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Detection of Bacterial and Fungal Leaf Diseases using Image Processing and Machine Learning Techniques

Ramesh Kumar Singh[1*], Jasmine Minj[2]

[1,2] Dept. of Computer Science and Engineering, Vishwavidyalaya Engineering College, Lakhanpur, India

[*] *CorrespondingAuthors:rksforever7@outlook.com Mobile: +91-7879283898*

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***Abstract*—**In Agriculture, leaf diseases have grownup to be a dilemma because it will cause vital diminution in each quality and amount of agricultural yields. Thus, automatic recognition of diseases on leaves plays a vital role in agriculture sector. This paper reviews all major techniques used for plant disease identification and also focuses on role of image processing techniques and machine learning in identification and classification of these disease. In this paper we are focusing on major fungal and bacterial disease found on leaves of plants, through this paper we also tried to focus on various studies have been done for the detection of such diseases. Finally, we conclude at the end gaps found in the previous studies and suggest some possible improvements for researchers.

***Keywords*—**plant disease, Machine Learning Techniques, bacterial disease, fungal disease

I. INTRODUCTION

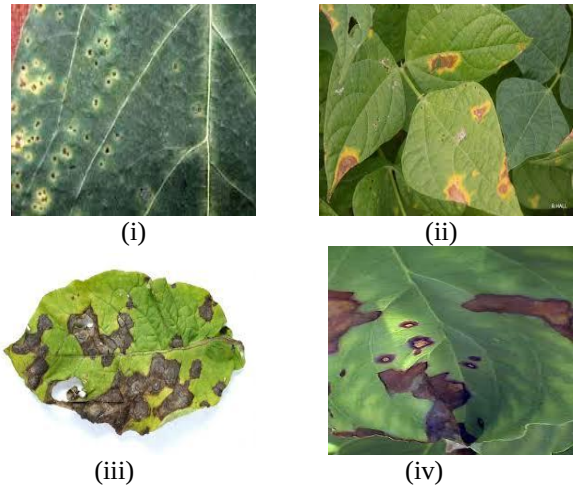
Fungi area unit the foremost common parasites inflicting disease. Most are microscopic (very little and may solely be seen with the help of a microscope) plants that take advantage of living inexperienced plants or on dead organic material. after they attack living plants, a sickness results. Fungi typically turn out spores that, once carried to a plant, will begin Associate in Nursing infection. These spores could also be carried from plant to plant by wind, water, insects and instrumentation. so as for plant spores to start new infections, adequate wetness and therefore the right air temperature area unit needed. A plant wound is usually conjointly required as Associate in Nursing entry for the plant. plant diseases area unit common throughout wet, wet seasons[1].

Bacteria area unit acellular microscopic organisms. Some attack living plants and cause disease. bacterium is carried from plant to plant by wind, rain splash, insects and machinery. These diseases occur totally on leaves, however some may additionally occur on stems and/or fruit. Leaf diseases area unit the foremost common diseases of most plants. they're typically controlled with fungicides, bactericides and resistant varieties. though leaf diseases area unit represented underneath many totally different symptom varieties, detain mind that variations aren't forever clear-cut and there area unit several names for leaf diseases aside from those given, a state of affairs which may be confusing[2].

The paper has is divided into further 4 more sections , where in section 2 we cover all the major bacterial and fungal diseases occurs in plant, section 3 contains the literature survey done on recent papers, section 4 focuses on major techniques used for identification of plant disease with their output, and in last section we concluded the all research gaps and possible solutions to the existing methods.

II. MAJOR TYPES OF BACTERIAL AND FUNGOUS DISEASES

Some most typical fungous and microorganism diseases area unit



(i) (ii) (iii) (iv)

Figure1: kinds of leaf diseases

(i) Leaf Spots
Leaf spots area unit typically rather definite spots of varied sizes, shapes and colours.there's nearly forever a particular margin. typically the spot, which can be caused by bacterium or fungi, is enclosed by a yellow halo[3,4,6].

