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RESEARCH ARTICLE

LEAF SPOTS DETECTION ON COTTON USING NEURAL NETWORK

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ABSTRACT

In this survey, we proposed computer aided with open source platform detection system for the leaf spot detection on cotton crop. This system plays very important role to improve outcomes in farming because it is important sector in India. Lot of peoples are depends on the cotton crop. There are many diseases on cotton crop. Due to this disease there is chance of the decrease productivity of the crop. Soour aim is to develop leaf spot detection system by using artificial neural network. Early detection of this disease can helpful for the farmer to take preventive action.

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INTRODUCTION

Agriculture is the prime livelihood of Indian farmers At present, India holds the second position in the world in agricultural production. Farmers are working like soldiers without thinking of weather it is a day or night as well as weather conditions, even though he is not getting rewards or benefits for the same. Situation of farmers in India is not well; he is struggling lot for the survival of his family. Agriculture of India is advanced to some extent but still there is lot of problems he is facing while farming his grains. Since independence population of India tripled and production is quadrupled. As cotton is one of the cash crop for indian farmers and India is among world's largest five producers of cash crops. So we have to help farmers for the better gain of this crop by preventing diseases and taking cure timely, he can earn good and will be able to fulfill needs of his family. There are different types of diseases found on cotton. Our aim is to find which type of disease on single click. There is no need to go anywhere for detection. Once, the farmer know about diseases, he can take preventing action on it.

Types of Leaf Spot Diseases

There are different types of diseases are present on cotton one of them are leaf spot. But leaf spot of cotton is divided into following three types.

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Alternaria leaf spot: Alternariamacrospora

Symptoms of. Alternaria leaf spot is given below:

- Small, pale to brown, round or irregular spots measuring 0.5 - 3 mm in diameter and cracked centers appears on the affected leaves of the plant.
- Affected leaves become dry and fall off.
- The disease may cause cankers on the stem.
- The infection spreads to the bolls and finally falls off.

Figure 1. Alternaria Leaf Spot

Cercospora leaf spot: Cercosporagossypiana

Symptom

- The disease affects older leaves of mature plants.
- The spots are round or irregular in shape yellowish brown, with purple, dark brown or blackish borders and white centres.

- Affected leaves become pale in colour and finally fall off.

Figure. 2. ***Cercospora leaf spot***

Bacterial leaf blight: Xanthomonascampestrispv. Malvacearum

Symptom

- Bacterial blight starts out as angular leaf spot with a red to brown border.
- The angular appearance is due to restriction of the lesion by fine veins of the cotton leaf. Spots on infected leaves may spread along the major leaf veins. As disease progresses, leaf petioles and stems may become infected resulting in premature defoliation. Black cankers may girdle the stem or branches causing the portions to die above the canker.
- A white waxy crust containing the bacterium may form on old leaf spots or cankers.
- Bolls may become infected causing boll rot which results in rotted seed and discoloured lint.
- Infected bolls have round, rather than angular, lesions that initially may appear water-soaked. As infection proceeds, bolls lesions will be sunken and dark brown or black.

Figure 3. Bacterial leaf blight

MATERIALS AND METHODS

This methodology uses artificial neural network and image processing techniques to find out spot on cotton leaf. We can use back propagation network to differentiate different typed of leaf spot on cotton. For back propagation network we can give input from 2D wavelet image and network will classified it as which type of leaf spot is it.

Mobile Image: The color image is captured by digital camera or mobile phone. This image is act as input image for our system.

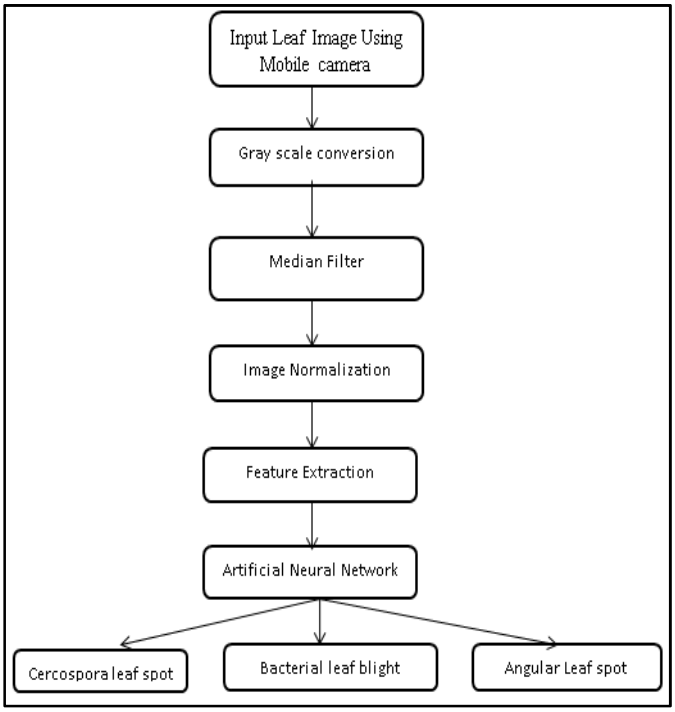

Figure 4. Proposed System

Gray scale conversion: Before pre-processing of images it is important to convert the color image intograyscale image by eliminating hue and saturation after we can perform pre-processing. The algorithm is to convert RGB values to grayscale values by forming a weighted sum of R, G and B Component:

