Plant Leaf Disease Diagnosis from Color Imagery using Co-Occurrence Matrix and Artificial Intelligence System

K. NATHIYADEVI[1], C. PRIYADARSHINI[2], M.S. PREETHIKA[3], S. NIVEDHA[4]

[1]*ASSISTANT PROFESSOR, Department of Electronics and communication Engineering, R.M.D Engineering College, Affiliated to Anna University, Chennai, India.*

[2,3,4]*U. G STUDENTS, Department of Electronics and communication Engineering, R.M.D Engineering College, Affiliated to Anna university, Chennai, India.*

Abstract- *The project presents leaf characteristics analysis using image processing methods for automated vision system used at agricultural field. In agriculture research of programmed leaf qualities location is basic one in observing enormous fields of harvests, and in this way naturally recognizes indications of leaf attributes when they show up on plant leaves. The proposed dynamic framework uses picture content portrayal and regulated classifier sort of neural system. Image processing techniques for this kind of decision analysis involves preprocessing of the input, feature extract from the processed image and output of the classification stage. At Processing, an input image will be resized and region of interest selection performed if needed. Here, color and features extracted from texture an input for network training and classification. Color features like mean, standard deviation of HSV color space and texture features like energy, contrast, homogeneity and correlation. The system will be used to classify the test images automatically to decide leaf characteristics. For this approach, automatic classifier Back Propagation Neural Network (BPNN) be used for classification based on learning with some training samples of that some category. This network uses tangent sigmoid function as kernel function. Finally, the simulated result shows that used network classifier provides minimum error during training and better accuracy in plant disease classification.*

Index Terms – Back Propagation Network (BPN), K Means Clustering, Plant Recognition, DWT(Discrete Wavelet Transform), GLCM (GreyLevelCo-occurrence Matrix*)*.

1. INTRODUCTION

The problems of sustainable agriculture and climate change examine results show that environmental change can adjust stages and paces of pathogen advancement; it can likewise alter have opposition, which prompts physiological changes of host-pathogen associations [2]. The circumstance is additionally muddled by the way that, today, sicknesses are moved all inclusive more effectively more than any time in recent days. New ailments can happen in places where they were already unidentified and, intrinsically, where there is no nearby mastery to battle them. Unpracticed pesticide utilization can cause the improvement of long haul opposition of the pathogens, seriously decreasing the capacity to retaliate. Auspicious and exact finding of plant infections is one of the mainstays of accuracy horticulture. It is vital to forestall superfluous misuse of budgetary and different assets, hence accomplishing more beneficial creation, by tending to the long haul pathogen obstruction improvement issue and relieving the negative impacts of environmental change. Right now, suitable and convenient infection recognizable proof including early avoidance has never been progressively significant. There are a few different ways to identify plant pathologies. A few sicknesses don't have any unmistakable manifestations, or the impact becomes recognizable past the point where it is possible to act, and in those circumstances, an advanced examination is compulsory. Be that as it may, most ailments create a sign in the obvious range, so the unaided eye assessment of a prepared proficient is the prime system embraced by and by for plant ailment recognition. So as to accomplish precise plant infection diagnostics a plant pathologist ought to have great perception aptitudes with the goal that one can distinguish trademark side effects [3]. Varieties in manifestations showed by infected plants may prompt an ill-advised conclusion since novice nursery workers and specialists could have a greater number of troubles deciding it than an expert plant pathologist. A robotized framework intended to help distinguish plant ailments by the plant's appearance and visual side effects could be of extraordinary assistance to beginners in the cultivating procedure and furthermore prepared experts as a confirmation framework in infection diagnostics.

Rong Zhou et al. for distinguishing proof of Cercospora leaf Spot structure sugar beet, etc. In spite of the matter the specialists have worked with SVM, the issue of distinguishing different sicknesses by utilizing SVM will be a confused undertaking, in light of this the proficiency of

the framework will diminish both in the terms of cost and time. Right now, have presented spiral premise work organize have been prepared with bacterial scavenging calculation that is vigorous in nature for sudden changes happen in leaf ailments and system alongside outspread premise work for include extraction to recognize and characterize six parasitic plant leaf ailments effectively.

