A Comparative Study on Various Plant Leaf Diseases Detection and Classification

Sonal P Patel.
RSR Rungta College of Engineering and technology
Dept. of Computer Science and Engineering
Bhilai, Chhattisgarh, India
patelbhavika028@gmail.com

Mr. Arun Kumar Dewangan
GD Rungta College of Engineering and Technology
Dept. of Computer Science and Engineering
Bhilai, Chhattisgarh, India
arun.dewangan@gmail.com

Abstract

When plants are affected by the diseases, it may affect the production as well as the economy of the country. In order to find out which disease affect the plants, the farmer need to contact the expert for the solution. The expert provides the suggestions which is based on its knowledge and information whereas sometimes searching the expert suggestion is time consuming, expensive and may be not precise. Therefore, to resolve this problem, Image processing techniques can be used which provides the accurate and fast solution. In this paper, we present survey on the variety of leaf diseases in plants and also their classification and identification. This paper gives different detection and classification techniques. There are various successful detection techniques like Probabilistic Neural Network, Genetic algorithm, Artificial Neural Network, Back propagation neural network and Support vector machine (SVM).

Keywords— *Feature Extraction, Dicot Plant Disease, Monocot Plant Disease, Pre-Processing, Segmentation, Classifier.*

I. INTRODUCTION

Plant disease is one of the very important issue which causes noteworthy reduction in the quality, growth and quantity of plant production. Detection and classification of plant diseases are essential task to enhance plant productivity and economic growth. Detection and classification are one of the very interesting topics as well as much more discussed in engineering and IT fields. Plant diseases cause a major production and economic losses in the agricultural industry. The disease management is a challenging task [6]. In India 60% of the people, spend their lives in agriculture [7]. Hence it become very important to detect diseases in leaves or other plants if occur.

There are variety of techniques involve which help to detect the plant disease such as thresholding, watershed, region growing, clustering etc. Hence, to detect plant disease the image should go through some steps like pre-processing, segmentation, feature extraction and classification processes. The pre-processing is a development process of image data to suppress unwanted distortion or improve some image features important for further processing.

The segmentation process is to subdivide an image into its meaningful regions and it is important process through which image features are extracted. There are variety of features of an image such as shape, depth, motion, grey level, color, texture, etc. Classification process is used to categorize the given input data into number of classes and groups. It helps to classify the data based upon selected features. It is very essential to identify leaf disease at an early stage and suggest solution so to minimize the loss [8].

II. BASIC TYPES OF PLANT FAMILY

A. Monocot Family Plant

Disease identification can be determined on the basis of their type of plant family. There are mostly of two types of plant Monocot family plant and Dicot family plant. The Monocot family plant has various characteristics such as one seed leaf, leaf veins, seed leaf are straight and parallel, which are in absence of wood.

Fig.1. Leaf Blotch

a. **Leaf Blotch:** The leaf blotch has small oval and rectangular or in the form of irregular brown spots appear on leaves and will become dirty brown as

shown in Fig. 1. The disease is governed by use of Mancozeb pesticides.

Fig.2. Leaf Spot

b. **Leaf Spot**: Leaf spot causes greyish or whitish spots with brown boundary of various sizes which appear on the upper surface of leaves and the spots are greyish or whitish dark in the center. Due to leaf spot, leaves will get dry and died as shown in Fig. 2. The disease is only controlled by the use of Zineb or Bordeaux pesticides.

B. Dicot Family Plant:

Dicot family plant has significance such as two seed leaf, nested leaf veins and complex structured, woody as well as woodless. The examples of Dicot family plants are cotton, coffee, potatoes, tomatoes, beans, honeysuckle, roses, peppers, strawberry, etc. Cotton is selected to make textile products and yarn products in India. Different precautions and pesticides are available to control the cotton Diseases. The cotton plant diseases are mention in detail in the following section.

