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Application of Image Processing and Machine Learning Techniques for Detection of Bacterial and Fungal Leaf Diseases: A Review

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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 imparts a straightforward and computationally good technique used for plant disease identification and grading victimization digital image process and machine vision technology. The paper is arranged into four major sections, in first section most common leaf diseases of Indian crops and vegetables are discussed then in next section, recent techniques used for recognition and classification of plant diseases are focused, along with challenges and limitation of each technique. In the third section, techniques discussed in the previous section are evaluated on the basis of different parameters like accuracy, algorithm used and database used, etc. to find out the gaps in the existing system.

Key words: plant disease, Machine Learning Techniques, bacterial disease, fungal disease deep Learning Techniques.

1. 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 a cellular 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].

MAJOR TYPES OF BACTERIAL AND FUNGOUS DISEASES

Some most typical fungous and microorganism diseases area unit

(i)

(ii)

(iii)

(iv)

Figure1: Fungal Infection on leaf diseases

(i) Leaf Spots

Leaf spots unit of measurement typically rather definite spots of various sizes, shapes and hues . there's nearly forever a specific margin. typically the spot, which may be caused by bacterium or fungi, is enclosed by a yellow halo[3,6].

(ii) Leaf Blights

Found on tomato and potato plants, blight is caused by the plant fungus and is common throughout 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 entire plant can become infected. Crops are severely damaged[4,6].

(iii) Fungous Infection:

Fungal infection is caused by fungi within the genus Colletotrichum, a typical cluster of plant pathogens that area unit responsible for diseases on several plant species. Infected plants develop dark, water-soaked lesions on stems, leaves, or fruit. The centers of these lesions usually become coated with pink, gelatinous many spores, particularly throughout moist, heat weather. a mycosis will crop a stunning harvest into unsound waste in just some days[5].

(iv) Brown Spot:

Brown spot has been traditionally mostly unheeded jointly of the foremost common and most damaging rice diseases. Brown spots could also be a fungus sickness that infects the coleoptile, leaves, leaf sheath, raceme branches, glumes, and spikelets. Its most noticeable injury is that the varied massive spots on the leaves which can kill the whole leaf. once infection happens within the seed, empty grains or noticed or discolored seeds square measure formed[3,4].

2. LITERATURE SURVEY

Devi et.al in [1] for any automatic image analysis method, the segmentation may be a vital task because all subsequent tasks within the image process heavily accept the quality of image segmentation. It determines the last word success or failure of the analysis. Chaudhary et.al in [2] during this analysis, a formula for sickness spot segmentation victimization image process techniques in plant leaf is enforced. this will be the first and necessary section for automatic detection and classification of plant diseases. sickness spots square measure totally different in color however not in intensity, as compared with plant leaf color. therefore we color rework of the RGB image is employed for higher segmentation of sickness spots. Bhattacharyya et.al in [3] multichannel informatics from a various vary of channels info is extremely time- and space-complex as a results of the range and enormity of underlying knowledge. Most of the classical approaches accept filtering and applied mathematics techniques. strategies during this direction involve Markov random models, vector directional filters, and applied mathematics mixture models sort of a mathematician and Dirichlet mixtures. Vijaya Kumar et.al in [4] the aim of this analysis paper is to identify the foot rot sickness infected within the betel} vine plants victimization digital imaging techniques. The digital pictures of the clean vine leaves and thus the digital pictures of the infected in footrot unhealthy betel vine leaves at completely different stages square measure collected from different betel vine plants employing a high-resolution camera . The median values for all betel} vine leaves square measure computed and calculated median values are keep within the system. The median values of the check betel} vine leaves square measure computed and compared with the keep median values. because the consequence of this analysis, it's known whether or not check betel} vine leaves are filled with footrot sickness or not. Finally, this analysis work helps to acknowledge foot rot sickness is acknowledged before it spreads to an entire crop. Singh et.al in [5] this paper, the strategy which may be accustomed compare the crop leaf color with the leaf chart (LCC), has been proposed for getting a detail about the need of plant, before enough to urge the yield affected. By making use of image processing technology an easy and robust method for the

colour prediction of paddy crop plant has been discussed along side the mathematical modeling which can provide an excellent platform to the advisory bodies within the agriculture field for the atomization of the crop health problems and solutions. Asfarian et.al in [6] the endeavors to expanding the quantity and nature of rice generation are impeded by the paddy ailment. This exploration endeavored to acknowledge the four noteworthy paddy ailments in Indonesia (leaf impact, darker spot, bacterial leaf, and shealth) utilizing fractal descriptors to interrupt down the surface of the injuries. The injury pictures were extricated physically. The descriptors of 'S' a part of every injury picture at that time utilized so as procedure utilizing probabilistic neural systems. This procedure 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 allows to acknowledge the principle stem, branches, and leaves of the plant. Extricated locales are then handled through the subsequent phase of the computerized examination, which recovers exact plant data, for instance , 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 varied 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 finishes up un positive in performing picture division on high goals picture particularly in online picture recovery frameworks. during this way, a chart based picture division strategy wiped out a multistage approach is presented here. A. Meunkaewjinda et al. [9] spoke to sickness location in grapes utilizing crossbreed insightful framework during which the infections in leaves of plants are reviewed by ascertaining the rest of ailing territory and therefore the leaf zone. Self-sorting out maps back spread neural systems were utilized by them for perceiving the reminder the grape leaves that were utilized to fragment he pixels of the grape leaf inside the entire picture. then malady division is performed. Gabor wavelet is then wont to channel the fragmented picture so on examine the shading highlights of the leaf. then help vector machines are connected so on characterize the various sorts 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 the acknowledgment of plant leaves. In this, different highlights are mined and ready by which set about as a contribution to PNN. The disadvantages of this strategy were that the precision of acknowledgment watched was 90% and therefore the highlights extricated weren't sufficient. Xu Pengyun et al. [11] exhibited a way for observing plant illnesses that were caused by spores. The shaded pictures are right off the bat changed over into dark scale picture so on break down and process however histogram age, the dim dimension remedy, picture include extraction, picture honing, etc. after thresholding, morphological highlights like expansion, disintegration, opening, then forth are connected on the double picture acquired. The disadvantages of this method were that handling time has all the earmarks of being high and there additionally exists varieties within the measure of spores. Rastogi, et.al. [21] proposed a model for recognition of sickness from the leaf of the plant, they initially perform pre handling at that time , grouping undertaking has been finished by utilizing a neural system. At long last, sickness evaluation is given by the seriousness of the 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 a web machine vision-based agro-therapeutic master framework that forms an image caught through the portable or handheld gadgets and decides the maladies so on assist inaccessible agriculturists with addressing the difficulty .

3. DIFFERENT METHODS AND THEIR RESULT ANALYSIS

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]	Cerospora beticola , Ramularia, Phomabeta e	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%

5. CONCLUSION

From table 1 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 there are some chances of improvement in this area. 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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