II. PROPOSED SYSTEM

2.1 DATA ACQUISITION

The data acquisition process was done by this project because there are no publicly available datasets pertaining of Leaf Images dataset., we use a set of images. The images were collected from real plants around us. The disease of the individual's plants can be shown in the leaf disease dataset images. The images include leaf from different agriculture plants with different position. The quality and size of images also varies from one image to another. However, this project doesn't have any significant bearing any image processing method to the collected images.

Figure 2.1 Some of Sample Images

2.2 PREPROCESSING

Image pre-processing function that the term for operations on images like changing the RGB image to gray one by adjusting the image resolution as needed. These operations don't increase image information content however they decrease it if entropy is associate degree metric. The point of preprocessing is partner degree improvement of the picture data that stifles undesirable twists or upgrades some picture choices pertinent for more procedure and investigation task.

2.3 FEATURE EXTRACTION

Highlight Extraction intends to diminish the quantity of highlights in a dataset by making new highlights from the current ones (and afterward disposing of the first highlights). These new diminished arrangement of highlights ought then to get the option to abridge the greater part of the data contained in the first arrangement of highlights. Right now, condensed variant of the first highlights can be made from a blend of the first set.

2.3.1 DWT

Positional Ternary Pattern (PTP) assigns eight-bit computer code to every element of a picture. Initially, Kirsch compass masks computes the sting response of eight neighborhood pixels. Then, we tend to choose the first and secondary direction from those edge responses. Here, we tend to take an extra step to pick out the secondary direction in such some way that, it will represent higher corner structure of that element. At last, we tend to introduce a ternary pattern of the first direction that distinguishes the flat and edge-based region.

2.3.2 GLCM

Given the input picture made of each array of pixels each with a force (specific dim level), the features from GLCM is a description of how different blends of the dimension measured levels co-occur frequently in a portion of the image or image. Surface element image makes propose of GLCM substance to give a proportion of the power variety.

2.4 SEGMENTATION

In segmentation method transfer digitalize picture into sequence of pictures, that kind of pictures are collection of pixel that we refer as perfect pictures. This method presented in simpler and vary the presentation of a picture into variable form that represent more understandable and handled very lucid way to analyze. That notable pictures are removed from original pictures.

If considering segmented process, the blur area that is the abnormality exist in the infected portion will appear clearly. If we consider the depth of subtraction operation, succeeding the blur picture and the threshold is selected. K-means clustering algorithm in the form of unsupervised learning that is used when unlabeled data is present. The purpose of this algorithm is to find groups in the data, with variable K representing the set of groups. Iteratively, the algorithm works to assign each datum to at least one of the K classes based on the characteristics given. Data points are clustered based on similarity of the features. The results of the K-means clustering algorithm are:

1. The K-cluster centroids, which can be used to mark new data.

2. Labels for the training data (data points are clustered supported feature similarity)

Rather than defining groups before staring at the information, clustering allows you to seek out and analyze the groups that have formed organically. The segment below, "Choosing k," explains how the amount of groups is determined.

III. DESIGN METHODOLOGY

3.1 BLOCK DIAGRAM OF LEAF DISEASE CLASSIFICATION

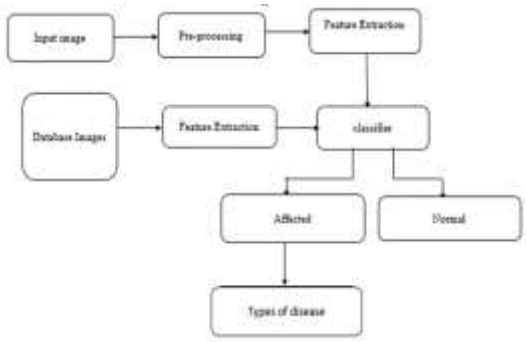

Figure 3.1 Block Diagram of Leaf Disease Classification

In the figure 4.1 represents input image of Leaf sample image can be given to the system. In the preprocessing stage it will remove the noise by using filter and then it sends it to Wavelet transform and GLCM for features extraction from the input image. Also, this used extract the features. Database are loaded into BPNN, given features values are send to the BPNN. It will classify the age estimation finally.

