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Plant Leaf Disease Identification and Classification: A Review

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Abstract: ***Image processing is a diverging area where researchers and advancements are taking a geographical progress in the agricultural field. Different researchers are going on energetically in plant disease detection. Identification of plant disease can augment the yield production as well as can be strong supportive for various sort of agricultural practices. This paper presents a survey on detection and classification of plant leaf diseases. It is troublesome for human eyes to recognize the correct type of leaf disease which happens on the leaf of the plant. In this way, so as to distinguish the plant leaf diseases precisely, the utilization of image processes and machine learning strategies can be useful.***

Keywords: Plant Diseases, Machine Learning, Neural Network, Leaf Diseases.

I. INTRODUCTION

India is an agricultural country wherein a large portion of the population relies upon agriculture. Research in agriculture is pointed towards increment of efficiency and food quality at reduced consumption, with expanded benefit. Agricultural production framework is a result of a complex interaction of soil, seed, and agro chemicals. Vegetables and fruits are the most vital agricultural products. Keeping in mind the end goal to acquire more significant products, an item quality control is essentially obligatory. Numerous examinations demonstrate that quality of agricultural products might be lessened because of plant diseases. Diseases are hindrance to the typical condition of the plant that interrupts or modify on its crucial functions, for example, photosynthesis, transpiration, pollination, fertilization, germination and so on. These diseases are caused by pathogens viz., fungi, bacteria and viruses, and because of unfavorable environmental conditions. In this manner, the early stage diagnosis of plant disease is an imperative task [1]. Farmers require nonstop observing of specialists which may be restrictively costly and time consuming. Along these lines searching for quick [2], more affordable and exact technique to consequently identify the diseases from the symptoms that show up on the plant leaf is of incredible realistic significance. This empowers machine vision that is to give image based automatic inspection, process control and robot direction. The goal of this paper to review on the plant leaf disease detection in light of the texture of the leaf. Leaf introduces a few advantages over flowers and fruits at all seasons worldwide [3], [4].

II. PLANT DISEASES ANALYSIS AND ITS SYMPTOMS

Following are some basic symptoms of fungal, bacterial and viral plant leaf diseases.

A. Bacterial disease symptoms

The disease is described by small light green spots which soon come into see as water-soaked. The injuries augment and afterward show up as dry dead spots as appeared in Fig. 1.

Fig. 1. Bacterial Disease on Leaf

B. Viral disease symptoms

Among all plant leaf diseases, those caused by viruses are the most hard to analyze. Viruses deliver no indications that can be promptly watched and frequently effortlessly confused with nutrient inadequacies and herbicide injury. Aphids, leafhoppers, whiteflies and cucumber scarab's insets are normal transporters of this disease, e.g. Mosaic Virus, Look for yellow or green stripes or spots on foliage, as appeared in Fig. 2. Leaves may be wrinkled, twisted and development might be hindered.

Fig. 2. Viral Disease on Leaf

C. Fungal disease symptoms

Plant leaf diseases, those caused by fungus are talked about beneath and appeared in Fig. 3, Fig. 4 and Fig. 5.

Fig. 3. Fungal Disease on Leaf - Downy Mildew

Fig. 4. Fungal Disease on Leaf - Late Blight

Downy Mildew

In downy mildew yellow to white fixes on the upper surfaces of older leaves happens. These zones are secured with white to grayish on the undersides as appeared in Fig. 3.

Late blight

Late blight caused by the fungus Phytophthora infesters is appeared in Fig. 4. It initially shows up on lower, older leaves like water-soaked, gray-green spots. At the point when fungal disease develops, these spots darken and afterward white fungal development shapes on the undersides.

Early blight

Early blight is caused by the fungus Alternaria solani appeared in Fig. 5. It initially shows up on the lower, older leaves like small brown spots with concentric rings that shape a bull's eye design. At the point when disease develops, it spreads outward on the leaf surface making it turn yellow.

Fig.5. Fungal Disease on Leaf – Early Blight

III. LITERATURE SURVEY

In this section we presents existing work done in the field of plant leaf disease recognition.

[5], This Proposed Work uncovered, an advance computing technology that has been created to enable the farmer to take

prevalent decision about numerous parts of crop development to process. Reasonable assessment and diagnosis of crop disease in the field is exceptionally basic for the expanded production. Foliar is the major essential fungal disease of cotton and happens in all developing Indian regions. In this work we express new innovative methodologies utilizing mobile captured symptoms of cotton leaf spot images and arrange the diseases utilizing HPCCDD Proposed Algorithm. The classifier is being prepared to accomplish intelligent farming, including early Identification of diseases in the groves, particular fungicide application, and so on. This proposed work depends on Image RGB feature ranging strategies used to recognize the diseases (utilizing Ranging values) in which, the captured images are processed for improvement first. At that point color image segmentation is done to get target regions (disease spots).

