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Plant Leaf Disease Detection Based on Image Processing Using MATLAB

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ABSTRACT: India is an agricultural country. About 70% of Indian economy depends upon agriculture. The plant leaf diseases are effecting the productivity ,quality and efficiency of the plants, thus effecting the growth of the country. To overcome this plant leaf diseases must be recognized during initial stages. The proposed scheme is based on the image processing technique using matlab. Earlier linear support vector machine was used to identify single diseases . Our proposed algorithm uses multi support vector machine that identifies many diseases and there by increasing the efficiency and productivity of the plants.

KEYWORDS: Support vector machine; plant leaf disease; productivity and quality; matlab; image processing.

I. INTRODUCTION

India is the land of agriculture. Farmers have an option to select required crops and then find appropriate pesticides for the plant to decrease the disease and increase the production. The cultivated plants will not always be healthy. In-order to increase the production with good quality the plant need to be monitored frequently because the plant disease leads to reduction of the product. For successful cultivation, one should monitor the health as well as the disease of the plant. Diseases in plant cause heavy loss of the product.

India is the world's highest producer of pomegranate. India exports 54000 tons of Pomegranate which makes 1.55% of total export in the whole world. Pomegranate is avital fruit crop, because of its health benefits.10-31% of production reduces because of the disease found on the leaf of the pomegranate plant. Hence the disease need to be identified at the early stages, recommending farmers to avoid the harm in production of the crop to increase the yield.

Plants suffers from leaf diseases like: Alternaria Alternata (fungal), Anthracnose, Bacterial Blight (bacteria), and Cercospora Leaf Spot. Plant disease will be basically identified by observing different patterns on the parts of the plant like leaf, fruit and stem. The indications on the leaf is taken into consideration for detecting the disease.

In ancient days, the expertise person would manually monitor and analyze the plant disease that involved huge work and also was time consuming. Image processing is one such technique that is used to detect the disease in plant. There are few countries where farmers are not having enough facilities to contact the expertise since it is time consuming and at the high cost. In such situation, image processing technique comes into picture and is beneficial in monitoring the field. The symptoms on the leaves will help in automatically detecting the disease, which is easy and also cheap. Image processing is a technique that measures the affected area of disease, determines the texture, color and shape of the affected area, and also classifies the disease.

The disease can be categorized as bacterial, viral, fungal etc. The proposed work emphasizes on identifying and categorizing the disease like Alternaria Alternata, Anthracnose, Bacterial Blight, and Cercospora Leaf Spot which are basically found on pomegranate, rice, soya bean, carrot, rose, watermelon, mango etc., using the technique called as image processing.

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It automatically detects plant leaf diseases. This system will provide fast, spontaneous, precise and very economical method in detecting and classifying leaf diseases.

II. RELATED WORK

In [1] author proposes different technologies of leaf disease detection using image processing approach and classified them based on the type of analysis tool and applications. Less time consuming and automatic diagnosis is the major requirement in agriculture to improve the crop production rate. Leaf colour ,size and texture changes with climate and environment conditions. The field expert and regular observations are required well in time. The scope of development of hybrid algorithms such as genetic algorithms, cuckoo optimizations and ant colony etc in order to increase the recognition rate of the final classification process.

In [2] the author is used for testing vineyard diseases based on photographs with grape leaves. A success rate higher than 90% has been achieved in the disease recognition process. The following lesion features: number of spots, their grey level, and area and then extracts a histogram indicating the number of pixels that have specific red, green or blue color level. It is assumed that the background is much brighter than the plant color in the present application version in order to avoid complicated and time consuming background separation technique. It analysis the color features of the spots in plant parts. It was evaluated on grape diseases with an accuracy that exceed 90% using small training set. The recognition of disease can often be based on symptoms like lesions and spots in various parts of plants. The color , area and the number of these spots can determine to great extent the disease that has mortified a plant.

In [3] the main objective is to diagnose the disease of brinjal leaf using image processing and artificial neural techniques. The diseases on the brinjal are critical issue which makes the sharp decrease in the production of brinjal. The study of interest is the leaf rather than the whole brinjal plant because about 85 to 95% of diseases occurred on the brinjal leaf like bacterial wilt, cercospora leaf spot tobacco mosaic virus. The leaf spot disease is considered in this work and it is possible to identify the disease using k-means clustering algorithm and ANN. Various parameters are computed as area, perimeter, centroid, diameter and mean intensity for identifying brinjal diseases.

