Plant Leaf Disease classification using Image processing Technique

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***Abstract*: Indian economy is highly depend on the agricultural products. Therefore detecting disease of plants at the earlier stage plays important role. To detect diseases, requires enormous amount of work, mastery in the leaf diseases, and additionally need the extreme amount of time. Image processing is a diverging area where researches and advancements are taking a geometrical progress in the agricultural field. Identification of plant diseases can not only maximize the yield production but also can be supportive for varied types of agricultural practices. Plant leaf disease detection and identification includes the stages like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper discusses techniques for image pre-processing, image segmentation algorithm used for automatic recognition and research on various plant leaf disease classification algorithms that may be used for leaves disease classification.**

Introduction

India is one of the developing countries wherein majority of population of country is depends on agriculture and agricultural production. Studies show that the plant leaf disease reduces the quality and quantity of agricultural products. Plant disease detection in simply naked eye by experts through observation is done [14]. For doing so, a large team of experts as well as continuous monitoring of experts is required, which costs very high when farms are large [1].In some countries formers don't have the idea regarding plan diseases so that they consult experts. Consulting experts cause high expenses along with that time.

However, diseases are important cause for the reduction of agronomics in India. Farmers are faces several problems for control the diseases on crops. Detecting the disease is the important part in the agriculture field. And automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper.In plants some general diseases are brown and yellow spots or early and late scorch and other fungal,viral and bacterial diseases.Image processing is the technique which is used for measuring affected area of disease, and to determine the difference in the color of the affected area. The present Decision Support Systems (DSS) are establish on call center need that the farmers have to convey details about plant leaf through orally[7] . DSS based on image processing can be useful to improve the production of agriculture.

In this work, we propose the system which concentrates on disease recognition and classification through image processing which helpful for decision making.

Literature survey

Wan MohdFadzil et al. [ ], discussed a disease detection method for orchid plant leaves. The orchid plant leaflet images are received the usage of digital camera. The algorithm makes use of an aggregate of various strategies inclusive of border segmentation method, morphological processing and filtering technique used for categorizing input images into two disease class as black leaf spot and solar scorch.

Chaitali G. Dhaware, Mrs. K.H. Wanjale et al. [ ], discussed a disease detection method for plant leaves using image processing. The images are taken with the use of mobile camera which have minimum 2 megapixels and above resolution.The proposed system consists of four main phases are preprocessing, segmentation, feature extraction and classification.

Rong Zhou et al. [], explained method for resilient and advance identify of leaflet patch in sugar beet. For capturing images, Nikon photographic camera was used that was mounted on a stand to stay constant distance. The author used white background whereas capturing images to avoid the additional complications in process. The method implements hybrid methods of guide matching and support vector machine. This technique usage color primarily forms options 978-1-4673-8855- for segmentation, orientation code matching and support vector machine classifier for final malady classification.

YouwenTian ,Lin Zhang et al. [ ], explained Study methods of detecting cucumber downy mildew using Hyperspectral imaging technology. Hyperspectral imaging technology has been widely applied in the quality nondestructive detection of the agricultural and livestock products.Hyperspectral image data is collected by the hyperspectral imaging system based on the spectrometer which is made of a high-spectral camera (ImSpector, V10E, Finland) based on spectrometer, a fiber halogen light of 150w (DC-950A,

Dolan-JennerCo., USA), a set of high-precision delivery device (Beijing ZhuoliHanguang Instrument Co., Ltd.), a high-performance computers and so on.

Vijai Singh, Varsha,Prof. A K Misra et al. [ ], explained detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm. Using digital camera image of the leaf is taken. After capturing the image,images are processed using image processing technique to get the feature so that it will help for analyzing. Genetic algorithms are evolutionary algorithms which provides the optimization solution for the problems. Set of solutions are provided by the algorithms known by population. Here solution from one population is used to form new population.

