# Machine Learning Based Leaf Disease Detection & Crop Optimization

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***Abstract-*** *Agriculture is one of the most important factors based on which a country's economy is decided. Alignments in crops are very regular, which is the one of the prominent factor that leads to the disease location and detection in plants pats is of high importance in agroindustry. Therefore it is important to successfully identify the diseases from the crop to selectively spray herbicides and fertilizes to reduce wastage use of chemical. In this work, we present an approach that integrates image processing and machine learning to allow diagnosing diseases from leaf images, to study quantitative plant physiology imaging and computer vision is used. Wavelet is very popular tool in image processing algorithm. Texture features are used for detection of crop. These features are mean, standard deviation, skewness and kurtosis which we have used in this paper. We are proposing an approach, which used to identify the plant infection i.e. plant disease. Here we are using minimum distance classifier for the classification of the disease. The proposed approach presents a path toward automated plant diseases diagnosis on a massive scale.*

***Keywords***- image segmentation, plant disease, minimum distance classifier.

## I. INTRODUCTION

Indian economy is highly dependent of agricultural productivity. One of the major factors responsible for the crop destruction is plant disease. Present method for disease detection of plant is observation by experts through their naked eye which needed; a large team of experts as well as continuous monitoring of plant is required, which is costly affair. In developed countries they are using the cutting edge technologies like information and space technology, biotechnology. It is necessary to change and utilize the research for eco-friendly crop management and increased role of research-based technologies and sustainable crop production. In plants, some general diseases seen are brown and yellow spots, early and late scorch, and others are fungal, viral and bacterial diseases. Image processing [1] can be used for measuring affected area of disease and to determine the difference in the color of the affected area. Automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper. Therefore in field of agriculture, use of automatic disease detection technique in plants plays an important role. Detection of a plant disease in very initial stage would be very beneficial. This also supports machine vision to provide image based automatic process control, inspection, and robot guidance. The simple principle of the operation of proposed system is to take the responses from various parameters that decide the productivity, processing them according to the algorithm and predict the suitable crop for the land along with the current status of crop if infected or not. Also suggestion is given of some fertilizers that could be used to improve the fertility. For making system available to common people we propose this system is made as an Android Application, where the farmer could feed the inputs, and obtain the necessary result.

## II. LITERATURE SURVEY

Literature review reports that the machine vision research varies widely in depending on the complexity of the visual scene. With the advancement of the personal computer most of the on field machine vision detection work has been performed and resulted that is starting from individual leaves kept on plain background to narrow leaves scenes of field plants growing in on field natural conditions. Textures and size feature used for weed detection and automation of fertilizer spraying [2]. Wavelet transform is used to extract the texture features of the crop and weed images for classification [3]. Energy, Entropy, Inertia, Contrast, Homogeneity these five texture features are extracted.

Vijai Singh and A.K. Misra [4] presents the review on various diseases classification techniques utilized for plant leaf illness location and a calculation for picture division strategy that can be utilized for programmed identification and additionally characterization of plant leaf ailments later. Banana, beans, jackfruit, lemon, mango, potato and tomato, are some of those ten species on which proposed calculation is tried. Along these lines, related ailments for these plants were taken for ID. With less computational endeavors the ideal outcomes were acquired, which likewise demonstrates the proficiency of proposed calculation in acknowledgment and characterization of the leaf illnesses. Another favorable position of utilizing this technique is that the plants illnesses

can be distinguished at beginning period or the underlying organize. To enhance acknowledgment rate in grouping process Simulated Neural Network, Bayes classifier, Fuzzy Logic and cross breed calculations can likewise be utilized.

S.Raj Kumar and S.Sowrirajan [5] have proposed image-processing based way to deal with consequently order the ordinary or infected leaves (Early leaf spot, Late leaf spot, Alternaria leaf spot) and furthermore give the cure to a similar which would be gainful to novices in cultivating or planting (as these maladies are basic in blossoming plants like rose too) . In they approach they have joined all the mixture highlights of a leaf to prepare the ANN (BPN-FF) and have made utilization of Lloyd's bunching which is more productive than the customary K-implies grouping to section the test pictures.
Dheeb Al Bashish et. al. [6], proposed that the RGB images be converted into HSI plane and then the color features are extracted (by SGDM generation). The texture features are extracted by obtaining GLCM (Grey Level Co-occurrence Matrix). The input images are segmented using K-means clustering technique and then the segmented images are analyzed by a pre-trained BPN network for detection and classification of plant leaf and stem diseases like early scorch, cottony mold, ashen mold, late scorch and tiny whiteness. The author also compares between various models incorporating various components such as HS,H,S,I,HSI and found that model HS provides the best efficient output amongst all other models with efficiency of 92.7%.

Niket, A.,et. al. [7], stated that the RGB images upon acquisition undergo color space transformation into HSI plane and upon segmentation using K-means clustering the green pixels are masked from the appropriate cluster and the masked green pixels are removed. Then the useful segments are obtained. Then the texture features are extracted using Color-Co-Occurrence Matrix (CCM). The classifier used in BPN-FF. But addition color or shape features or both might
have improved the efficiency of classification.

