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Detection Of Leaf Disease Using Image Processing.

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ABSTRACT

In India, agricultural productivity is something that plays a key role in country's economy. In our country agriculture is a major occupation on which most population depends. Now-a-days plants are frequently prone to diseases. Diseases cannot be classified into one or two , they are many. Identification of disease in an early stage prevents heavy loss of field. The identification process should e quick to avoid a serious outbreak. In general symptoms are observed on plant parts such as leaf , stem, fruits, etc..Leaf shows symptoms by changing color or by spots on it. Most plant diseases are caused by fungi, bacteria and viruses which are microorganisms. Generally identification of plant disease is either done by naked eye or by pathogen detection. Both the processes are time consuming as well as costly. This paper suggests an idea of automatic detection of disease on leaf using image processing techniques.

Keywords: Automatic detection, Neural Networks , K means Clustering , Edge detection , RGB to Gray

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INTRODUCTION

In our country in-spite of advancement in science and technology agriculture is one such occupation which hasn't shown its proper development. Most of the farmers use old classical techniques to yield as well as to cure the infected disease. The naked eye observation of experts is the most opted approach for detection of plant disease. This requires continuous monitoring of experts which turns out to be an extremely time consuming and costly process. Also farmers have to travel miles to reach experts. Most of the farmers are unaware of non-native diseases. And in most cases a disease is classified on very minute changes in the symptoms. Lack of awareness results in severe outbreak .As number of such outbreaks increase it shows it's adverse effect on country's economy. To avoid such cases there must be a process accessible to everyone and should consume less time. This paper suggests an approach which provides more accurate results related to identification as well as classification of disease the plant is infected to avoid serious circumstances. When the disease is identified more accurately there exist a better chance to reduce the loss to a possible extent. The captured image is first processed for the required changes and then converted to HSI color space format using segmentation. Then the required features are extracted. Now the image is compared to system database to identify the disease which is to be followed by a proper diagnosis.

LITERATURE REVIEW [1-5]

Basing on the necessity plant leaf disease detection has been a very essential research topic. Researchers have made their effective attempts which made improvisations to reduce duration of process , different sorts of approaches that could be made to detect the disease automatically etc...Many papers have also been published in different journals in which different attempts were made. here are some paper works and article that have been published in past 10 years.

In 2015 a paper was published in International Journal of Advanced Research in Electronic and Communication titled Detection of leaf disease using image processing which suggests a methodology based on neural networks.

In the same year an article was published in Elsevier which suggests the approach towards detection using soft computing techniques and image segmentation techniques.

In 2012 there was a paper published by IJIRSET which opted the methodology of plant leaf disease in image processing using MATLAB

In 2012 an author named P. Revathi proposed a work on HPCCDD algorithm for image analyzing and classification of diseases which reduced production loss but had limited accuracy.

In 2010 there was a study made on regularization and extraction technology for feature detection which achieved 90% accuracy to detect a fungal disease but was only constrained to focus on fungal disease.
In 2008 an article was published which opted a software prototype system for disease detection which had a very low success ratio in most cases.

Another approach system uses thresholding and propagation network. In some approaches methods were suggested to detect only specific diseases such as Leaf blast, Brown spot, Late scorch ,Cottony mold etc...In these cases though accuracy is high it is only obliged to identify the disease if it matches the disease chosen .

PROPOSED SYSTEM

There are many approaches for automatic leaf detection using image processing. This paper proposes a methodology basing upon artificial neural networks. this process involves 5 steps. Firstly a data base should be created with collection of various leaves. This collection should be huge because more the collection better the accuracy. Image acquisition, followed by Image preprocessing in which two sub processes are imbibed. Third step involves feature extraction in which required features are extracted.

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IMAGE ACQUISITION

Image acquisition is the primary step in processing of an image. Briefly it is capturing of the image by means of a corresponding device. The device which captures the image is to be chosen carefully as the entire process depends upon the image acquired. Hence the image should be clear and possess a better resolution.

Fig 1:Image acquisition

IMAGE PREPROCESSING

Preprocessing involves two steps. Primary step is to convert an image from RGB to gray. This is done using MATLAB which is a high level language for matrix calculations , numerical analysis and scientific computing.

COLOR CONVERSION

Grayscale is a range of shades of gray without any other apparent color . In grayscale the darkest possible shade is black and lightest possible shade is white.

