases that contaminates the crops. Agriculturists can make early choices which are they can analyze the leaf plant infection. Advanced Image processing could be a quick technique, consistent and more exact procedure for leaf plant malady discovery. In this paper, we review leaf plant disease detection and classification using image processing methods from different authors that help agriculturists in the agriculture field. It contains a few stages such as image acquisition, image processing, segmentation, feature extraction, and classificationPlant health analyser India considers agriculture as it back bone in terms of economy. Every tree originates from seed and saplings are considered to be a small tree. Sapling stage is considered to be sensitive as it is more prone to diseases. Saplings require utmost care for it to have a healthy growth. This project is carried out to implement an Automatic plant health checking vehicle with the help of MATLAB where a rover keeps moving in a nursery capturing the image of the leaves. The image taken is processed using MATLAB and checked for certain diseases present. Depending on the disease detected the cause and its remedy are provided.Image processing based automated identification of late blight disease from leaf images of potato crops Late Blight is one of the most common and devastating disease for potato crops in all over the world. For less use of pesticide and to minimize loss of potato crops, identification of late blight disease is necessary. The conventional method of disease identification is based on visual assessments which is a time consuming process and involves manpower. The proposed work presents image processing based automated identification of late blight disease from leaf images. In the proposed method, adaptive thresholding is used for segmentation of disease affected area from leaf image. The threshold value is calculated using statistical features of image which makes the proposed system fully automatic and invariant under environmental conditions. The proposed method is tested on leaf images of potato crops obtained from plant village database associated with Land Grant Universities in the USA and achieved 96% accuracy. The experimental results indicate that proposed method for segmentation of disease affected area from leaf image is convincing and computationally cheap.

EXISTINGSYSTEM: In developing countries, farming land can be much larger and farmers cannot observe each and every plant, every day. Farmers are unaware of non-native diseases. Consultation of experts for this might be time consuming & costly. Also unnecessary use of pesticides might be dangerous for natural resources such as water, soil, air, food chain etc. as well as it is expected that there need to be less contamination of food products with pesticides Drawbacks are Farmers cannot afford so much money for persons who visit the crop for disease prediction. Speed and accuracy of getting result is delayed. As the cultivational fields are quite large and have very large number of plants in that, hence it becomes very difficult for the human eye to properly detect and classify each and every plant.

PROPOSED SYSTEM: The model that is proposed by us to detect and classify the infected plant leaves consists of 4 phases. Those phases are Dataset Collection, Image Preprocessing , Segmentation , Selection of Classifier Advantages are Farmer can predict the diseases so that can use the right cultivation and fertilizers method. So that they can improve the product quality and crop yield prediction.Based on our proposed system we

achieved the best model for prediction of diseases in variety of crops.

MODULES : Modules are Dataset Collection ,Image Preprocessing ,Segmentation Selection of Classifier

Dataset Collection : Firstly, the images of leaves were collected from online sources such as GitHub, Kaggle and also some of the image's dataset consists of 20,000 images divided into 19 different classes. The dataset consists of both healthy and infected leaves which covers diseases like black rot, rust, bacterial spot, early blight, late blight, leaf scorch, target spot, mosaic mvirusof different crops like apple, potato, tomato, grape, strawberry, corn.

Fig: 1 Images from Dataset

Image Preprocessing : In this step images are resized to smaller pixel size in order speed up the computations. The acquired images contain some noise. This noise is removed using some filtering techniques like Gaussian Blur. After that images are present in RGB format which is not appropriate for further work as RGB format is unable to separate image intensity. Hence it is converted to another color space that is HSV which separate color from intensity. Also, RGB color space is noisier than HSV.

Fig: 2 Images after Preprocessing

Segmentation: In this step, segmentation of images is done in order to separate the leaves from the background. Segmentation is performed using K-means clustering with 2 cluster centers, one for background and one for foreground. K-means clustering is unsupervised learning technique that is used to segregate the data points in the predefined number (k) of clusters or groups on the basis of their similarities.After finding the two clusters, one with background and other one with leaf part, the clustered image is used to change the pixel value of the background of the leaf to black. By doing so the useless information from the image is eliminated which in turn increases accuracy.

