Leaf Disease Detection Using Image Processing

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Abstract— India is fast developing country and agriculture is the back bone for the countries development in the early stages. Due to industrialization and globalization concepts the field is facing hurdles. On top of that the awareness and the necessity of the cultivation need to be instilled in the minds of the younger generation. Now a day's technology plays vital role in all the fields but till today we are using some old methodologies in agriculture. Identifying plant disease wrongly leads to huge loss of yield, time, money and quality of product. Identifying the condition of plant plays an important role for successful cultivation. In olden days identification is done manually by the experienced people but due to the so many environmental changes the prediction is becoming tough. So we can use image processing techniques for identification of plant disease. Generally we can observe the symptoms of disease on leafs, stems, flowers etc. so here we use leafs for identification of disease affected plants.

Keywords: Image Processing, Leaf Disease, SVM, Matlab, Feature Extraction

I. INTRODUCTION

India is a cultivated country, where 70% of Indian population is relay on agriculture. Agriculture sector plays a strategic role in the process of economic development of the country. Therefore in field of agriculture, detection of disease in plants plays a very important role. Identification of disease is extremely tough in agriculture field. If identification is inaccurate then there's a huge loss on the production of crop and economical value of market. Leaf disease detection requires huge amount of work, knowledge in the plant disease, and also require the more processing time. The existing technique for plant disease detection is simply naked eye observation by specialists through which identification and detection of plant disease is completed. For doing thus, a large team of experts as well as continuous monitoring of plant is required, which costs extremely high when we do with large farms. In such conditions we can use image processing for identification on leaf disease in MATLAB. Image processing is used for measuring affected area of disease and to see the difference in the color of the affected area. The aim of the project is to identify and classify the disease accurately from the leaf pictures.

A. Challenges of image processing:

Some challenges for image processing system researchers and developers are as follows;

- To identify the affected area of leaf, the images of various leaves are taken as predefined database.
- Shape, size, and texture of every leaf image tested by feature extraction.
- Segmentation is done by using k-means clustering method for leaf disease detection.
- To classify the affected region of leaf, SVM classifier and artificial neural networks are used.

B. Plant disease analysis:

In most of the cases, symptoms of the disease in plants are seen on the stem, fruit and leaves. In the present work, symptoms of plant leaf have been considered for the detection of disease. In plants leafs, brown and yellow spots are common symptoms for general diseases. Early and late scorch, viral, bacterial and other fungal diseases are also generally found in plants. In the proposed work, some of the common diseases, from which plants are influenced, have been considered. Some of the diseases on plant leaves are shown below in figure.

Fig. 1.1: Frog eye leaf spot

Fig. 1.2: Ash rust

Fig. 1.3: Fungal disease

Fig. 1.4: Sun burn disease

In the field of production, plant disease is a significant factor that degrades the eminence and quantity of the plants. The analogical approach followed in plant diseases are the classification and detection model. Both the classification and detection model are comprehensively studied by the Engineering and IT fields.

II. PROPOSED METHOD:

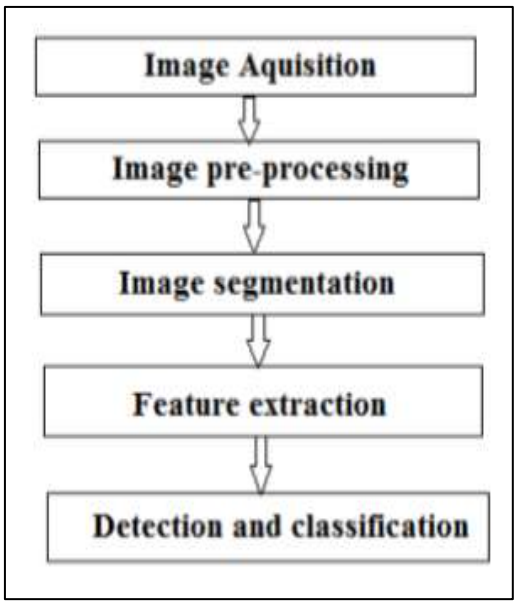

Fig. 2.1: Leaf disease detection system

A. Image acquisition:

It refers to acquiring an image by means of camera of a leaf. Image of a leaf can be taken as pre-defined database image.

B. Image pre-processing:

Once an image has been acquired, pre-processing algorithms can be applied to improve the image quality, for example to highlight important features or to remove noise. Preprocessing of input image is used to improve the quality of image and to remove the undesired distortion from the image. Clipping of the leaf image is performed to get the interested image region and then image smoothing is done using the smoothing filter. To enhance the contrast Image enhancement is also completed. Image pre-process tasks are the initial stage before feature extraction. There are three steps of image preprocessing processing, i.e., image cropping, image converting and image enhancement. The image is cropped on leaf diseases area, and converted to gray levels. To enhance the image we used Laplacian filter. Image enhancement is used to highlight the certain feature present in that image. Advanced image enhancement technique is used to improve the accuracy of operation. It is also used to uniformly distribute to the intensity value.