Methodology

The proposed approach comprises of four fundamental stages: Image acquisition of plant leaf images, pre-processing of images, image segmentation, feature extraction and classification of images in different disease classes. The following fig. shows the general flow of system. The images of the leves taken by digital camera of which the area is affected. Then to process those images, various image-processing techniques are applied on them to get different and useful features required for later analyzing purpose[1].

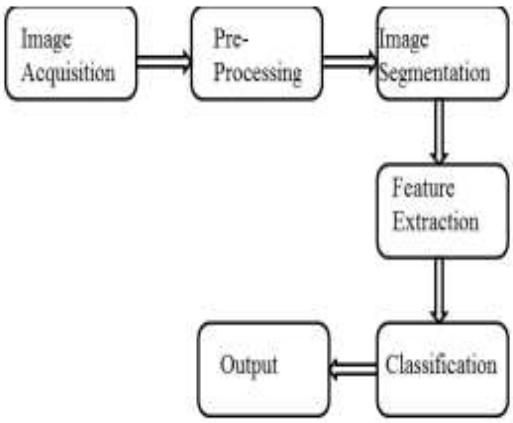

Fig. Flow of system

1. Image Acquisition

Image Acquisition is Digital image Processing. It is defined as the action of retrieving an image from some source, foe processing. It is the first step in the workflow sequence because without the image no processing is possible.

Here the leaf image is obtained by mobile camera which have minimum 2mega pixel and above resolution. The dataset have two types of classes firstly healthy leaf images and secondly infected leaf images which have disease wise sub classes [1].

2. Image Pre-processing

Image processing is a method to convert into digital form and perform some operation on it, in order to get some enhanced image. The image captured may be of different forms and of various dimensions hence the images are preprocessed [3]. The primary pre-processing stage is to resize the given input image. The initial size of image is large that occupy longer for process time. Therefore, each image is converting into 512 X 512 sizes to evade prolonged [1].

3. Image Segmentation

Process of separating or grouping of images of different parts is known as image segmentation. Segmentation is morphological operations. Morphological operations are some simple operations based on the image shape [13]. It is normally performed on binary images. Two basic morphological operators are Erosion and Dilation. Segmentation of image is applied for background subtraction. Two main techniques are mainly used for background subtraction: cluster based and color based [1]. Cluster subtraction gives better result than color based subtraction. Color spacing is the main concept which is used here there is color point is divided by three color components that is **red()**, **green ()**, and **blue ()**.

A collection of object is known as **clusters**. In which "similar" object between them and "dissimilar" are blegongs to the other cluster.

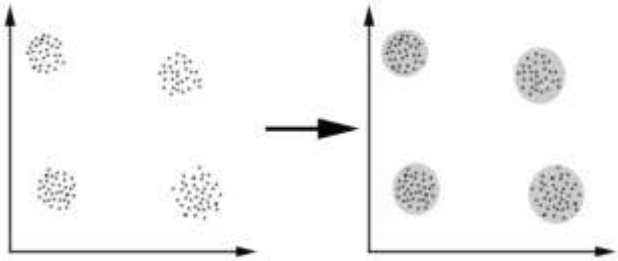

Fig 2 Cluster based segmentation

In this method the 4 clusters are identified easily using this data can be divided; the **distance** is the similarity property: Two or more object are close according to the given distance then those objects belongs to the same cluster. This is called **distance-based clustering**.

Conceptual clustering: The objects of two or more which are belongs to the same cluster in which one defines the common property of all. In other words, objects are grouped according to their fit to descriptive concepts, not according to simple similarity measures.

4. Classification

After segmentation next stage is extracting the features of an image. There are several of approaches that are used for image classification. A number of the strategies are principal component analysis (PCA), fuzzy logic, K-nearest neighbor (KNN), support vector machine (SVM), artificial neural network (ANN), neuro-fuzzy interference system, etc[1]. Here we discuss three methods they are Support vector machine, K-nearest neigbor, Fuzzy logic.