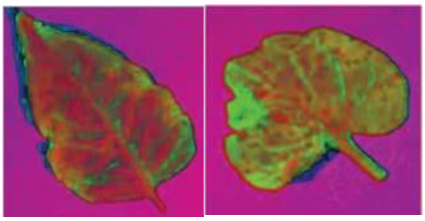

Fig: 3 Images converted to colour

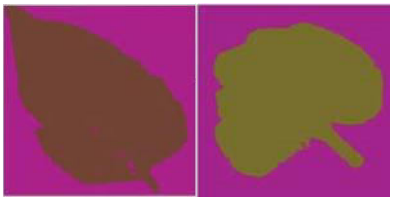

Fig: 4 Images after K-means clustering

Fig: 5 Images after removal of Background

Selection of Classifier: This is the classification problem as we have to classify the type of disease on the leaf of the plant. So, we have plenty of machine learning as well as deep learning

algorithms that we can apply on this dataset. We have decided to start with low complex algorithms and increasing the complexity level in order to increase accuracy of the model. We have selected four classifiers namely – logistic regression, KNN, SVM and CNN.

FLOWCHART :

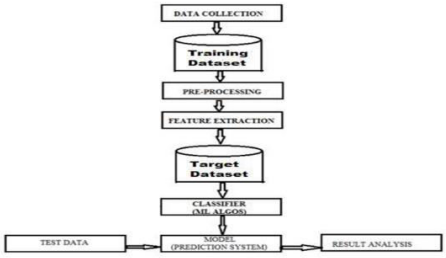

Fig: 6 Flowchart

ALGORITHMS :

Logistic Regression: It is the simplest classification algorithm available but yet powerful enough to make some good results. The logistic regression makes the use of logistic function that is sigmoid function to squeeze the output in range of 0 and 1. After training on training set, the model gives the accuracy of 66.4% on testing set which is not that bad considering complexity of algorithm and number of classes in dataset.

KNN (K Nearest Neighbors): It is the algorithm can be used in both classification as well as regression problems. It is very simple and easy algorithm to implement. Here we plot all the datapoints in space and then find the k nearest neighbors of the datapoint that we want to classify by finding the distance between all other datapoints and the input datapoint. Then k datapoints are chosen which are nearest to that datapoint and their classes are taken then predicted class of input is the class with maximum occurrence. On our dataset the knn model was able to give accuracy of 54.5%.

SVM (Support Vector Machine): SVM is another machine learning algorithm that we have used to classify the diseases. In this algorithm all points are mapped in space so that points of different class can be divided by gap. Gap should be as wide as possible so that boundary can separate them. This boundary is called decision boundary and the extreme data points of classes called support vectors. Kernel tricks are used for nonlinear dataset. The kernels that are available are linear, nonlinear, polynomial and RBF. The svm in our case worked poorly as it gives accuracy of only around 53.4% after using linear kernel.

CNN (Convolutional Neural Network): This is the far most complex deep learning model that we have used to classify the diseases. As it is very complex hence it requires good computational power as well. It is the most common neural network that is applied to image classification problems. CNN is a neural network which comprises of four layers namely-Convolutional layer, Pooling layer, Activation function layer and Fully connected layer

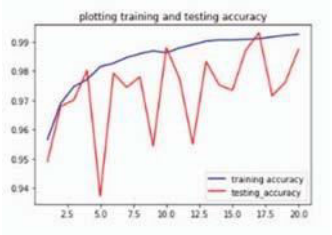

Fig: 7 Accuracy plot of CNN

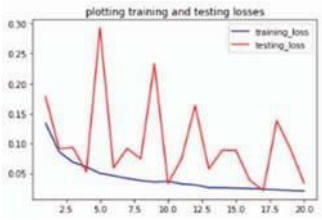

Fig: 8 Error plot of CNN

CONCLUSION : Artificial intelligence is the solution for detecting and classifying different plant leaf disease is presented which makes use of convolutional neural network for classification purpose. The presented model used the dataset that consists of more than 20,000 images with 41 total classes.The main purpose of this system is to improve the efficiency of automatic plant disease detection. Experimental results show that the proposed system can successfully detect and classify the plant disease The following nm model can be extended by using even more large dataset with more categories of diseases and the accuracy can also be improved by tuning the hyperparameters. The remedies for the classified disease can also be included in the model. The model then can be deployed on android and as well as IOS platform to reach out the farmers who can make the actual use of the proposed system.

FUTURE WORK : In the future work, there are two directions should be improvedincluded extended data set. We can study other species and diseases were not involved in the paper. Optimize the model. Through the experiment of the paper model has achieved good recognition accuracy, and is worth of further study and optimization. At the same, we should design a network model which can classify crop images with higher accuracy.

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