C. Image Segmentation:

In image Segmentation an image is partitioned into various parts of same features or having some similarity. The segmentation can be completed using various methods like Otsu‟ method, k-means clustering, converting RGB image into HIS model etc. Image segmentation is one of the most important precursors for disease detection and has a crucial impact on the overall performance of the developed systems.

D. Feature extraction:

Feature extraction plays an important role for classification of an image. In many applications feature extraction of image is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease classification, texture means how the color is distributed in the image, the roughness, hardness of the image. In this paper considers color, texture and morphology as a feature for disease detection.

E. Detection and Classification:

In this phase of classification, extraction and comparison of the co-occurrence features for the leaves with the corresponding feature values are stored in the feature dataset. First, the Minimum Distance Criterion and then SVM classifier are used to done the classification. Image classification is one of the most difficult steps in image processing and also it is an important process in pattern recognition. For classification phase, different kind of machine learning techniques is used to assign a class to a set of unclassified data. In pattern recognition, the percentage of accuracy was described by the classification process.

1) Support vector machine:

They were enormously popular around the time they were developed in the 1990s and continue to be the go-to method for a high-performing algorithm. Support vector machine is a group of supervised learning models with associated learning algorithms that analyses data used for detection and

regression analysis in machine learning. When data are not labeled supervised learning is not possible. It constructs a hyper lane and a set of hyper lane which in a high and infinite dimensional space, which can be used for other task like outlier detection. Support vector machine is based on finding the hyper lane that gives the largest minimum distance to the training.

The advantages of support vector machine are:

- It is effective in high dimensional spaces.
- And Still effective in cases where number of dimensions is greater than the number of samples.
- It is also memory efficient.
- Versatile.

The disadvantages of support vector machines are:

- If the number of features is much greater than the number of sample, avoid overfitting.
- SVMs do not directly provide probability estimates.

Support vector machine (SVM) analyses the data after that it classify that data and then the regression is done. Two main parameters accuracy and detection of time, in these two the disease is detect. The experiments on leaf images with three common diseases proved the satisfactory performance of our method in terms automation, accuracy and efficiency. Segmentation will assist in following processes (such as feature extraction and identification) for disease detection and analysis of leaf. Support vector machines (SVM) increase the recognition rate.

2) Neural networks:

The disease detection techniques are based on two main neural network technologies: Self- Organizing map and multilayer perception's (the most widely used architecture). Neural network is a system of hardware or software patterned after the operation of neurons in the human brain. Neural network also called artificial neural network.

3) K-Nearest Neighbour (KNN):

The K-Nearest Neighbour is a kind of classifier which can train and test data at the same time. K-NN classifier is instance based classified that performs classification of unknown instances by relating unknown to known by using distance or similarities function. It takes K nearest point and then assigns a class of majorities to the unknown instance.

F. Leaf disease identification:

The original leaf images were processed in the form of predefined database by using Matlab. Feature parameters of color, shape and texture were extracted from each segmented image, respectively. Usually, the largest proportion of classification features indicates the largest contribution in detection. In fact, it does not mean that more features are better. Too many features may degrade the effectiveness of the disease detection algorithm. Among all the features, some features may not contribute meaningful information to the disease recognition algorithm; even some features may actually reduce the quality and accuracy of the detection algorithm, and some features have little or no effect on the detection. Therefore, selecting the most significant features is a very important step in the leaf disease detection task. When the optimal feature subset obtained, the diseases can be recognized by SVM.