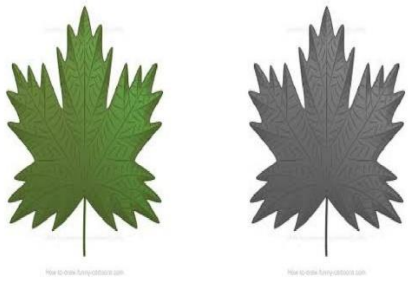

Fig 2: Color conversion

EDGE DETECTION

It is an image processing technique for finding the boundaries of objects included in the image. It works by detecting discontinuities in the brightness of image. obtained in canny operator is comparatively high. Here again MATLAB is used to detect edges.

FEATURE EXTRACTION

The image pre-processed is now passed to the further step which is feature extraction. In this the required features are obtained from the image. Features such as color , texture, shape are extracted using various mathematical relations . In this case shape can be neglected.

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COLOR

Since the color of leaf for each species of plant differ this is considered to be a good parameter.

MEAN

When a set of values have sufficiently strong central tendency i.e..a tendency to cluster around some particular value, then it may be useful to characterize the set by a few numbers that are related to its moments. Best known as mean.

$\bar{x} = \frac{1}{N}\sum_{j=1}^{N} x_j$

VARIANCE

Variance of the distribution bears the following formula

var = $\frac{1}{N-1}\sum_{j=1}^{N}(x_{j-}\bar{x})\text{^}2$

SKEWNESS

It characterizes the degree of asymmetry of a distribution around its mean.

skew = $\frac{1}{N}\sum_{j=1}^{N}[x_j - \bar{x}]\text{^}3/\sigma\text{^}3$

KURTOSIS

It is a non dimensional quantity . It measures the relative flatness of the distribution

kurt = $\left\{\frac{1}{N}\sum_{j=1}^{N}[\frac{x_{j-}\bar{x}}{\sigma}]\text{^}4\right\} - 3$

TEXTURE

ECCENTRICITY

It is the characteristic feature of all conic sections

eccentricity=$\sqrt{\left(1-(b|a)\right)^2}$

where b and are minimum and maximum axial length respectively.

CORRELATION

It returns the measure of how correlated a pixel is to its neighbor over the whole image.

correlation=$\sum(i-\mu_i)(j-\mu_j)p_{(i,j)}/\sigma_i\sigma_j$

HOMOGENEITY

Homogeneity Ranges from [0,1]

homo = $\sum|p(i,j)|\,/(1+|i-j|)$

INVERSE DIFFERENCE MOMENT

This is influenced by homogeneity of image.

IDM=$\sum 1/1 + (i-j)p(i,j)$

CLASSIFICATION

Neural networks are actually taught instead of being programmed. Neural network an be quoted as an example of artificial intelligence. Technical mode i.e.., teaching mode can be supervised or unsupervised. Neural networks learn in presence o noise. Neural computing is an information processing paradigm, inspired by biological system, composed of a large number of highly interconnected processing elements which are neurons working in unison to solve specific problems. training of a neural network means nothing but learning. It reduces the error and makes the network efficient. whether our neural network is a simple perception or a much complicated multilayer network with special activation functions, we need to develop a system procedure for determining appropriate connection weights. The general procedure is to have the network learn the appropriate weights from a representative set of a training data. ANN can be classified into several types such as K-means clustering, mountain climbing, Subtractive clustering etc.. This paper suggests the approach of k means clustering . This is because it is highly efficient compared to other approaches in classifying the scrambled data. It is also easy to compute.

K-MEANS CLUSTERING

K means clustering is a type of unsupervised learning, which is used when you have unlabeled data. The goal is to find groups in data with the number of groups represented by the variable K. It works iteratively to assign each data point to one of K groups based on features that are provided. Data points are clustered based on feature similarity. It defines K centers, one for each cluster these centers are placed in an cunning way because of different location causes different result. So the better choice is to place them as far as possible from each other. In the next step each point that belongs to the data given is taken and is associated to the nearest center. When no point is pending the first step is completed and an early groupware is has to be done between the same data set points and nearest new center. A loop has been generated . Because of this loop we can notice that K center changes it's location for each step such that no more changes are done or in other words center does not move any more. Finally it aims at minimizing an objective function known as squared error function given by:

$j(v) = \sum_{i=1}^{c}\sum_{j=1}^{c_i}(\|x_i - v_j\|)\text{^}2$

where,

$\|x_i - v_j\|$ is euclidean distance between x_i and v_j
c_i is the number of data points in i^{th} cluster.
c is the number of cluster centers.

OPERATION

There by we conclude this paper with the easiest and most reliable approach of automatic detection of a leaf disease using artificial neural networks with the approach of K-means clustering. This indeed begins the progress of modernization in the field of agriculture . This makes technology development accessible to the maximum extent especially in the areas where it is highly needed i.e., in agricultural field. As the prevention of the disease begins to have its impact qualitative outcome increases.

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