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Detection of Leaf Diseases by Image Processing

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Abstract: **Major economic and production losses occur because of diseases on the plant .Now a days there are several diseases seen on the plants. For increasing production and quality it is Important to control such a harmful diseases .For controlling such a diseases it is necessary to detect a specific disease. In our country many farmers are not so educated to get correct information about all diseases, they require expert advice. But it is impossible for expert to reach at each farmer. Even if they got expert, expert uses naked eye observation. But naked eye observation has very less accuracy. We introduce here new approach for detecting plants leaf diseases .It is very sensitive and accurate method in the detection of plant diseases, which will minimize the losses and increases the economical profit. It includes following steps in that, image acquisition, image pre-processing, features extraction and neural network based classification.**

Keywords: Image acquisition, pre-processing, features extraction, classification, neural network.

I.INTRODUCTION

Most peoples in the India are farmers. They depend on the agriculture. They have aim to increase productivity and quality of product. Vegetables and fruits are the most important agricultural products for from customer view.[2] The economical profit depends on a product quality which is depends on a quality of a soil, seeds and fertilizers. So for increasing the profit farmer mainly focuses on these three main things. Instead there is one more thing which affect on a production that is diseases. To increase profit we have to control these diseases. But it is necessary to detect and control such diseases in a specific period which is at there initial state. So it is important to destroy such diseases before it will affect on some basic operation of plant body such as
Photosynthesis, transpiration, pollination, fertilization, germination etc [3]. These diseases occurred due to the pathogens such as fungi, bacteria and viruses, and due to adverse environmental conditions [1]. Therefore, it is necessary to diagnosis a plant diseases. For that farmers requires continuous monitor the plant body which is time consuming process. It also the very expensive process for the farmers [4]. So the latest develop method give us machine view for detecting plant diseases which is much accurate and less time consuming [6]. In this method robot guidance is used to inspection and further processes. The objective of this paper is to concentrate on the plant leaf disease detection based on the color of the leaf [5].

II.METHADOLOGY

For detection and classification of plant diseases we have used an image processing based solution. The overall concept for any vision related algorithm of image classification is almost the same and shown in fig.1. First, the digital images are acquired from the environment using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that neural network technique is used for the classification as per specific problem. Following image shows us basic steps involve in our paper.

The step-by-step procedure as shown below:
1) RGB image acquisition
2) Convert the input image into color space
3) Segment the components
4) Obtain the useful segments
5) Computing the color features
6) Configuring the neural network for recognition.

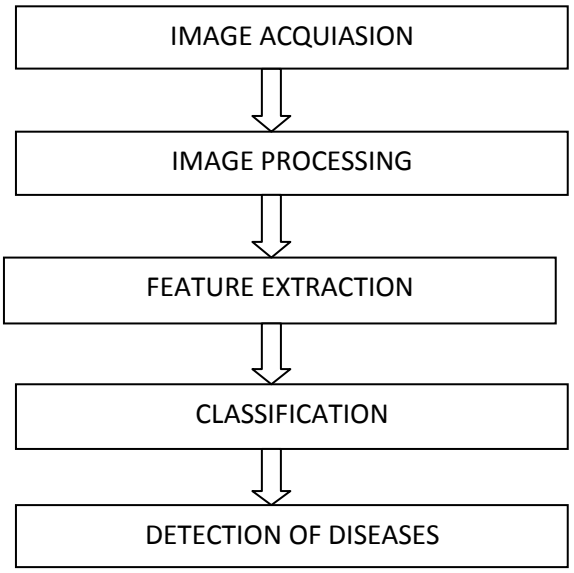

Fig1: Basic procedure for the Leaf Disease Detection

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Fig2.Original image

A. Image acquisition

For the analysis of diseases leaf we require images of diseases leaf. There are so many types of the diseases on the leaf. Firstly image acquisition is very important step. These images are acquired by using different digital technique. In this technique digital camera is used to capture images. For the analysis of disease on the leaf, better quality images are required. For the analysis of the diseases, image database is needed. The construction of an image database is clearly dependent on the application. This database affects on the efficiency. The image database on the application itself is responsible for the better efficiency of the classifier which decides the strongest of the algorithm.

B. Image pre-processing

After the image acquisition and creating the image database, the next step is image pre-processing. For the acquiring the original image data image pre-processing is step is very efficient process. The original image is shown in fig.2. In the pre- processing of image we suppress undesired distortion of these images and enhance some images features important for further processing and analysis task. In image pre-processing step it includes color space conversion, image enhancement and image segmentation. Our acquired image is having some image format .This image is converted into the RGB format. The RGB Images of leaves are converted into color space representation. To specify the color in some standard accepted way is the purpose of the color space conversion. These RGB images of the leaf are converted into the HSV image format. HSV is the Hue Saturation Value shown in fig.3

-HUE - It is a color attribute that describes pure color as perceived by an observer shown in fig.3 a).