$$I=0.2989\times R+0.5870\times G+0.1140\times B \quad (1.1)$$

Median Filter: Median filtering is used to remove noise for minimizing the influence of small structures like water bubbles. It is used to remove pepper and slat noise. The median filter considers each pixel in the image in turn and looks at its nearby neighbors to decide whether or not it is representative of its surroundings. Instead of simply replacing the pixel value with the mean of neighboring pixel values, it replaces it with the median of those values. The median is calculated by first sorting all the pixel values from the surrounding neighborhood into numerical order and then replacing the pixel being considered with the middle pixel value.

Image Normalization: In this step, we are trying to increase image clarity and obtain better performance. Normalization is a simple image enhancement technique that attempts to improve the contrast in an image by `stretching' the range of intensity values it contains to span a desired range of values.

Features Extraction: For Feature Extraction we are using 2D wavelet Transform. The Wavelet analysis aims to tell us which frequency at what time. The DWT is the decomposition of image X which creates four subbands LL, LH, HL and HH at each level s of the decomposition. Wavelet transform decomposes a signal into a set of basic functions. These basis functions are called wavelets. The upper leftmost square represents the smooth information (Lowest Frequencies) i.e. a blurred version of the image. The other squares represent detailed information (edges) in different directions (horizontal, diagonal and vertical) and at different stages. There are Mean,

Mean absolute Deviation standard Deviation, L1 norm and L2 Norm features are extracted from the wavelet image.

The mean of m bv n wavelet image is given below:

$$\text{Mean}=\frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n}X_{ij} \quad (1.2)$$

The standard deviation of m by n wavelet image is given below:

$$\text{Standard deviation}=\sqrt{\frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n}(X_{ij}-\text{mean})^2} \quad (1.3)$$

The Mean absolute deviation is a measure of dispersion, i.e. how much the values in the dataset are likely differing from their mean.

$$\text{Mean Absolute Deviation}=\frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n}\left|(X_{ij}-\text{mean})^2\right| \quad (1.4)$$

The L1 norm of matrix m by n of matrix X is defined as

$$L1=\max_{j}\sum_{i=1}^{m}|X_{ij}| \qquad \text{where,}: = 0,1,2\ldots\ldots n \quad (1.5)$$

The L1 norm of matrix m by n of matrix X is defined as

$$L2=\sqrt{\max \text{ eigen value} X^{H}X} \quad (1.6)$$

Artificial neural Network: Classifier is used for classifying different types of leaf spot diseases on cotton . Based on the computational simplicity Artificial Neural Network (ANN) based classifier is used. In this proposed system, Back propagation (BPN) Algorithm can be used for training. The neural network classifier structure consists of Input layer, Hidden layer and Output layer. In this methodology, there is one hidden layer with ten hidden neurons and Output layer with one output neuron. Activation function used is Log sigmoid function. The log sigmoid function is defined as follow:

$$f(x)=\frac{1}{1+e^{-x}} \quad (1.7)$$

It gives an output of 0 or 1 or in between that. Zero represents Cercospora leaf spot and one represents Bacterial leaf blight and in between that represent angular leaf spot. The hidden and output layer adjusts weights value based on the error output in classification. In BPN algorithm, signal flow will be in forward direction. The output of the network is compared with desired output. If both do not match, then an error signal is generated. This error is propagated backwards and weights are adjusted so as to reduce the error. In BPN, weights are initialized randomly at the beginning of training. There will be a desired output, for which the training is done. Supervisory learning is used here. During forward pass of the signal, according to the initial weights and activation function used, the network gives an output. That output is compared with desired output. If both are not same, an error occurs.

Error = Desired Output - Actual Output (1.8)

During reverse pass, the error is back-propagated and weights of hidden and output layer are adjusted. The whole process then continues until error is zero.

The network is trained with known values. After training, network can perform decision making.

Performance Evaluation

We can evaluate the performance of the system by calculatingaccuracy of the system,

$$Accuracy=\frac{Number\ of\ correct\ classification}{Total\ Number\ of\ Test\ Images}\ X100 \quad (1.8)$$

Conclusion

In this paper, weproposed diseases analyzer on the cotton, the analysis of the variousdiseases present on the cotton leaves can be effectively detected in the early stage before it will damage the whole plant. Here the technique presented can able to detect the disease more accurately. By varying the Image processing techniques and training algorithms of ANN, the accuracy can be improved for this system and the images are classified into specific types

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