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ANALYSIS OF PLANT LEAF DISEASE IDENTIFICATION IN IOT USING MACHINE LEARNING AND DEEP LEARNING TECHNIQUES

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ABSTRACT

The process of plant leaf disease detection is a significant one of the agricultural field. Most common symptoms of plant disease are Leaf spots that caused by bacteria, fungi, or viruses. An advanced computer vision enabled system is used in the different features or symptoms based plant diseases detection and classification. Several signs that indicate a plant are diseased or not. Recently, automated technologies are developed to applied in the plant disease detection and also prevent crop disease and losses. In this paper is an attempt to analyze possibility to applyEnd to end DL model, TCI-ALEXN, Improved DCNN, Wavelet threshold guided bilateral filtering model, Deep learning segmentation method for analyzing plant leaf disease identification issues. But, the leaf disease detection accuracy is not improved and false positive rate is not decreased. In order to address these problems, existing machine learning and deep learning based plant leaf disease identificationcan be used for recognizing leaf disease.

Key-words: Plant leaf disease identification,End to end DL model, TCI-ALEXN, Improved DCNN, Wavelet threshold guided bilateral filtering model and Deep learning segmentation method

INTRODUCTION :

India is an agricultural country where the population depends on farming. Diseases in plants suffers in production and economic. Also, it lessens agricultural products quality and quantity. Now, plant diseases detection has improving attention in large field of crops monitoring. Plant diseases create great intimidation for global food security. The plant diseases rapid identification remains challenging one. Several techniques are developed to accurately detect if the plant is healthy or not and also recognize the type of infection. The main intention of the plant leaves diseases identification is to prevent the losses within the yield. Internet of things (IoT) help to identify plants leaves detection. Here, machine learning and deep learning techniques are used to diagnose diseased leaves from digital images. Image processing is to extract the image significant information.The leaves color leaves damage level and region, texture parameters are utilized for classification. Furthermore, different image features are to identify different plant leaves diseases to achieve the improved accuracy. Many diseases detection techniques are difficult to observe the symptoms on the plant leaves and other issues like detecting plant leaf, stem, and fruit diseases, disease affected area measuring, color of the affected area determining, and determine size & shape of fruits. Some common symptoms of fungal, bacterial and viral plant leaf diseases.

LITERATURE SURVEY:

An end-to-end deep learning model was introduced in [1] to identify the healthy and unhealthy corn plant leaves to extract deep features. However, it failed to categorize more corn diseases and other plant diseases from digital images. A convolutional layer and combining the Inception layer with the ConCat layer using AlexNet feature extraction through using Transfer learning (TCI-ALEXN) was developed in [5] to improve the accuracy of maize disease detection. But it failed to identify more types of maize diseases and provides automatic recognition.

An Improved Deep Convolutional Neural Networks with a Multi-Scale Attention Mechanism was introduced in [2] for classifying maize Small Leaf Spot. But, it failed to estimate the performance of Maize Small Leaf Spot Classification. A Wavelet threshold guided bilateral filtering model was employed in [3] to reduce the image noise of accurate detection of maize disease. But, it failed to perform the intelligent monitoring of maize diseases for early and accurate maize disease. A deep learning segmentation method was developed in [4] to distinguish between different plant species at

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the pixel level. However, the more advanced color balancing techniques were not used to generate more realistic images. A novel method based on K-means clustering and an improved deep learning model was developed in [6] for accurately diagnosing corn leaves common diseases. But the performance of time consumption was not computed.

DATASET DESCRIPTION :

Dataset for this research purpose has been collected from the PlantVillage dataset hosted on Kaggle which is publicly available. The dataset consists of approximately 217,000 images consisting of 38 different categories of both healthy and diseased plant images. From this dataset, one is healthy corn leaves and the other three having infected leaves, namely northern leaf blight, common rust, and gray leaf spot.

Methodology

Figure 1.1 shows the steps in the existing workflow which involves Image Preprocessing, Feature extraction and classification.