[6], Proposed Research work uncovered, an advance computing technology has been produced to enable the agriculturist to take unrivaled decision about numerous parts of crop created to process. Appropriate evaluation and diagnosis of crop disease in the field is extremely basic for the expanded production. Foliar is the major imperative fungal disease of cotton and happens in all developing Indian cotton regions. In this work we express Technological Strategies utilizing mobile captured symptoms of Cotton Leaf Spot images and classify the diseases utilizing neural network. The classifier is being prepared to accomplish intelligent farming, including early detection of disease in the groves, particular fungicide application, and so on. This proposed work depends on Image Edge detection Segmentation systems in which, the captured images are processed for improvement first. At that point R, G, B color Feature image segmentation is completed to get target regions (disease spots).

[7], Plant diseases cause significant damage and economic losses in crops. Accordingly, lessening in plant diseases by early diagnosis brings about significant change in nature of the item. Incorrect diagnosis of disease and its seriousness prompts unseemly utilization of pesticides. The objective of proposed work is to analyze the disease utilizing image processing and manmade brainpower systems on images of grape plant leaf. In the proposed framework, grape leaf image with complex background is taken as info. Thresholding is sent to mask green pixels and image is processed to expel clamor utilizing anisotropic diffusion. At that point grape leaf disease segmentation is finished utilizing K-means clustering. The diseased segment from divided images is distinguished. Best outcomes were watched when Feed forward Back Propagation Neural Network was prepared for classification.

[8], Producing agriculture items are troublesome task as the plant goes to an attack from different micro-organisms, pests and bacterial diseases. The symptoms of the attacks are by and large recognized through the leaves, steams or natural product investigation. The present paper examines the image processing methods utilized as a part of performing early detection of plant diseases through leaf features review. The goal of this work is to actualize image investigation and classification methods for extraction and classification of leaf diseases. Leaf image is captured and afterward processed to decide the status of each plant. Proposed framework is demonstrate into four sections image preprocessing including RGB to various color space conversion, image improvement; portion the region of enthusiasm utilizing K-mean clustering for factual utilization to decide the imperfection and seriousness territories of plant leaves, feature extraction and classification. Texture feature extraction utilizing statistical GLCM and color feature by means of mean values. At long last classification accomplished utilizing SVM. This procedure will guarantee that chemicals just connected when plant leaves are recognized to be affected with the disease.

[9], Images pass on important information and data in natural sciences. Digital image processing and the image examination technology have an essential part in science and farming divisions. Programmed detection of plant diseases and development of solid plants is of incredible significance and farming automation. The instance of a plant, the term disease is characterized as any impedance happening to the typical physiological capacity, delivering trademark symptoms. The investigations of plant diseases allude to concentrate the outwardly noticeable examples of a specific plant. The distinguishing proof of plants, leaves, stems and discovering the pests or diseases, or its rate is discovered extremely viable in the effective development of crops. The naked eye perception is the approach embraced by a significant number of the farmers for the detection and distinguishing proof of plant diseases. It requires constant observing and discovered less valuable on extensive homesteads. Likewise, the farmers are ignorant of non - local diseases. With the guide of imaging technology the plant disease detection frameworks consequently recognize the symptoms that show up on the leaves and stem of a plant and aides in developing solid plants in a ranch. These frameworks screen the plant, for example, leaves and stem and any variety saw from its trademark features, variety will be naturally distinguished and furthermore will be educated to the client. This paper gives an evaluative examination on the current disease detection frameworks in plants.

[10], The complex impact effects of disease stages and disease symptoms on ghostly attributes of the plants prompt restriction in disease seriousness detection utilizing the spectral vegetation indices (SVIs). Despite the fact that machine learning procedures have been used for vegetation parameters estimation and disease detection, the impacts of disease symptoms on their

exhibitions have been less considered. Thus, this paper explored on 1) utilizing halfway slightest square regression (PLSR), ν support vector regression (ν-SVR), and Gaussian process regression (GPR) strategies for wheat leaf rust disease detection, 2) assessing the effect of training sample size on the outcomes, 3) the impact of disease symptoms consequences for the expectations exhibitions of the previously mentioned techniques, and 4) correlations between the exhibitions of SVIs and machine learning procedures. In this examination, the spectra of the infected and non-contaminated leaves in various disease symptoms were estimated utilizing a non- imaging spectroradiometer in the electromagnetic region of 350 to 2500 nm. To deliver a ground truth dataset, we utilized photographs of a digital camera to register the disease seriousness and disease symptoms parts. At that point, diverse sample sizes of gathered datasets were used to prepare every technique. PLSR demonstrated coefficient of assurance (R2) values of 0.98 (root mean square error (RMSE) = 0.6) and 0.92 (RMSE = 0.11) at leaf and shade, separately. SVR indicated R2 and RMSE near PLSR at leaf (R2 = 0.98, RMSE = 0.05) and shade (R2 = 0.95, RMSE = 0.12) scales. GPR indicated R2 values of 0.98 (RMSE = 0.03) and 0.97 (RMSE = 0.11) at leaf and overhang scale, separately.

