Identification of Plant Diseases through Artificial Neural Networks

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Abstract: Main purpose of this paper is to detect and recognize disease in plants. Image processing technique is used to distinguish weather the leaves are healthy or affected by disease. feature extraction and classification is performed. Difficulty lies in extraction of leaf features through image, those extracted features are used by classifiers for disease recognition. Classification is performed using classifier, ANN (artificial neural networks). morphological characteristics, texture, color of plant leaf are considered for identification and classification.

***Keywords*: image processing, diseased leafs, preprocessing, segmentation, classification.**

I. INTRODUCTION

Most of the country are depended upon agriculture. Agriculture plays a important role in human life. The Disease Identification in plants is an important area of computer vision research. The goal of the recognition system is to automatically detect the plants leaf and recognize whether the leaf is diseased or not. The ability to recognize the complex images enables the construction of several important applications. Automated plant identification system, Disease identification system in various plants which helps farmers to find the right pesticides for respective disease. Various modern technologies have come forward to minimize postharvest processing, to protect against agricultural sustainability and to increase the productivity. Various Laboratory based approaches such as polymerase chain reaction, gas chromatography, mass spectrometry, thermography and hyper spectral techniques have been deployed for disease identification. These techniques are not considered. Since it's not a cost effective and time consuming.

A. Image processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. Image-processing is used for visualization, image.

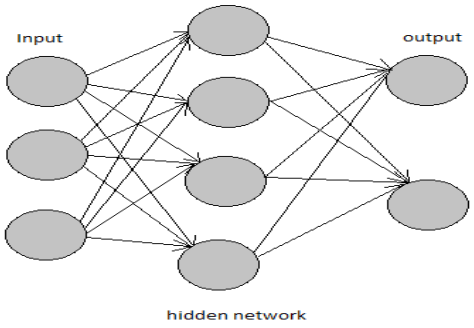
In this paper for disease recognition in leaf we perform preprocessing, segmentation, feature extraction and assification.

B. Artificial neural network

An Artificial Neural Network employs supervised learning rule to become efficient and powerful. The information in neural networks flows in two different ways. Primarily, when the model is being trained or learning and when the model operates normally – either for testing or used to perform any task. Information in different forms is fed into the model through input neurons, triggering several layers of hidden neurons and reach the output neurons, which is known as a feedforward network.

As all the neurons do not trigger at the same time, the neurons that receive the inputs from the left are multiplied with the weights as they travel through hidden layers. Now, add up all the inputs from every neuron and when the sum exceeds a certain threshold level, the neurons that had remained silent will trigger and get connected.

C. Figure



ANN simple model

II. LITERATURE REVIEW

Vimal K. Shrivastava *et al.* [1] "RICE PLANT DISEASE CLASSIFICATION USING TRANSFER

LEARNING OF DEEP CONVOLUTION NEURAL NETWORK". In this paper Author proposed transfer learning of deep CNN used to classify rice plant diseases. The MatConvNet toolbox is used for implementation of Alex Net CNN model. The considered dataset has been randomly partitioned into training and testing set. To analysis the effect of partitioning, three sets of training-testing partition has been done. Model classifies rice diseases with classification accuracy of 91.37% for 80%- 20% training-testing partition. Drawback is using less amount dataset of rice disease images.

Guiling Sun *et al.* [2], "Plant Diseases Recognition Based on Image Processing Technology "In this paper make use of multiple linear regression model to discover or detect the disease in plants, the images from training libraries are placed into the many linear regression model, then the disease recognition system is constructed by using the least squares method. Use the images inside and outside the training libraries to test the accuracy of the system. The results of multiple regression system can discriminate the severity of plant diseases better. Having more training images, the results will be more accurate.

T. N. Tete and S. Kamlu, [3], "Detection of plant disease using threshold, k-mean cluster and Ann algorithm," This paper proposed various techniques of segmentation for identification of different the plant disease. thresholding and K- means cluster algorithms are used for segmentation. RGB image of infected leaves was selected. Cluster algorithm gives better result compare to thresholding for distinct data set.