(ii) Leaf Blights
Found on tomato and potato plants, blight is caused by the plant fungus and is common throughout the u. s.. faithful its name, the sickness happens later within the season with symptoms usually not showing till when blossom. blight 1st seems on the lower, older leaves as water-soaked, gray-green spots. because the sickness matures, these spots darken and a white fungous growth forms on the undersides. Eventually the whole plant can become infected. Crops is severely damaged[3,4,6].

(iii) Fungous Infection:
Generally found within the jap a part of the united states, fungal infection is caused by fungi within the genus Colletotrichum, a typical cluster of plant pathogens that area unit to blame for diseases on several plant species. Infected plants develop dark, water soaked lesions on stems, leaves or fruit. The centers of those lesions usually become coated with pink, gelatinous lots of spores particularly throughout moist, heat weather. fungal infection will cut back a gorgeous harvest into unsound waste in precisely some days[3,4,5].

(iv) Brown Spot:
Brown spot has been traditionally mostly unheeded jointly of the foremost common and most damaging rice diseases. Brown spot may be a fungus sickness that infects the coleoptile, leaves, leaf sheath, raceme branches, glumes, and spikelets. Its most noticeable injury is that the various massive spots on the leaves which may kill the entire leaf. once infection happens within the seed, empty grains or noticed or discoloured seeds area unit formed[3,4,6].

III. LITERATURE SURVEY

Devi et.al in [1] for any automatic image analysis method, the segmentation is a vital taskbecause all subsequent tasks in image process heavily accept the standard of image segmentation. It determines the ultimate success or failure of the analysis. Chaudhary et.al in [2] during this analysis, an formula for sickness spot segmentation victimization image process techniques in plant leaf is enforced. this can be the primary and necessary section for automatic detection and classification of plant diseases. sickness spots area unit totally different in color however not in intensity, as compared with plant leaf color. therefore we color rework of RGB image is used for higher segmentation of sickness spots. Bhattacharyya et.al in [3] multichannel informatics from a various vary of channel info is very time- and space-complex as a result of the range and enormity of underlying knowledge. Most of the classical approaches accept filtering and applied math techniques. strategies during this direction involve Markov random models, vector directional filters and applied math mixture models like mathematician and Dirichlet mixtures. Vijayakumar et.al in [4] the aim of this analysis paper is to spot the foot rot sickness infected within the betel} vine plants victimization digital imaging techniques. The digital pictures of the clean vine leaves and therefore the digital pictures of the infected in foot rot unhealthy betel vine leaves at completely different stages area unit collected from different betel vine plants employing a high resolution photographic camera. The median values for all betel} vine leaves area unit computed and calculated median values area unit keep within the system. The median values of check betel} vine leaves area unit computed and compared with the keep median values. because the consequence of this analysis, it's known whether or not check betel} vine leaves area unit full of foot rot sickness or not. Finally this analysis work is helps to acknowledge the foot rot sickness is acknowledged before it spreads to complete crop. Singh et.al in [5] this paper, the strategy which can be accustomed compare the crop leaf color with the leaf chart (LCC), has been proposed for getting a detail about the requirement of plant, before enough to get the yield affected. By making use of image processing technology a simple and robust method for the color prediction of paddy crop plant has been discussed along with the mathematical modelling which may provide a great platform to the advisory bodies in the agriculture field for the atomization of the crop health problems and solutions.

Asfarian et.al in [6] the endeavors to expanding the amount and nature of rice generation are impeded by the paddy ailment. This exploration endeavored to recognize the four noteworthy paddy ailments in Indonesia (leaf impact, darker spot, bacterial leaf, and shealth) utilizing fractal descriptors to break down the surface of the injuries. The injury pictures were extricated physically. The descriptors of 'S' part of every injury pictures at that point utilized in order procedure utilizing probabilistic neural systems. This procedures accomplished at any rate 83.00% exactness while distinguishing the sicknesses. Paproki et.al in [7] the proposed technique creates a shrewd parcel of the underlying lattice that permits to recognize the principle stem, branches, and leaves of the plant. Extricated locales are then handled through the following phase of the computerized examination, which recovers exact plant data, for example, stem length, leaf width, length or region. Choong et.al in [8] division on manufactured pictures and regular pictures are secured to contemplate the execution and impact of various picture unpredictability towards division process. This examination gives some exploration discoveries for successful picture division utilizing diagram dividing technique with calculation cost diminished. In light of its cost costly and it ends up un positive in performing