3.2 BPNN

BPNN is a supervised learning algorithm used for artificial neural network processing. The backpropagation algorithm mainly consists of two stages i.e.- forward propagation and backward propagation passes through which the different layers or parts of the network are trained. The algorithm for BPNN can be given as follows:

1. The initial step is to initialize the weights randomly.

2. Next, an input vector pattern is provided to the network.

3. Verify the outputs of the network by directing input signals further.

4. Calculate $\partial j = (yj-dj)$ for all output neurons, where dj is the desired output of neuron j and yj is its current output: $yj= g(\sum iwijxi) = (1 + e-\sum iwijxi)-1$, assuming a sigmoid activation function.

5. For remaining neurons (from last hidden layer to first), compute $\partial j = \sum kwjkg'(x)\partial k$, where ∂k is the ∂j of the succeeding layer, and $g'(x) = yk(1 -yk)$.

6. Update the weights according to: $wij(t + 1) = wij(t) - yiyj(1-yj)\partial j$, where, wij is a parameter called the learning rate. 7. Again its goes step 2 for a some number of iterations, or until the error is decreased to a pre specified value.

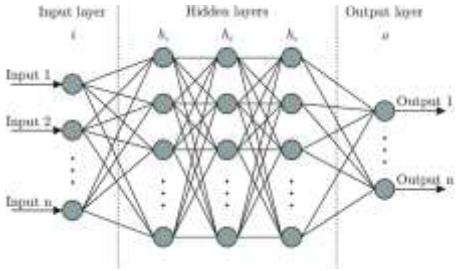

Figure 3.2 Back Propagation Neural Networks Architecture

After the process of the features are extracted, input into these features to the neural network in the figure 4.2. Multilayer Perceptron (MLP) uses neural network for this system. Multiple concealed layers are utilized in the applications where precision is the one of the main criteria and no restriction for the preparation time is referenced. Indeed, even the disadvantage of utilizing various shrouded layers in the neural system is that they are progressively inclined to fall in terrible neighborhood minima [3] In these have all out four layers in the neural system input layer yield layer and two concealed layers. Sigmoid capacity is utilized as initiation work for actuating the neurons.

Backpropagation techniques is utilized to preparing the network system. It is one of the important thing to regulated learning where it know the normal outcome in advance. At the point when the normal outcome isn't acquired, we proliferate the mistake to past layer until the information layer is come to. This procedure is proceeded iteratively until we get insignificant mistake that can be endured. In these find the mean squared error (MSE) over entire set of training pattern by this,

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

From which, E is error of total training with p denotes all training patterns, E_p was a single pattern of training error, n represents all output nodes, t_j sub n represents the target value for node n in output layer j, and a_j sub n represents the actual activation for the same node, ½ is a value applied

to simplify function's derivative [4].

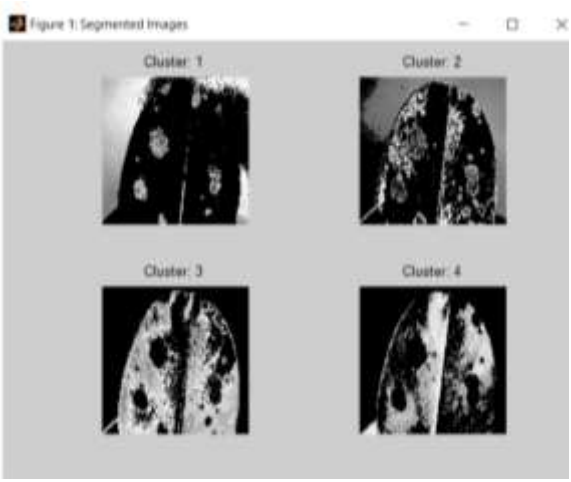

Figure 3.3 Segmentation Output Images

Input layer consists of 136 neurons which are (x,y) axes of co-ordinates. Every (x y) axes from the co-ordinate pair is corresponded into a singular value decomposition particular worth disintegration (SVD) along these lines we have absolute 68 neurons from the outset concealed layer. Segmentation of output images in the figure 4.3.