M. S. Arya *et al.* [4]," "Detection of unhealthy plant leaves using image processing and genetic algorithm with Arduino, "Author uses mat lab for experiment. The Fresh and Diseased leaves of plants like pepper, potato, tomato with late blight and leaf spot was chosen as input data. At first, performing the color transformation from RGB to HSI, then image is separated as RGB components, green pixels of image are masked and by using specific threshold value masked image are removed. Then this threshold image is mapped to R, G, B components. For proposed algorithm Infected pepper plant by late blight disease is given as input. To the given input image Color transformation structure is performed Image segmentation is used to distinguish the foreground from the background. Simple thresholding Is done using Otsu's method. By using various image parameters Otsu's method is used to separate the affected area.

R. M. Prakash *et al.* [5]," Detection of leaf diseases and classification using digital image processing", Author of this paper used citrus leaves (60 images), in which diseased leaves (35), normal leaves (25). using K-Means Algorithm The RGB images is converted into L*a*b* color space and those are segmented. The classification is done through SVM. The image is converted from RGB to grey scale and resized. The extracted features(GLCM)of converted image is stored in database, these extracted vectors are given to the classifier as input and the vectors of database are partitioned as training and testing vectors, classification is performed by SVM. By this 90% accuracy is obtained.

X. Zhang *et al.* [6]," Identification of Maize Leaf Diseases Using Improved Deep Convolutional Neural Networks" Author proposed detection and classification of eight different types of maize leaves. for recognition of disease the improved Google Net and Cifar10 deep learning model are proposed. To test and train maize leaves images Two models are used by parameter adjustment, pooling combinations changing, addition of dropout operations and rectified linear unit functions and reducing classifiers. During recognition phase, the Google Net model obtain accuracy of 98.9%, and the Cifar10 model achieves accuracy of 98.8%.

X. SUN *et al*. [7]," Image Recognition of Tea Leaf Diseases Based on Convolutional Neural Network", In this paper author make use of tea leaves to detect the disease in it.CNN used for recognition purpose. Preprocessing are done through image segmentation and data enhancement.to accelerate the convergence of network rrelu linear function was used. Frequently the learning rate and iteration numbers are adjusted in order to achieve higher recognition accuracy. In this proposed model CNN achieves 93.75%, SVM achieves 89.36%, BPNN achieves 87.69%.

R. Gandhi *et al.* [8]," Plant disease detection using CNNs and GANs as an augmentative approach", In this paper author used CNN to detect disease in Indian plants, and for classification of image deep learning technique is used. Inception v3 and mobile

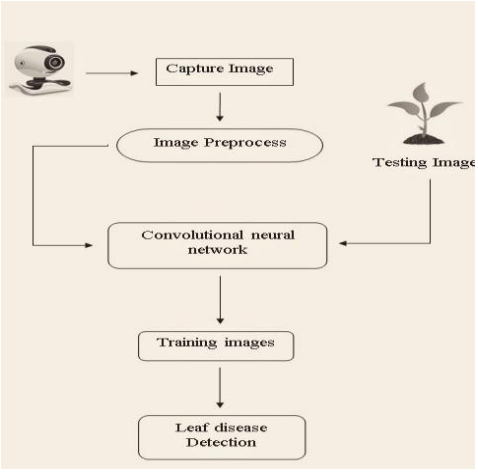
Nets are the two architectures used to compare accuracy of both and training speed. For augmentation of limited datasets this system also make use of GANs.accuracy achieved in this model is 88.6%.

V. Suma *et al.* [9],” CNN based Leaf Disease Identification and Remedy Recommendation System”, In this proposed model author used CNN MODEL. dataset is divided as several parts, for training 70%, validation 10% and for testing 20%. several architecture and model are used to test. different network parameters are selected based on error and trial. Accuracy of classification is more than that of grey scale and segmented images. This ensures color images is better for feature extraction to perform classification. whole experiment is done using python. K-mean cluster used for classification. classification accuracy achieved is 99.36%.

S. Kaur *et al.* [10],” Semi-automatic leaf disease detection and classification system for soybean culture”, In proposed model soybean leaves is used to detect disease and classification they make use of 1000 images of plant village dataset for Three classes (frog eye, downy mildew and Septoria leaf blight). Semi _automatic system that uses k-mean concept for implementation is considered. Based on SVM classifier experiment are carried out by considering texture features, color features and its combination. The average classification accuracy is 90%

III. METHODOLOGY

To Detect the leaf disease in plants image processing technique is used Morphological characteristics, texture, color are best fit for identification and classification of disease. It involves preprocessing, segmentation, feature extraction, classification and recognition.