-SATURATION - Saturation termed as relative purity or the amount of white light added to hue shown in fig.3 b).

-VALUE - Value means amplitude of light shown in fig.3 c).

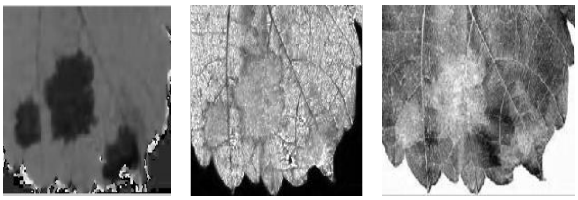

Fig.3 a) Hue b) Saturation c) Value

After the color space transformation process, hue component is used for further analysis. Saturation and value are dropped since it does not give extra information.

C. Feature extraction

Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant then it can be transformed into a reduced Set of features . In the analysis of diseases on images, there is a need to extract the diseases that are the part of the leaf. This process is called feature extraction. The extracted features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

It follows two steps:

1) Preprocessing

2) Feature extraction

3) Pre- processing

This is used for feature extraction including different steps such as filtering, normalization, segmentation & object identification. From this we get set of significant regions & objects.

1) Feature extraction

Different features such as color, texture, shape are used to describe contain of an image. Different features of images are extracted and the image database is generated on the other hand. From the given suspected image, features are extracted and these features are compared with the feature database and the similar image with maximum similarities is retrieved.

There are three methods of feature extraction which are mostly used. These are,

- Texture Based Feature Extraction
- Shape Based Feature Extraction
- Color Based Feature Extraction

- *Texture Based Feature Extraction*

An image texture is a set of matrices calculated in image processing designed to qualify the perceived texture of an image. Texture gives us information about the spatial

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arrangement of color or intensity in an image or selected region of an image. Texture is also the important property of an image. but it is not able to describes the image features as that of color because it is related to only with the special arrangement of color or intensity and it cannot find the similarities from the feature database as much as color.

- *Shape Based Feature Extraction*

Shape based image retrieval is the measuring of similarity between shapes represented by their features. Shape is an important visual feature and it is one of the primitive features for image content description. Shape content description is difficult to define because measuring the similarity between shapes is difficult. Therefore mostly we use color based feature extraction.

- *Color Based Feature Extraction*

Feature extraction on the basis of its color is mostly used because of its accuracy, effectiveness, low storage requirement etc. We can describe color information by using different color model such as R,G,B models, H,S,V (hue, saturation, value) and Y , Cb, Cr (luminance and chrominance) as shown below. Color is perceived by humans are a combination of three basic colors. These are Red, Green, and Blue. The Other color models can be generated by varying the combination of this primary color. Here we can see that there is a conversion of original image into a binary image using mat lab. After then by taking a negation of a binary image we get masked image shown in Fig.4 a) and b). Here we focus on a particular area by using these two images we generated a binary mask image shown in fig.4. Here our focused area is on its original color. Color based feature extraction will be useful for a further procedure in classification of diseases.

Fig.4 a. Binary Image b. Mask Image

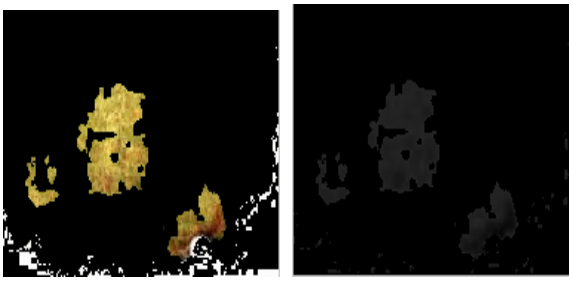

Fig.5 a) Binary Mask Image b) Hue Image

III. CLASSIFICATION

Before going to the classification we must know the concept of object recognition. The overall procedure of a classification is totally depending on an object recognition technique. There is a little difference between in image processing and object recognition and image processing deals with different technique which can improve the visual quality of the input image, whereas object recognition deals with the description and classification of object. The tree diagram shown in fig.6 will useful for the better understanding of an approach of the object recognition technique.

In Decision theoretic approach, the pattern is represented in a vector space so the decision algorithm which is based on a statistical concept is used to decide which class the pattern belongs to. This method can broadly divide into classical and neural network approach. In this the classical approach depends on the statistics of the input data to be classified. Another one that is neural network is basically information-processing system that has some performance characteristics. In this paper we will go through the neural network approach for further classification.

IV. NEURAL NETWORKS

Artificial neural networks are the relatively complicated electronic networks of neuron based on neuron structure of brain. It is a set of more than one simple processor rather than using a single complex processor as like in the CPU machine. If we give a sample image to the processor then processor "learn" by comparing their classification of the record with the known actual classification of the record. The errors from the initial classification of the first record is fed back to the network and used to modify the network algorithm. The second time around and so on for many iterations.