Fig.3. Bacterial Blight

a. **Bacterial Blight:** It is the most dangerous disease obtained in cotton plant which infects all the different parts of plant leaf as shown in Fig. 3. Because of bacterial disease about 10% to 30% are losses in cotton production. This specific type of disease affects during the development of cotton plant. And it also causes seedling blight, boll rot, black arm and leaf spot. This spots convert into brown spots on plant leaf. Bacterial Blight can be controlled and variety of pesticides are available such as Pseudomonas fluorescents and Bacillus subtilis.

Fig.4. Fusarium Wilt

b. **Fusarium Wilt:** It is fungal disease as shown in Fig. 4. It affects the plant at any growing stage. Fusarium disease can causes the drooping of the older lower leaves, yellowing of the lower leaves, and followed by stunting of the plant and death of the plant.

Fig.5. Target Spot

c. **Target Spot**: It is disease formed tan to brown color spot that have concentric rings like a bull's-eye as shown in Fig. 5 affected plant may look healthy from the top view, so it is very important to inspect lower leaves, where the first spot usually seen. It will start with only a few spots whereas after that, the disease will progress with more affected, and it does not take so much time to spread all over on plant.

d. **Leaf Curl**: It can be caused by fungal or virus as well as it can easily visible as shown in Fig. 6. In view of leaf curl disease the development of plant leaf will stop and also it is an incurable disease.

Fig.6. Leaf Curl

e. **Grey Mildew**: This disease mostly found in middle aged or older aged plant and it looks like pale spot or irregular angular spots on leaf as shown in Fig. 7. Usually this spots are of 4-5 mm in diameter on the surface of plant leaf.

Fig.7. Grey Mildew

III. LITERATURE SURVEY

Aakanksha Rastogi [1], focused in the present scenario it is very important to have an established approach for grading the defects on the plant leaves automatically. For this a system based on Machine Vision Technology and Artificial Neural Network (ANN) is of great use for automatically detecting the leaf plant as well as for leaf disease detection and grading.

These systems are going to be very helpful for agriculturist since it is efficient than the manual method. The proposed system uses Euclidean distance technique and K means clustering technique for segmentation of image to segment the leaf area, disease area and background area of the input leaf image in order to calculate the percentage infection of the disease in the leaf and to grade them into various classes.

Md. Nazrul Islam [2], focused on an experimental result indicates that the proposed approach is valuable, can significantly evaluate two classifiers GA and PNN to support an accurate detection of leaf diseases in a little computational effort where successful classification rate of GA is more than PNN.

Garima Tripathi [3], focused on an automatic image processing and neural network based approach has been studied and proposed for plant leaf disease detection. The color co-occurrence method has been applied for extracting set of color and texture features specific to the type of leaf diseases. The extracted set of features has been used as input to train a feed forward back propagation neural network and subsequent detection of leaf diseases. Based on proposed approach, an efficient, simple, fully automatic, cheap, fast and reliable system can be developed for detection and classification of plant diseases.

S. Arivazhagan [4], focused on an application of texture analysis in detecting and classifying the plant leaf diseases has been explained in this paper. Thus the proposed algorithm was tested on ten species of plants namely banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota. The diseases specific to those plants were taken for our approach. The experimental results indicate the proposed approach can recognize and classify the leaf diseases with a little computational effort. By this method, the plant diseases can be identified at the initial stage itself and the pest control tools can be used to solve pest problems while minimizing risks to people and the environment.

K. Muthukannan [5], focused on the neural network algorithm is proposed for diseased plant leaf classification. The neural network techniques such as feed forward neural network (FFNN), learning vector quantization (LVQ) and radial basis function network (RBF) were tested for two different diseased leaf image classifications such as bean and bitter gourd leaves. The performance is measured using classification parameters such as Accuracy, Precision, Recall ratio and F measure. With these four parameters the performance is analyzed and based on the analysis the FFNN classification approach provides better result.