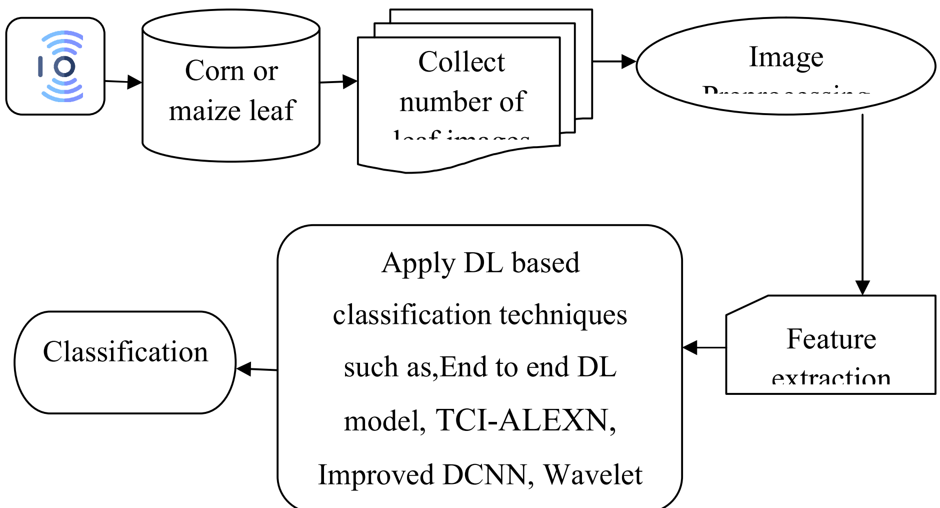

Figure 1.1 Flow processes of plant leaf disease detection

PLANT LEAF DISEASE IDENTIFICATION MODEL :

End to end DL model :

The classification model of end to end DL model comprises three stages namely data preparation phase, training phase, and evaluation phase. The designed model using PlantVillage dataset divided into training and testing for assessing the model's performance. The training subset is fed to the deep learning model to learn the image complex features. After that, the model's overall performance on data is evaluated via test subset. Based on the input image accurate classification as leaf blight, common rust, gray leaf spot, or healthy classes, the evaluation is done.

TCI-ALEXN:

The AlexNet model has the more able for of rapid and accurate classification, and it is extensively applied in transfer learning. The Inception module is applied in GoogleNet applications with improved performance results. The pooling layer is to improve the AlexNet performance. After that the batch normalization (BN) is added to the convolutional layer that improves mean average precision. The network's multi-scale feature extraction capabilities are ensured by Inception module. The TCI-ALEXN consists of pre-training module and extension layer. The extension layer is to extract high-dimensional features and multi-scale feature maps used for classification. A fully-connected layer is to address over-fitting issues.

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IMPROVED DCNN :

The multi-scale dilated-inception module is designed to integrate the inception module and dilated convolution for improving maize fine-grained disease features extraction ability. Also, the connection between features is strengthening by using the dense connection strategy. The designed network model is comprises convolution layers, max-pooling layer and a batch normalization layer. Furthermore, the batch normalization layer and the activation functions are added to increase the model convergence rate.

WAVELET THRESHOLD GUIDED BILATERAL FILTERING MODEL :

The developed Wavelet threshold guided bilateral filtering model is to address issues of low accuracy and noisy features in the maize images for achieving more accurate maize diseases recognition. An input of the model is using the maize leaf disease image data set. At first, the image noise is removed and the input image is decomposed at processing layer that increases the ability to oppose environmental interference and avoids the maize disease spots in their images. Then, the multi-channel multi-scale fusion network structure with attenuation factor is established to improve the ability of feature extraction while increasing the robustness of the deep network. Finally, it chooses the activation functions and optimizers of the model.

DEEP LEARNING SEGMENTATION METHOD :

The network based segmentation architecture is proposed to improve the training process and overall performance of the model. This model needs to learn filters to detect slight differences, focusing on set of pixels and to add relevant information to the other pixels of the plant placed far away from the informative attribute. Multi-scale detection is a key feature to scale the leaves changes from one image to another. In general, it finds different plants at different growth stages. Also, it uses high-resolution images to inform the fewer differences in the leaves shape. The images are resized at network first layer without lose any information. Furthermore, the network carried out two tasks such as classification and segmentation.

CLASSIFICATION:

The mapping between the features is learned by using extracted feature maps and the output classes generally comprise fully connected layers. The inputs from one layer are connected to every activation unit of the next layer at the fully connected layers. In order to avoid classification issues, the SoftMax activation function is applied to get normalized output value.

CONCLUSION :

In this work,plant leaf disease detection using regression based classificationtechniques. Various performance evaluation metrics were used to analyze the performance of the models implemented for plant leaf disease detection on PlantVillage dataset. When comparing the result with existing methods accuracy is improved by 91%, precision is increased by 96.28%, recall is enhanced by 93% and F-Score is increased by 93%.

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