Neuron in an artificial neural networks is a –

- Set of input values (Xi) and associated weight (W).
- A function (g) that sums the weight and maps the results to an output(Y).

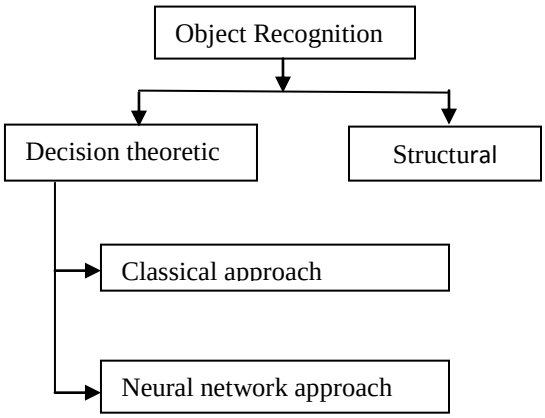

Fig.6 Neural Network

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A. *Training of neural network*

In the training phase the current class of each record is known and the output nodes can therefore be assigned "correct" values "1" for node corresponds to the correct class and "0" for the others. It is thus possible to the network calculated values, for the output nodes to these "correct" values, and calculated as error term for each node.

These errors term are then used to adjust the weights in the hidden layers so that hopefully, the next time around the output values will be closer to the "correct" values. To classify the disease on grape leaf neural network classifier is used and for desired results it has to be trained.

There are four steps in the training process:

- Assemble the training data
- Create the network.
- Train the network.
- Test and validate network response to new inputs.

The back propagation algorithm is used in layered feed-forward ANNs. Back propagation neural networks architecture is chosen as it was a simple and one of the most commonly used neural networks.

B. B*ack propagation algorithm*

Back propagation is most popular, effective and easy to learn model for complex, multilayered networks. Its greatest strength is in nonlinear solution to ill-defined problem. The basic model of back propagation neural network is shown in fig.7

The typical back propagation network has an input layer, output layer and at least one hidden layer. There is no theoretical limit on the number of hidden layers but typically there are just one or two, some work has been done to which indicates that a maximum of five layers are required to solve problem of any complexity. Back propagation adjusts the weights of the NN in order to minimize the network total mean squared error.

The basic idea of the back propagation algorithm is to reduce the error, until the ANN learns the training data. When finally the system has been trained correctly and no further learning is needed, the weights can, if desired, be frozen.

The back propagation neural network is as represented as weighted sum:

$$A_j(\vec{x},\vec{w}) = \sum_{i=0}^{n} x_{i} w_{ji}$$

The most common output function of back propagation neural network is the sigmoid function:

$$o_j(\vec{x},\vec{w}) = \frac{1}{1+e^{A(\vec{x},\vec{w})}}$$

The training process for neural network is used to obtain a desired output when specific inputs are given. Thus the error value is calculated from the difference between the actual and the desired output, in order to minimize the error

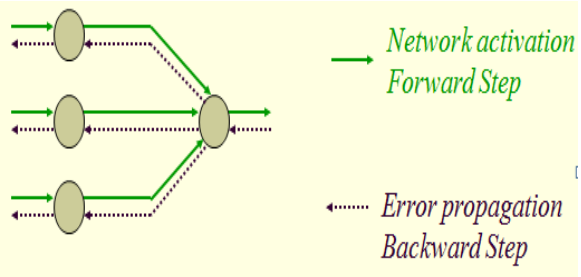

Fig.7 back propagation method

Weights have to be adjusted as the error depends on weights. The error of the network will be determined by the sum of the errors of all the neurons in the output layer:

$$E(\vec{x},\vec{w},\vec{d}) = \sum_{j} (o_j(\vec{x},\vec{w}) - d_j)^2$$

Back propagation consists of the repeated application of the following two passes:

Forward pass: In this step, the network is activated on one example and the error of (each neuron of) the output layer is computed.

Backward pass: in this step the network error is used for updating the weights. The error is propagated backwards from the output layer through the network layer by layer. This is done by recursively computing the local gradient of each neuron.

V.RESULT

By using the above work we can distinguish the different diseases as shown in fig.8.

Serial no.	Image	Diseases
1		Powdery Mildew
2		Downy Mildew
3		Black Rot
4		Normal Leaf

Fig.8 Classification of Diseases

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VI. CONCLUSION

Main approach of our paper is to recognize diseases on the grape leaf. Here we have successfully recognized the diseases as shown in fig.8 for example powdery mildew, downy mildew, black root. This result shows that this approach is a valuable approach for detection of diseases with some computational effort. The future work of this paper will focus to develop the real time detection of diseases and diagnosis of the disease also.

VII. REFERENCES

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