Tomato Leaf Disease Detection using CNN

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Abstract—***Many plants both domestic and in commercial agriculture are affected by new diseases everyday. Farmers with great experience can easily find out what's wrong with their plants but not accurately all the time. This project solves this Problem by developing the machine learning model using Convolution neural network by training the tomato leaf image data.one can easily feed the image to the model and get the result of disease instantly.***

Keywords—CNN, tomato leaf

I. INTRODUCTION

Developed Technologies have provided the ability to produce sufficient food to meet the demand of society. But still, the safety and security of the food or crops remained unattained. Factors like change in climate, the decline in pollinators, Plant disease, and others are challenging to the farmers. An important foundation for these factors needs to be attained on a priority basis Making use of analysis and detection processes using present technology helps the farmers to get rid of such problems. During pandemic situations like COVID 19 the nation is dependent on the recent technologies to prevent address the issues to reduce the transmission of the diseases . As plant diseases are a significant threat to human life as they may lead to droughts and famines. In turn it results causing substantial losses, where farming is accompanying in commercial purpose. The use of technologies like Computer vision and Machine Learning (ML) helps to fight against diseases In this paper, we are using ML to give a solution to tomato leaf Diseases. In this method, we have divided the process into three stages Identity, Analyze and Verify with the Available dataset. The key issues and challenges are identified while analyzing the tomato leaf diseases of plant. Some of them are as follows The quality of the tomato leaf image must be high, Publicly available Dataset requirement, Noisy data affecting the leaf samples, Through the process of segmentation, diseases may be identified but the samples must undergo training and testing, Classification is one more challenge, in the stage of detecting the leaf diseases, Color of the leaves may be varied due to environmental effect, Variety of diseases can be seen in various kinds of plants, so detection of disease is quite difficult .Based on the challenges discussed above and combined techniques using image processing (IP) and ML, the proposed model provide better accuracy. Keeping all these things in mind, in this paper an algorithm based on ML and IP tools to automatically detect tomato leaf diseases is proposed.

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II. FORMUALTION OF THE PROBLEM

The main objective of this project is to predict the leaf disease of Tomato plant. With the use of CNN(convolutional neural network approach) ,the tomato leaf images are trained and the model is saved into the database. The single image can be fed to the model and the leaf disease can be easily identified.

III LITERATURE REVIEW

Lot of work has been devoted to the detection of tomato leaf diseases using image processing in the history and it continues to attract research to carry out their research work in this field. Automatic crop disease detection using image processing and machine learning has been gaining prominence in recent years.

P. Krithika et al, pre-processed by image resizing, contrast enhancement and color-space conversion. The K-Means clustering for segmentation and feature extraction using GLCM is performed. Classification was made using multiclass SVM. R. Meena et al., performed color space conversion followed by enhancement process. The primary colors of leaves are converted into. The K-Mean clustering algorithm is used for segmentation. The GLCM and SVM are used for feature extraction and classification respectively. Bharat et al., acquired images using digital camera and median filter is used for image enhancement. K-Mean clustering is used for segmentation. SVM is used for classification. Pooja et al., segmentation is done to get the areas of interest that is the infected region. It is done using k-Mean clustering algorithm, Otsu's detection converting RGB to HSI later segmentation is done using boundary and spot detection algorithm. Rukaiyya et al., performed pre-processing by contrast adjustment and normalization. The conversion of color transform into YCBCR and Bi-level thresholding is performed. The GLCM, and HMM are used for features extraction and classification .

Chaitali et al., segmentation of image is applied for background subtraction. The classification approach is carried out by KNN, ANN and SVM method. In KNN, it classifies samples using nearest distance between trained and testing subjects . Varun et al., has developed model for extraction thresholding technique and morphological operation. Then multiclass SVM is used as classifier. For segmentation, based on a set of marks generated by analysis of the color and luminosity components of different regions of image is color spaces. The GLCM is used for feature extraction. Vijai Singh et al., considered samples of plant leaves like rose/beans (bacterial disorder), lemon (sun burn disorder), banana (early scorch) and beans (fungal) that are captured using a digital camera. The green regions as background using thresholding algorithm. Finally, the genetic algorithm is used to get the segmented image. The color co-occurrence is adapted for useful extraction of features from the segmented images. The Minimum Distance Criterion and then SVM classifier is used for classification purpose. The average accuracy of 97.6% has been recorded.

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Sa'ed Abed et al., performed scaling and stretching (min-max linear) process for the input samples to improve the quality. The creation of HIS model is completed and the same is segmented later. The techniques of combined Euclidean distance and K-mean clustering is performed for segmentation of the samples. The GLCM and SVM are used for feature extraction and classification respectively. Arya et al., takes input RGB image and creates color transformation then conversion of the input samples to HIS format. Finally, segment the components using Otsu's method. Nema et al., images of 81 were included in the database and analysis was performed in color space. Segmentation of the leaf disease was carried using k-means clustering and the classification of the disease was performed using SVM. Statistical information such as mean, median, mode, standard deviation was used by authors to record their findings. Vidyashree Kanbur et al., developed the model for leaf detection disease using multiple descriptors. The model was tested on local leaf database and the performance of the model was superior., but it can be tested on publicly available dataset. Pushpa et al., Indices Based Histogram technique is used to segment unhealthy region of the leaf. The authors have surpassed other segmentation techniques such as slice segmentation, polygon approximation, and mean-shift segmentation. Kaleem et al., considered pre-processed to resize them into 300*300 sized images, remove background noise, enhance brightness, and adjust the contrast. The K-means clustering for segmentation and the useful features are extracted using Statistical GLCM and SVM classifier is used for classification of leaf disorders.

IV METHODS

The methodology which we use to detect tomato Leaf disease is by using CNN(Convolutional Neural Network) model which is the efficient Neural Network for deep Learning.
It consist of Three stages

- Data preprocessing
- Training using CNN model
- Evaluating the model by using performance measures

Data Preprocessing

Our data here is images which are stored in the named folder which denotes the type of disease. First the images are converted to grayscale (0 to 1) by python keras library.

Training

Keras will automatically classify the image data according to the folder name . The data is fed to the Convolutional neural network which contains three layers

Evaluation

CNN model displays the accuracy ,validation accuracy(97 %) which denotes our model works perfectly
The model is stored as the file . Then the model is taken as input and single image is fed to the model and resulting disease is detected for the tomato plant

V RESULTS

Using the method mentioned above has given the accuracy of 94% , validation accuracy of 69% with the loss of 14.66% .This model works well for the tomato leaf image data and the classification and the training Is efficiently performed by the CNN(Convolutional neural network)

VI.CONCLUSION

Plant disease detection is very momentous and important research area. Further, the accurate disease detection and classification of the plant leaf image is very important for the successful cultivation and reduce the loss of crops. During the review, it was observed that classification techniques were widely used for the identification and detection of diseases in plant leaves. Among the classification techniques, many researchers have reported CNN method gave the highest accuracy and recommended for plant disease detection. In future work, the development in hybrid algorithms by using genetic algorithms, antcolony, cuckoo optimization, and particle swarm optimization with SVM, ANN, and KNN would increase the efficiency in plant disease detection. Mobile application can be developed with inbuilt remedial solution that can be used by farmers to detect any kind of leaf, stem, fruit flower disease including nutrient deficiency easily. Deep learning is most powerful technique that has promising features for accurate plant disease detection and classification than machine learning technique. is paper talks about how to use machine learning and image processing to figure out if leaves
are sick or not

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