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Different Techniques for Detection of Plant Leaves Diseases

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Abstract: As we know that Plant disease detection is an interesting field. Plants are the way to live. In our daily life we are completely dependent on plants. There by plants should be taken care. In most of the studies it is been shown that quality of agricultural products shall be reduced due to various components. The plant diseases are such as bacteria, viruses and fungi. The disease in plant leaf restricts the growth of the plant and also destroys its yield. Every time there is the need of expert to identify plant diseases but manual identification is expensive and also time consuming. So, automatic methods are necessary for detection of disease. Through this paper, we have presented a survey on the different methods of plant leaf disease detection.

Keywords: Disease Identification, Feature Extraction, Image Processing, Leaf Disease.

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1. Introduction

The detection and classification of plant leaf diseases correctly is the key to prevent the crop loss. Different plant leaf bears different diseases. There are a list of classifiers and different methods to detect plant leaf diseases. Methods for leaf diseases are explained as existing work in Literature Review Section.

Literature Review Section describes the basic concept of leaf diseases signs Plant leaf diseases caused by viruses are the most difficult to diagnosis. Viruses produce no indicative signs that can be readily observed and often confused with herbicide injury and nutrient deficiencies. Leaf hoppers, Aphids, whiteflies and cucumber beetles insects are common carriers of this disease, example Mosaic virus, and look for yellow or green stripes or spots on foliage, as shown in Figure 1. Leaves might be curled, wrinkled and growth may be stunted [1].

Figure 1. Viral Disease Symptoms

Plant disease diagnosis is a science as well as an art. The Viral Disease Symptoms diagnostic process (i.e. recognition of signs and symptoms), is inherently visual and requires clear judgment as well as the use of scientific methods. India is a cultivated country and about 3/4th of the population depends on agriculture. Disease on plant leads to the significant reduction in both the quantity and quality of agricultural products. The research of plant leaf disease refers to the studies of visually observable patterns on the plants. Monitoring of disease on plant plays a major role in successful cultivation of crops in the farm. In ahead of time, the monitoring and analysis of plant diseases were done manually by the expertise person in that field. This requires huge amount of work and also requires more processing time. The digital image processing techniques can be used in the plant disease detection [2].

Leaves are mainly affected by viral, bacterial fungal. A symptom of plant disease is an evident effect of disease on the plant. Symptoms may include change in color, shape or function of the plant as it responds to the pathogen. In this paper are discussing these diseases symptoms that should be keep in mind if plant growth seems low.

Pathogenic bacteria cause many serious diseases of vegetables. Bacteria do not penetrate directly into plant tissue but they will enter through wounds or natural plant openings. Wounds can out-turn from damage by other pathogens, insects and tools during operations such as pruning and picking
The disease is distinguished by tiny pale green spots which soon come into view as water- soaked. The lesions enlarge and then appear as dry dead spot as shown Figure 2.
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Figure 2. Bacterial Disease Symptoms

Plant leaf diseases, which are caused by fungus shown in Figure 3. E.g. Late blight caused by fungus. It first appears on lower, older leaves like gray- green spots, water- soaked. When fungal disease grows-up, these spots darken and then white fungal growth forms on the undersides.

Figure 3. Fungal Disease Symptoms

2. Literature Review

2.1. Comparison of Different Techniques

Khirade et al. has discussed some segmentation and feature extraction algorithm that can be used for the detection of plant diseases by using the image of their leaves. It is very hard to detect the plant diseases manually due to requirement of excessive time, knowledge of plant diseases and much

amount of work. Here author has allocates the entire process of plant leaf diseases detection into five steps: Image acquisition, Pre- processing, Segmentation, Feature extraction and Final classification of diseases. Image acquisition used the transformation structure for RGB (red, green, blue) leaf image. Then image is pre-processed to remove the disturbance and enhance the image contrast. Segmentation is done for the partitioning of image into various feature parts using Otsu filters and k- means clustering etc. This segmented image is additionally used for feature extraction and then final classification is performed using various classification techniques. Using these methods, plant diseases can be efficiently identified [3]. Sachin et al [4] has made use of feed forward back propagation Neural Network based technique for the Diagnosis and classification of diseases in grape leaf. Author has used the image s of grape leaf with complex background for the diagnosis as input. The noise of the image can be removed by further anisotropic diffusion which is further segmented using k-means clustering. Finally results are observed using neural network. Out-turns are experimented on powdery mildew and downy mildew images with simulation in MATLAB. Confusion matrix is considered with the false positive and true positive parameters for the validation of results. The author declared to have the training accuracy of 100% if used hue feature alone [5].

Kutty et al. has used the neural network based system to classify the pumpkin leaf diseases of Downey Mildew and Anthracnose. Author has calculated the true negative rate, true positive rate and overall accuracy for the efficiency of the proposed concept. This classification is based on the color feature extraction from red, green, blue color model which is obtained from the identified pixels in the region of interest. The overall performance is depicted with Receiver operating characteristic curve having AUC value of 0.5. The true classification result also depicts the value of 75% [6].

Rothe et al in his paper suggested pattern recognition techniques for the spotting and classification of cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight. The dataset images are taken from the field of Universal Institute of Cotton Research Hyderabad. The isolation of diseased spots is done by using Active contour based segmentation algorithm. Author has also suggested some feature directions to the similar concept for the crops of orange, wheat, maize and citrus etc [7].

Table 1. Comparison of Different Techniques

Techniques	Author Name	Description
K-means clustering	Sachin [4]	Discussed various plant leaf diseases & classification method.
Feed Forward Back Propagation Neural network	Sanakki et al [5]	Neural network based classification is conducted for the grape leaf diseases detection.
Neural Network	Kutty et al [6]	Neural network is used to classify watermelon leaf disease with accuracy 75%
Neuro- Fuzzy Inference System	Rothe et al [7]	Cotton leaf Diseases of Alternarnia, Myrothecium and Bacterial are detected.