TABLE I. Shows comparison between various existing approaches

Ref.	Image Dataset	No. of Classes/Disease	Image Processing Steps	Disease Segmentation Technique	Extracted Features	Classifier Accuracy
[5]	Images are captured using mobile phone	3 disease 1) Fusarium Wilt 2) Verticillium Wilt 3) Leaf blight	Image preprocessing, Leaf Edge detection, Segmentation,	Canny and sobel	Color, Texture	NN: 98.1%
[6]	Sample images	6 disease 1) Bacterial blight 2) Fusarium Wilt 3) Leaf Blight 4) Root rot 5) Micronutrient 6) Verticillium Wilt	Image preprocessing, Segmentation, Diseased Edge detection, Statistical analysis of disease	Canny and sobel	Boundary, Color, Texture	NN: 90% to 95%
[7]	Downloaded 16 images	1) downy mildew 2) powdery mildew 3) anthracnose	Image Preprocessing, Anisotropic Diffusion	K-means clustering algorithm	Texture	100% when using hue features alone
[8]	Images of various leaves acquired using a digital camera	1) Citrus canker 2) Anthracnose 3) Overwatering 4) Citrus greening	Image Preprocessing, Image Enhancement using SF-CES, Color-space conversion	K-mean clustering	Color, Texture	96%
[9]	Sample images	1) Berry spot 2) Quick wilt	Image preprocessing	Masking of green pixels, Threshold based Segmentation	texture	-
[10]	Proposed method is trained with 25, 50, 75 100, 125, and 150 samples	Wheat leaf rust disease	Image preprocessing, image filter	PLSR, ν-SVR, and GPR	Color	GPR's performance using smaller training dataset results in higher accuracy than other implemented methods

IV. CONCLUSION

Plants plays a vital part in our lives, without plants there won't be the existence of the ecology of the earth. A lot of leaf type now makes the human being in a front of a few issues in the particular of the utilization of plants, the principal need to know the utilization of a plant is the identification of the plant leaf.

This paper surveys and summarizes image processing strategies that have been utilized for recognizing plant diseases. Disease in plant causes a critical decrease in quantity and quality of the agricultural product. Identification of symptoms of the disease by the naked eye is troublesome for the farmer. Plant protection, particularly in large farms, is done by utilizing computerized image processing strategy and feature extraction that can recognize diseased leaf using color, texture and boundary information of leaves.

Techniques like Canny and Sobel for segmentation gives accuracy about 90 to 95% only. They are not 100% accurate. But, K-Means clustering technique for segmentation gives about 95 to 98% accuracy when calculated under some conditions. Hence the accuracy of K-means is better than other. Hence neural network combined with k-means can be used for segmentation and classification process efficiently.

References

1. Anand H. Kulkarni, Ashwin Patil R. K.,Applying image processing technique to detect plant diseases, International Journal of Modern Engineering Research, vol.2, Issue.5, pp: 3661- 3664, 2012.
2. F. Argenti,L. Alparone,G. Benelli , Fast algorithms for texture analysis using co-occurrence matrices Radar and Signal Processing, IEE Proceedings , vol. 137, Issue 6, pp:443-448 , No. 6, December 1990.
3. P. Revathi, M. Hemalatha, Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques, IEEE International Conference on Emerging Trends in Science, Engineering and Technology, pp-169-173, Tiruchirappalli, Tamilnadu, India, 2012.
4. Tushar H. Jaware, Ravindra D. Badgujar and Prashant G. Patil, Crop disease detection using image segmentation, National Conference on Advances in Communication and Computing, World Journal of Science and Technology, pp:190-194, Dhule, Maharashtra, India, 2012.
5. P. Revathi and M. Hemalatha, “Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques,” Emerging Trends in Science, Engineering and Technology (INCOSET), 2012 International Conference, pp. 169-173. IEEE, 2012
6. P. Revathi, “Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection using Image Edge Detection,” Computing Communication & Networking Technologies (ICCCNT), Third International Conference, pp. 1- 5. IEEE, 2012
7. S. S. Sannakki, V. S. Rajpurohit, V. B. Nargund and P. Kulkarni, "“Diagnosis and classification of grape leaf diseases using neural networks”, 2013 Fourth International Conference on Computing, Communications and Networking Technologies (ICCCNT), Tiruchengode, 2013 IEEE, pp. 1-5.
8. K. R. Gavhale, U. Gawande and K. O. Hajari, "Unhealthy region of citrus leaf detection using image processing techniques, & International Conference for Convergence for Technology-2014, Pune, 2014 IEEE, pp. 1-6.
9. 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 IEEE, pp. 168-173.
10. D. Ashourloo, H. Aghighi, A. A. Matkan, M. R. Mobasheri and A. M. Rad, "An Investigation Into Machine Learning Regression Techniques for the Leaf Rust Disease Detection Using Hyperspectral Measurement," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 9, no. 9, pp. 4344-4351, Sept. 2016.