One of the best methodology with high accurate result is given by Support Vector Machine. Previously like in past pixel based image classifier is supported by support vector machine. Now a days a advancements is taken in this field .Advances such as remote sensing in Object Based Image Analysis (OBIA) with combination of high level and low level computer vision techniques. Compare to pixel based techniques with object based analysis feature of the images significantly increases. Increased complexity of the classification process results, and causes problems to traditional classification schemes. The objective of this study was to evaluate SVMs for their effectiveness and prospects for object-based image analysis as a modern computational intelligence method. Here, an SVM approach for multi-class classification was followed, based on primitive image objects provided by a multi-resolution segmentation algorithm. Next step is feature selection, which provides the information of the spectral, shape and texture.

In SVM classification, assume that the training data (xi,yi) for i=1,2,……N and , where N is the sample number for class C1 and for class C2.

Finding minimum one hyperplane, v is vector and b is bias,

$Yi(v.xi+b)>0$ where $i=1,2,\ldots N$ (1)

The values of v and b are rescaled such that,

$Yi(v.xi+b)>=1$ where $i=1,2,\ldots N$

i.e. the distance between the hyperplane and a point class to 1/[v]equation (1) can be,

$Yi(v.xi+b)>=1$ (2)

This technique creates the hyperplanes in high dimensional space for categories the datapoints into different classes. Support vector machine is does the classification by detecting the perfect hyperplane which differentiates the datum of different categories [1].

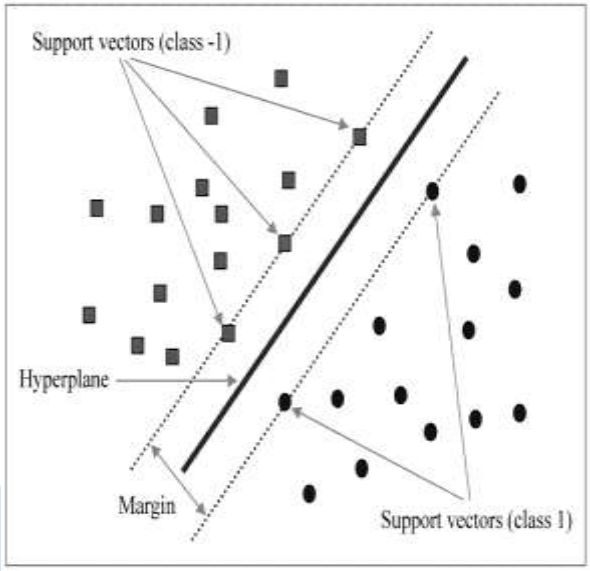

Fig optimal hyperpane support vector machine

KNN: K-nearest neighbor is very simple algorithm. In KNN method classifies images with using nearest distance between trained dataset and testing dataset [1]. After we gather K nearest neighbors, then we take majority of these k nearest neighbors to be the prediction instance. The data of KNN may be measurement scale from ordinal, nominal [15]. Here the drawback is predicting the K value.

Fuzzy Logic: In Fuzzy image processing techniques is consists of all the approaches, that understands the images and process it, their features and segments in to fuzzy sets.

Fig The general structure of Fuzzy logic

There are three steps in Fuzzy image processing:

I. IMAGE FUZZIFICATION

II. MODIFICATION OF MEMBER VALUES

III. IMAGE DEFUZZIFICATION(IF NECESSARY)

Image data are coded is fuzzification and decoding of the results is known as defuzzification. For edge detection in digital images Fuzzy logic reasoning strategy is proposed. Digital images of without determining threshold value.

Conclusion

A method focus on image processing is applied for automatic leaf unhealthiness classification which establish on leaf image processing. With less and computational efforts will get best and accurate results. One more advantage of this method is that at early stage or the initial stage the plant leaf disease is identified. The farmer most effective require to seize the image of the plant leaf the usage of mobile camera and forward it to the DSS, without any additional inputs.

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