In [4] author discribes visual symptoms of plant disease from analysis of colored images using image processing methods that has been proposed. Color co-occurance for feature extraction is also proven to be helpful in many of plant disease detection based on color and texture. It is useful to benefit oil palm industry demands. High end image capturing device has been used to capture images of leaf surface followed by extraction of features like shape color and texture of disease types. K-means clustering to detect infected object and neural networks are thus commonly used for obtaining accuracy in detecting and classifying the diseases. Image processing provides more efficient ways to detect diseases caused by fungus, bacteria or virus on plants. It presents an overview of using image processing methods to detect various plant diseases.

In [5] the proposed algorithm is tested on main five types of plant diseases like Ashen Mold, Early Scorch, Cottony mold, late scorch tiny whiteness. The computer can automatically classify 32kinds of plants from the leaf images loaded from digital cameras or scanners. Probabilistic Neural Network (PNN) is adopted for it has fast speed on training and simple structure. Detect the symptoms of the disease occurred in leaves in an accurate way. The symptoms are identified in the initial stage and classified them using the k-means algorthim and thus increases the recognition rate. Here test our program on five disease which effect on the plants they are early, scorch, cottony mold, ashen mold, late scorch, tiny whiteness.

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III. PROPOSED ALGORITHM

A. *Design Considerations:*

- Start with images of which classes are known for sure.
- Find the property set or feature set for each of them and then label suitably.
- Take the next image as input and find features of this one as new input.
- Implement the binary SVM to multiclass SVM procedure.
- Train SVM using kernel function of choice. The output will contain the SVM structure and information of support vectors, bias value etc.
- Find the class of the input image.
- Depending on the outcome species, the label to the next image is given. Add the features set to database.
- Steps 3 to 7 are repeated for all the images that are to be used as database.
- Testing procedure consists of steps 3 to 6 of the training procedure. The outcome species is the class of the input image.
- To find the accuracy of the system or the SVM in this case random set of inputs are chosen for training and testing from the database.
- Two different sets for train and test are generated. The steps for training and testing are same, however followed by test is performance.

B. *Description of the Proposed Algorithm:*

The binary classifier which makes use of the hyper-plane which is also called as the decision boundary between two of the classes is called as Support Vector machine (SVM). Some of the problems of pattern recognition like texture classification makes use of SVM. Mapping of non-linear input data to the linear data provides good classification in high dimensional space in SVM. The marginal distance is maximized between different classes by SVM. Different kernels are used to divide the classes. SVM is basically binary classifier which determines the hyper plane in dividing two classes. The boundary is maximized between the hyper plane and the two classes. The samples that are nearest to the margin will be selected in determining the hyper plane are called as support vectors.

Fig 1 below shows the concept of support vector machine. Multiclass classification is also possible either by using one-to-one or one-to-many. The highest output function will be determined as the winning class.

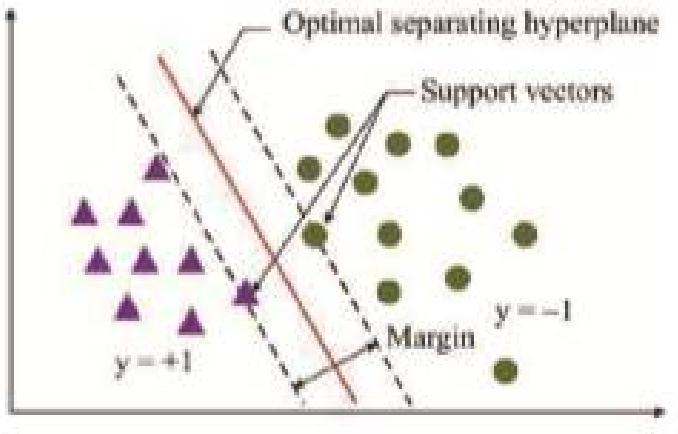

Figure 1: Linear SVM

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Main advantages of SVM are:

1) Accuracy prediction is high.
2) Robust, if there are error in the training examples.
3) It is a geometric interpretation with a sparse solution.
4) The complexity of computation of SVM doesn't depend on dimensions of the input space unlike neural networks.