picture division on high goals picture particularly in online picture recovery frameworks. In this way, a chart based picture division strategy done in multistage approach is presented here. A. Meunkaewjinda et al. [9] spoke to sickness location in grapes utilizing cross breed insightful framework in which the infections in leaves of plants are reviewed by ascertaining the remainder of ailing territory and the leaf zone. Self-sorting out maps back spread neural systems was utilized by them for perceiving the shades of the grape leaves that were utilized to fragment he pixels of the grape leaf inside the whole picture. After that malady division is performed. Gabor wavelet is then used to channel the fragmented picture so as to examine the shading highlights of the leaf. After that help vector machines are connected so as to characterize the diverse kinds of illnesses in grape leaves. Stephen Gang Wu [10] set in motion a leaf acknowledgment calculation utilizing effectively extricated highlights and profoundly productive calculations for acknowledgment reason. A Probabilistic Neural Network (PNN) was utilized for acknowledgment of plant leaves. In this, different highlights are mined and prepared by which go about as a contribution to PNN. The disadvantages of this strategy were that precision of acknowledgment watched was 90% and the highlights extricated were not sufficient. XuPengyun et al. [11] exhibited a method for observing plant illnesses that were brought about by spores. The shaded pictures is right off the bat changed over in to dark scale picture so as to break down and process however histogram age, the dim dimension remedy, picture include extraction, picture honing, etc. Subsequent to thresholding, morphological highlights like expansion, disintegration, opening and so forth are connected on the double picture acquired .The disadvantages for this method were that handling time has all the earmarks of being high and there additionally exists varieties in the measure of spores. Rastogi, et.al. [21] proposed a model for recognition of sickness from leaf of plant , they initially perform pre handling at that point, grouping undertaking have been finished by utilizing neural system. At long last, sickness evaluating is given by seriousness of illness. Pujari J.D. et.al. [22] exhibited an examination on various picture handling systems utilized for parasitic sickness identification and discovered growths as a primary wellspring of ailment in plants. Habib T. et.al. [23] present an online machine vision-based agro-therapeutic master framework that forms a picture caught through portable or handheld gadget and decides the maladies so as to assist inaccessible agriculturists with addressing the issue.

IV. COMPARISION OF DIFFERENT TECHNIQUES

Many application needs image processing and many other classification techniques for the purpose of classification of plant disease here we are going to compare some of the major image processing and machine learning based classification techniques in the table shown below

Table 1 Comparison of Previous Method

Reference	Diseases / harvesting identified	Features Extracted	Classification / Algorithm	Accuracy
[12]	Early Blight and Late Blight	Color, shape	Leaf Vein Detection and Blob detection algorithm	94.1%
[13]	Cerosporabeticola , Ramularia, Phomabetae	LBP	Naive Bayer Classifier	97%
[14]	Bacterial leaf Blight, Brown Spot, Leaf blast, Leaf Scald	Blobs, area and color	Euclidean distance of input and extracted images	Not Given
[17]	Leaf spots and leaf blotch	K-means Segmentation GLCM feature extraction	Weighted K-Nearest Neighbour	93%
[18]	Brown leaf spot, bacterial leaf blight, brown spot	Color	YC_bC_r. Histogram Algorithm	85%
[19]	Hawar Leaf, Anthracnose and Pestalotiopsis, palmarum	Median of RGB, Quartile 1 of RGB, Quartile 3 of RGB, Standard Deviation of RGB, Shape	Neural Network Classification	87.75%

V.CONCLUSION

From table1 we can conclude that, there are lots of image processing and machine learning techniques have been applied for the detection of disease of a plant but as far as accuracy is concern highest accuracy gain is 97% using naïve bayes classifiers even through here are some chances of improvement in this area. Also we can see from table that performance is low i.e. 85% on applying image processing techniques for classification. From above study it has also been recognized that major diseases which hams the plant leaves are basically bacterial and fungal diseases. So researcher may contribute in this area for their work.

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