***TABLE 1**. Shows comparison between various existing approaches and its limitation*

Ref. No.	Method Used	Data Source	Approach	Strength	Limitation
[1]	• GLCM • Artificial Neural Network • fuzzy logic	Leaf sample	Proposed system is divided into two phases • feature extraction • Applied KNN Algorithm	• Efficient • Effective manner	• Do not have the ability to learn and adapt after solving a problem. • Require extensive testing
[2]	Probabilistic Neural Network (PNN) • GLCM	Leaf sample	Author propose solution is an improvement to the future extension proposed with an extra phase named Genetic Algorithm which is based on principles like selection, crossover and mutation.	Valuable , little computational effort	• The recognition rate for dynamic image acquisition is varies.
[3]	• Color Co-occurrence Method • feed forward back propagation neural network	Leaf sample	Propose and evaluate a framework for detection and classification of plant leaf/stem diseases using image processing and neural network technique.	• Efficient, Fully automatic	• Neural networks cannot be retrained • NN requires a long training period.
[4]	SVM classifier	Leaf sample	Proposed system is a software solution for automatic detection and classification of plant leaf diseases. The developed processing scheme consists of four main steps, first a color transformation structure for the input RGB image is created.	• Accuracy is improved to 94.74% by SVM	• lack of transparency and high algorithmic complexity
[5]	• Feed Forward Neural Network (FFNN) • Learning Vector Quantization (LVQ)	Leaf sample	Proposed the neural network algorithm is proposed for diseased plant leaf classification. The neural network techniques such as feed forward neural network (FFNN), learning vector quantization (LVQ) and radial basis function network (RBF) were tested for two different diseased leaf image classifications such as bean and bitter gourd leaves.	• FFNN classification approach provides better result. • quickly work it out, even if the data is 'noisy	• Do not provide explanations • Not used for little Data.

IV. CONCLUSION

The techniques which are basically used for the detection and classification of leaf disease in plants which are K means clustering for segmentation, artificial neural network, Probabilistic Neural network and GLCM and SGLDM for texture analysis. There are some of the challenges appear in these techniques are, it requires huge dataset for classification and diseased symptoms are varies. Therefore, some stages variety of disease has same symptoms then the classification technique may not be able to classify the correct disease. So, there is scope for more improved techniques.

REFERENCES

[1] Aakanksha Rastogi, Ritika Arora, Shanu Sharma, “Leaf Disease Detection and Grading using Computer Vision Technology &Fuzzy Logic”, presented at the 2nd International Conference on Signal Processing and Integrated Networks (SPIN), IEEE, 2015, pp. 500–505.

[2] Md. Nazrul Islam, M.A. Kashem, Mahmuda Akter and Md. Jamilur Rahman, “An Approach to Evaluate Classifiers for Automatic Disease Detection and Classification of Plant Leaf”, presented at the International Conference on Electrical, Computer and Telecommunication Engineering, RUET, Rajshahi-6204, Bangladesh, 2012, pp. 626–629.

[3] Garima Tripathi, Jagruti Save, “AN IMAGE PROCESSING AND NEURAL NETWORK BASED APPROACH FOR DETECTION AND CLASSIFICATION OF PLANT LEAF DISEASES”, Int. J. Comput. Eng. Technol. IJCET, vol. 6, no. 4, pp. 14–20, Apr. 2015.

[4] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, “Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features”, Agric Eng Int CIGR J., vol. 15, no. 1, pp. 211–217, Mar. 2013.

[5] K. Muthukannan, P. Latha, R. Pon Selvi and P. Nisha, “CLASSIFICATION OF DISEASED PLANT LEAVES USING NEURAL NETWORK ALGORITHMS”, ARPN J. Eng. Appl. Sci., vol. 10, no. 4, pp. 1913–1918, Mar. 2015.

[6] J. Francis, Anto Sahaya Dhas D and Anoop B K, "Identification of leaf diseases in pepper plants using soft computing techniques," 2016 Conference on Emerging Devices and Smart Systems (ICEDSS), Namakkal, 2016, pp. 168-173.

[7] R. Anand, S. Veni and J. Aravinth, "An application of image processing techniques for detection of diseases on brinjal leaves using k-means clustering method," 2016 International Conference on Recent Trends in Information Technology (ICRTIT), Chennai, 2016, pp. 1-6.

[8] P. R. Rothe and R. V. Kshirsagar, "Cotton leaf disease identification using pattern recognition techniques," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-6.