3.3. SOFTWARE SYSTEM

3.3.1 MATLAB

MATLAB Is a superior language for professional figuration. It integrates measurement, perception and programming in a easy to use situation in which problems and arrangements are communicated in can scientific documentation. Regular uses include application advancement along with GUI building with various algorithm.

MATLAB is tool with framework whose essential information component is an exhibit that doesn't require dimensioning. This grants you to deal with various specific enrolling issues especially those with framework and vector designs in a limited quantity of the time it would take to form a program in a scalar non intelligent language.

IV. RESULTS AND DISCUSSION

This area exhibits our experimentation and talks about our outcomes. We isolate this segment into two sub-segments as per mark esteem type. In the primary area we apply our analyses so as to gauge the age of an individual as people do (in number). In the second area we attempt to characterize the individual into one of a few gatherings (classes) each with various range.

4.1. LEAF DISEASE IDENTIFICATION & CLASSIFICATION

We run numerous investigations with various MLP structures and various parameters. The best outcomes and ideal structures for created Multi-layer perceptron neural system (MLP) for getting least estimation blunder and best coefficient for relationship among genuine and hypothetical evaluated.

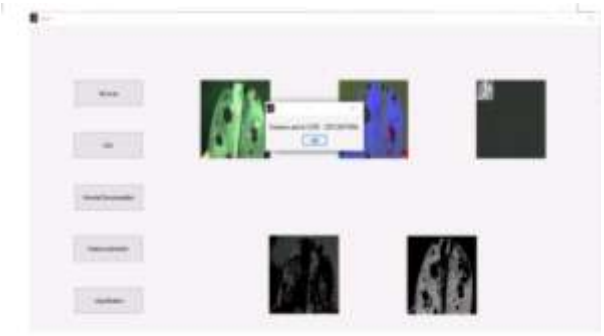

Figure 4.1 Output Image Disease Classfication

In leaf disease identification done through BPNN. During the time spent setting up our MLP using flexible learning rate and power estimation. We test the framework using 10-cross endorsement with stratified looking at. The results show best exactness when number of containers are tinier. Right when ranges get discretize the name attribute into apparent trademark. This discretization is performed by binning. The guideline extent of leaf picture dataset is isolated into characterizations. Each class progressively unequivocal the precision decreases.

V. CONCULSION AND FUTURE WORK

This paper showed how Back Propagation Neural Networks (BPNN) could be utilized to construct exact age estimator. So as to prepare the neural system, we extricate shape highlights from genuine human dental pictures that we caught at before time. We use Multi-layer perceptron arrange (MLP) as characterization and relapse device. It's estimation reliabilities were assessed by figuring relationship coefficient between the specific and evaluated age esteems for characterization precision. The outcomes show that MLP arrange has a decent presentation and sensible estimation precision it could be a significant device for plant leaf disease classification.[i]

Table 4.1 Comparsion of BPNN and SVM Algorithm

Parameters	BPNN	SVM
Validation Accuracy	97.2	88.5
Validation Loss	6.8	11.1
Train Accuracy	93.8	90.7
Train Loss	6.2	9.3

Consequently, the profound learning system were more precise than the profound learning and neural systems. Contribution of the picture datasets were prepared and tried. Aftereffects of the picture acknowledgment relies upon the rundown of layers of neural systems organized and the quantity of ages. The profound learning structure was likewise utilized for object discovery the pace of precision of 89 % has been acquired.

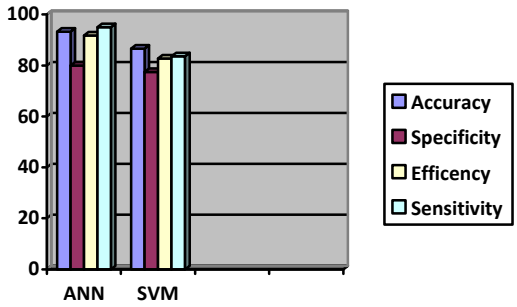

Figure 4.2 Validation data of Leaf Disease

Our Future work include building up a programmed milestone discovery calculation, attempt to incorporate progressively important highlights for identification of leaf disease process, increment our preparation set models and attempt to fabricate a necessary action taken place that can be a hardware module.

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