2.2. Basic Concept of Leaf Disease Detection

Plant leaf disease spotting includes some basic step of image processing to spot & classify plant leaf disease. These steps are image acquisition, image pre-processing, image segmentation, feature extraction, classification and leaf disease detection.

These steps are described as below in Figure 4.

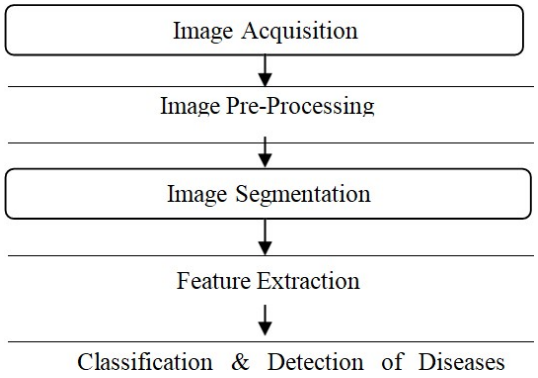

Figure 4. Basic concept of Leaf Disease Detection

1. Image Acquisition
   The first step of any image system is the image acquisition. Image acquisition involves the steps to obtain the plant leaf and captured the high quality pictures through the good camera. Images are acquired from the agriculture field or internet (websites). The efficiency of the result depends upon the standard of database images. This image is in RGB form
2. Image Pre-Processing
   Image pre-processing involves the steps of RGB, image enhance to filtering, Lab conversion etc. Here, image enhancement is carried out for enlarge the contrast. Filtering techniques are used for image smoothing. There are different types of filtering techniques available in image processing like average filter, median filter, Gaussian filter etc.
3. Image Segmentation
   Image segmentation means partitioning of image into different parts of having some similarity or same feature. The segmentation can be done using various methods like k-means clustering, Otsu' method converting red, green, blue image into HIS model etc. The K-means clustering is used for differentiation of object based on a set of features into K number of classes. The classification of object is done by minimizing the sum of the squares of the distance between the object and the relative cluster.
4. Feature Extraction
   Feature extraction plays an important role for identification of an objects. After performing the image segmentation, the disease portion from the image is extracted. In many applications of image processing feature extraction is used. Textures, shape, Color, edges, morphology are the features which can be used in plant disease detection. Color features are obtained by various methods, such as Color moments, Color histogram and Color structure descriptor. GLCM (Grey Level Co-occurrence Matrix) method is used for extraction of texture features [8] [9].
5. Classification and Detection of Diseases
   At last, classifiers are used for the training and testing of the datasets. These classifiers may be support vector machine (SVM), k-nearest neighbor, neural network, fuzzy logic based etc. These methods are used to classify and detect the leaf diseases

4. Proposed Method

The proposed approach includes the three major stages namely: Data Acquisition, Data Pre-processing and Classification. Flow diagram is shown in Figure 5 and current section includes the brief discussions of the same.

1. Data Acquisition
   The leaf disease images have been taken from the internet or agricultural fields [10]. Python script is used download the images of diseased leaves. The acquired dataset consists of around 15000 images belonging to different classes [11] [12] [13]. Each of the downloaded images

belongs to the red, green, blue color space by default and were stored in the uncompressed JPG format.

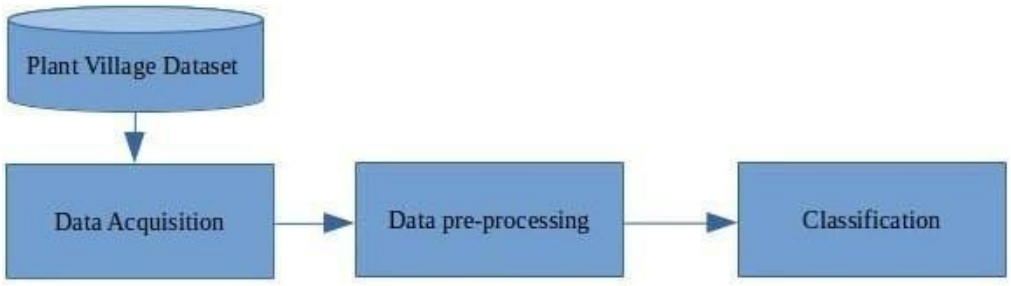

Figure 5. Proposed Methodology

2. Data pre-processing
   The acquired dataset consisted of images with less noise and hence noise removal was not a needed pre- processing step. The images in the dataset were resized to 80*80 resolution in order to speed up the training process and make the model training computationally feasible [14]. The process of make consistent either the input or target variables tends to fasten the training process [15]. This is done through development of the numerical condition of the optimization problem.
3. Classification
   Convolutional neural networks can be used for the creation of a computational model that works on the unstructured image inputs and converts them to corresponding different output labels [13] [16]. They belong to the category of multi-layer neural networks which can be trained to learn the need features for classification purposes. They require less pre- processing in comparison to sets which belongs to different distributions.

4. Conclusion

In this paper, we have generally discussed various methods for the identification and classification of plant leaf diseases like pattern recognition method, back propagation, neural network, support vector machine etc. Thus, the above-mentioned methods can be made use of as a decision tool to help and support farmers in identifying the diseases that can be found in the plant. With an accuracy of 94-95% the methodology proposed can make an accurate detection of the leaf diseases with little computational effort. We have also discussed the basic concept of plant leaf disease detection and various leaf diseases symptoms

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