III. RESULT

Fig. 3.1: Selected leaf image

Fig. 3.2: Enhance image contrast

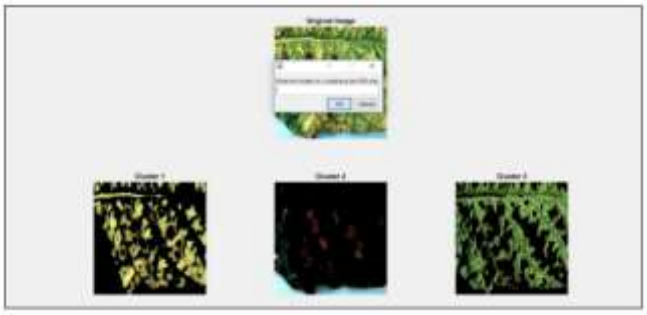

Fig. 3.3: Image clustering

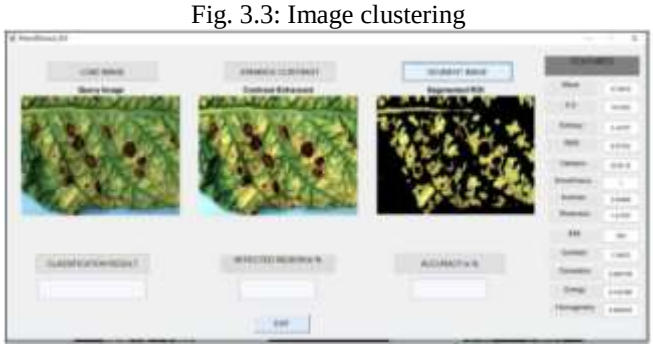

Fig. 3.4: Feature extraction

Fig. 3.5: Classification and affected region

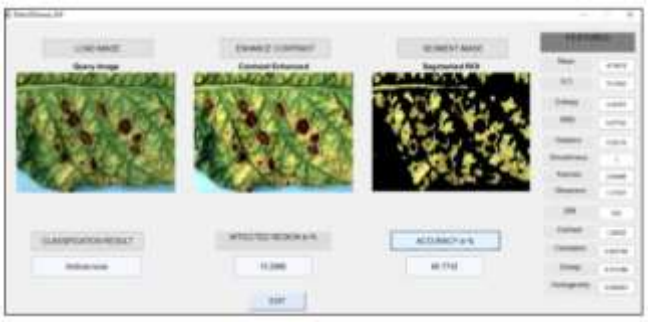

Fig. 3.6: Accuracy

IV. CONCLUSION

This project presents the better feature extraction technique for plant leaf disease detection using image processing. There are many methods in automated or computer vision for disease detection and classification but still there is lack in the research topic. All the disease can't be identified using single technique. From study of above classification techniques we tend to come up with following conclusion. The k-nearest neighbor method is probably the simplest of all algorithms for predicting the class of a test example. An obvious disadvantage of the kNN method is the time complexity of creating predictions. Additionally, neural networks are tolerant to noisy inputs. But in neural network it's tough to understand structure of algorithm. SVM was found competitive with the best available machine learning algorithm in classifying high-dimensional data sets.

REFERENCES:

[1] Anand R, Veni S et al. [2016], "An Application of image processing techniques for Detection of Diseases on Brinjal Leaves Using K-Means Clustering Method" Fifth International Conference On Recent Trends In Information Technology.

[2] N.Krithika et al. [2017], "An Individual Grape Leaf Disease Identification Using Leaf Skeletons and KNN Classification" International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS).

[3] G.P. Saraswathy et al. [2017], "Detection of Leaf Diseases and Classification using Digital Image Processing" International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS).

[4] Arti N. Rathod et al. [2014], " Leaf Disease Detection Using Image Processing And Neural Network" International Journal of Advance Engineer ing and Research Development (IJAERD) Volume 1,Issue 6,June 2014, e-ISSN: 2348 - 4470 , printISSN:2348-6406.

[5] Hrishikesh P. Kanjalkar [2014], "Feature Extraction of Leaf Diseases" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3, Issue 1, January 2014.

[6] Sachin B. Jagtap et al. [2014], "Agricultural Plant Leaf Disease Detection and Diagnosis Using Image Processing Based on Morphological Feature Extraction" IOSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 4, Issue 5, Ver. I (Sep-Oct. 2014), PP 24-30 e-ISSN: 2319 – 4200, p-ISSN No. : 2319 – 4197.

[7] Pranita P. Gulve et al. [2015], "Leaf Disease Detection of Cotton Plant Using Image Processing Techniques" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.

[8] Priya P. et al. [2015], "Study of Feature Extraction Techniques for the Detection of Diseases of Agricultural Products" National Conference on Advanced Innovation in Engineering and Technology (NCAIET-2015),Vol. 3, Special Issue 1, April 2015.

[9] R. N.kadu et al. [2015], " Leaf Disease Detection Using Arm7 and Image Processing" Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 5, Issue 2, (Part -1) February 2015.J.Jeya

[10] J.Jeya Priyankha et al. [2017], "Crop Disease Identification Using a Feature Extraction HOG Algorithm" Asian Journal of Applied Science and Technology (AJAST) Volume 1, Issue 3, Pages 35-39, April 2017.

[11] K. Narsimha Reddy et al. [2017], "A Literature Survey: Plant Leaf Diseases Detection Using Image Processing Techniques" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834, p- ISSN: 2278-8735.Volume 12, Issue 3, Ver. II (May - June 2017).

[12] Malti K. Singh et al. [2017], "Detection and Classification of Plant Leaf Diseases in Image Processing using MATLAB" International Journal of Life Sciences Research ISSN 2348-3148, Vol. 5, Issue 4, pp: (120-124), October - December 2017.

[13] Dixit Ekta Gajanan et al. [2018], "Android Based Plant Disease Identification System Using Feature Extraction Technique" International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 05 Issue: 01, Jan2018.

[14] Saradhambal.G et al. [2018], "Plant Disease Detection and Its Solution Using Image Classification" International Journal of Pure and Applied Mathematics, Volume 119 No. 14 2018, 879-884, ISSN: 1314-3395.

[15] Varsha Sawarkar et al. [2018], "A Review: Rose Plant Disease Detection Using Image Processing" IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, pISSN: 2278-8727, Volume 20, Issue 4, Ver. III (Jul - Aug 2018)