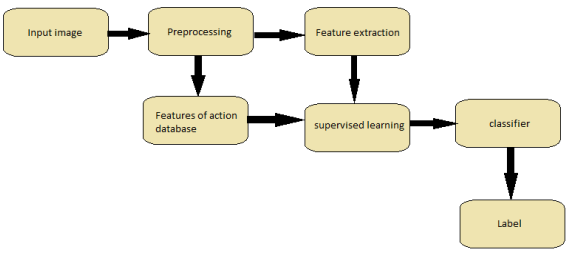
Preprocessing is used to alter the given input image in a uniform size to enhance the feature of that image for further processing.

Segmentation is performed to partition the digital image of leaf into number of pixels called image object. Label is assigned to each pixel. Pixel with same label shares particular characteristics.

Feature extraction is performed using HOG (histogram of gradients). HOG is a feature descriptor used for object detection and image outline are defined through intensity gradients. *three* types of feature descriptors are used. Hu moments, Haralick Texture, Color Histogram.

The labeled datasets are segregated into training and testing data. The feature vector is generated for the training dataset using HoG feature extraction. The generated feature vector is trained under a Random Forest classifier. Further the feature vector for the testing data generated through HoG feature extraction is given to the trained classifier for prediction. The labeled training datasets are converted into their respective feature vectors by HoG feature extraction. These extracted feature vectors are saved under the training datasets. Further the trained feature vectors are trained under Random Forest classifier. The feature vectors are extracted for the test image using HoG feature extraction. These generated feature vectors are given to the saved and trained classifier for predicting the results. the proposed model is to discriminate the plant’s leaf through the mathematical model to derive the outcome.

A. Block diagram



Block diagram of proposed model

Image Acquisition:

The plant leaf images are obtained using a camera, resulting in an RGB (Red, Green, and Blue) format. A color transformation structure is established for the RGB leaf image, followed by the application of a device-independent color space transformation to this structure.

Image Pre-processing:
It involves various techniques aimed at eliminating noise and removing unwanted objects from images. One method is image clipping, which entails cropping the leaf image to focus on the area of interest. Smoothing filters are applied to achieve image smoothing, while image enhancement techniques are utilized to boost contrast. Additionally, RGB images are converted to grayscale through a color conversion process using a specific equation.
(x)=0.2989*R + 0.5870*G + 0.114.*B

Image Segmentation
1. Segmentation: The process of segmentation employs a boundary and spot detection algorithm. Initially, the RGB image is transformed into the HIS color model to facilitate segmentation. Both boundary and spot detection techniques are utilized to identify the infected areas of the leaf. In boundary detection, an 8-connectivity approach is used for pixel analysis, followed by the application of the boundary detection algorithm.
2. K-means clustering: This method is employed to classify objects into K distinct categories based on a defined set of features. The classification process aims to minimize the total squared distance between each object and its associated cluster.
3. Otsu Threshold Algorithm: Thresholding transforms grey-level images into binary images by assigning a value of zero to all pixels that fall below a specified threshold and a value of one to those that exceed it.
4. Feature extraction is crucial for object identification and is widely utilized in various image processing applications. In the context of plant disease detection, several features such as color, texture, morphology, and edges can be employed. Texture refers to the distribution of color within the image, as well as the image's roughness and hardness. This aspect can also aid in identifying areas of a plant that are infected.

Detection and Classification K-propagation is a training technique employed in multi-layer neural networks, commonly referred to as the generalized delta rule. This method utilizes gradient descent to reduce the overall squared error of the network's output. A neural network is designed to accurately recognize the input patterns presented during training, a process known as memorization. Additionally, it should be able to respond appropriately to inputs that are similar, yet not identical, to the training samples, a capability referred to as generalization.

IV. RESULT AND ANALYSIS

Any image file format, including png, bmp, jpg, gif, and others, can be chosen for processing. After selecting the image file, it will be read and undergo pre-processing using specified methods. Following the display of the contrast-enhanced image, the program will proceed with segmentation and clustering.

V. CONCLUSION

This paper includes detection of plant disease using ANN that helps farmer to find disease in early stage itself. Morphological characteristics, texture, color are best fit for identification and classification of disease. Most of the authors had used artificial neural network model for detection purpose. Computational speed is more compare to other techniques. Automatic plant disease detection overcome of using cost effective method. This helps farmer to choose best pesticides for respective disease.

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