Shortcomings of SVM are:

1) This classifier involves long training time.
2) Weights (learned function) is difficult to understand in SVM

Classification is performed by considering larger number of support vectors of the training samples. The standard form of SVM was intended for two-class problems. However, in real life situations it is often necessary to separate more than two classes at the same time. In this Section, we explore how SVM can be extended from binary problems to multi classification problems with k classes where k > 2. There are two approaches, namely the one-against-one approach and the one-against-all approach.
In fact, multi-class SVM converts the data set to quite a few binary problems. For example, In one-to-one approach binary SVM is trained for every two classes of data to construct a decision function. Hence there are k (k−1)/2 decision functions for k-class problem. Suppose k = 15, 105binary classifiers need to be trained. This suggests large training times. In the classification stage, a voting strategy is used where the testing point is designated to be in a class having the maximum number of votes. The voting approach is called the "Max Wins" strategy.
In one-against-all approach, there will be one binary SVM for each of the class to isolate the members of one class from the other class.

IV. SIMULATION RESULTS

To have a closer look at the results and interim outcomes of this project/work varieties of inputs are necessary. Some of the variations in same class images are to be observed. To begin, input image is read and displayed. Select the load image option which allows to select the image for further processing.

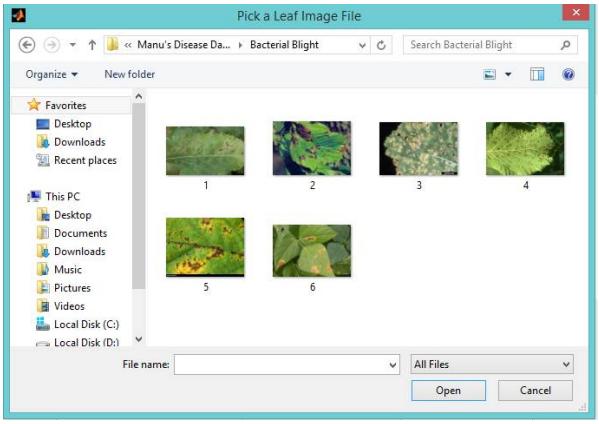

Fig.1. Select the input image

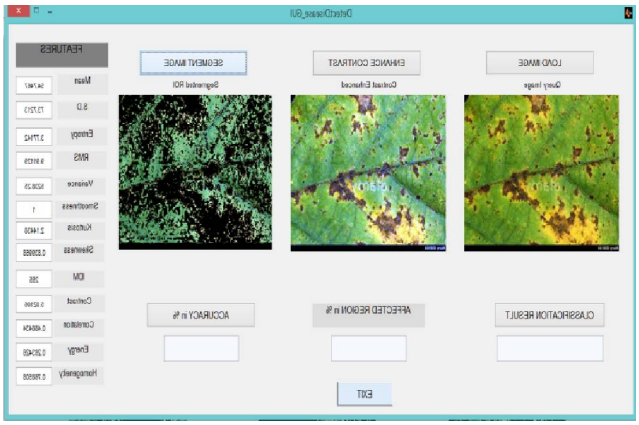

Fig. 2. Displaying the segmented image

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Fig. 3. Detected Bacterial Blight disease

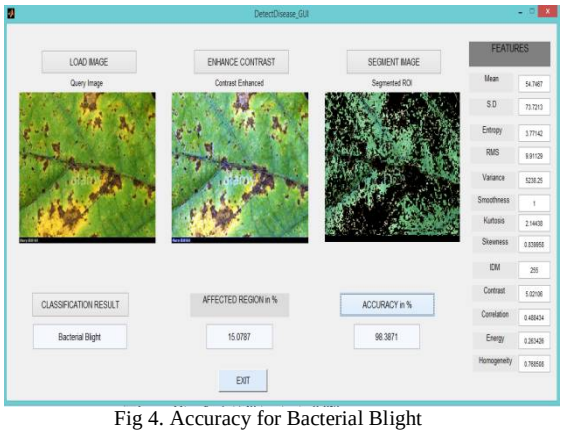

Fig 4. Accuracy for Bacterial Blight

V. CONCLUSION AND FUTURE WORK

The world is moving more towards technology dependent era. Every day we keep hearing owes of farmers that even after using costly fertilizers the leaves were eaten away by various diseases. One of the most sensitive and costly treatment in India in terms of leaf concerned is that of pomegranate. The expertise in this field is rarely available. Since the opinion of an expert can vary from that of novice, for the benefit of all it is advisory to make the most use of the technology available to infer or conclude for treatments. The machine learning methods bring this aspect to reality, by observing the database and helping the botanists in diagnosis of diseases where lot of precision is required. And one of the machine learning technique, SVM is used in this project for classification of leaf diseases. The accuracy results available range from mid-90 to top 90 percent. This can be bettered by increasing the database. However the results obtained from real life images are very encouraging.

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