Arivazhagan, S.,et. al. [8], proposed a new method in which the RGB images are converted to HSI plane and only the Hue component is used for further analysis. Then the green pixels are masked and the masked green pixels are removed. The useful components are obtained upon segmentation and only the texture feature is extracted using Co-occurrence matrix. Then the neural network employing SVM classifier is used to detect and classify early scorch, yellow spots, brown spots, late scorch with efficiency of 94.74%. Here only a single feature extraction is employed and the classifier which is not that efficient in classifying the disease but effectively detects whether the leaf is diseased or not.

Gurpreet Kaur and Himanshu, M.,et. al. [9], provide the study of various classifiers namely K-Nearest Neighbors(KNN) classifier, Support Vector Machines(SVM) classifier, Back Propagation Neural Network-Feed Forward(BPN-FF) classifier, Probabilistic Neural Network(PNN) classifier, General Regression Neural Network(GRNN) classifier.

Sanjeev, S.S.,et. al. [10], provided a new way in which the k-means segmentation is done, followed by feature extraction using GLCM and the classification is done via BPN. Here only hue component is used and instead of k-means segmentation other algorithms could have employed to extract lesion more accurately.

G. Ravichandran and Koteeshwari R S [11], built android app for the crop prediction which suggest the suitable crop to farmer based on soil parameters, which were entered in application by farmer after soil testing. Here automatic soil testing is not performed and there is no check on the current crop status.

## III. PROPOSED SYSTEM

We are proposing a prototype system which is a combination of hardware and software. Sensors designed for obtaining the physical attributes we use pH and soil moisture sensors, which are interfaced with controller. Here we are using raspberry pi controller. Figure 1 shows the actual connection of proposed system.

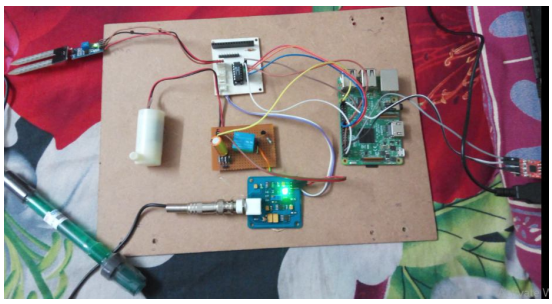

**Figure 1. Prototype system**

High resolution camera digital camera is used to capture the images from farm beforehand and transfer them to computer where image processing is performed in order to detect any diseases on the plant leaves. If starting of disease is detected then appropriate fertilizer is sprinkled on crop using fertigation pump. As we are having pH and moisture related data of soil, suggestion can be given to farmer which crop is suitable of that soil. First preprocessing of images is performed to remove any noise in image to perform enhancement of image, then we perform segmentation using

the conversion of image from RGB to $YC_BC_R$ plane and feature extraction of where we have considered features such as mean, standard deviation, kurtosis and skewness for texture features and discrete wave form transformation for the colour feature extraction. Classifier used is minimum distance classifier which is used to classify unknown image data to classes which minimize the distance between the image data and the class in multi-feature space. The distance is defined as an index of similarity so that the minimum distance is identical to the maximum similarity with the reference image. Based on which decision is taken if leaf is having any disease or in healthy state.

## IV. RESULT ANALYSIS

The result of the proposed system is given below.

After training the dataset the pre-processing of the input image is done by using the top hat and bottom hat approach the below figure 2 shows the top hat and bottom hat enhancement results [12].

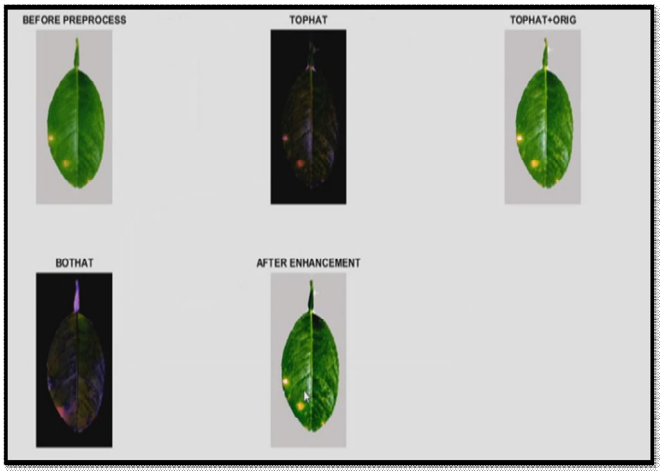


**Figure 2. Output of final enhancement**

After the enhancement the image segmentation is performed which is used for segmentation the image various contours after the segmentation the features are extracted. The output of $YC_bC_r$ model is given in figure 3.

$$Y = (77/256)R + (150/256)G + (29/256)B \quad -(1)$$
$$C_b = -(44/256)R - (87/256)G + (131/256)B + 128 \quad -(2)$$
$$C_r = (131/256)R - (110/256)G - (21/256)B + 128 \quad -(3)$$

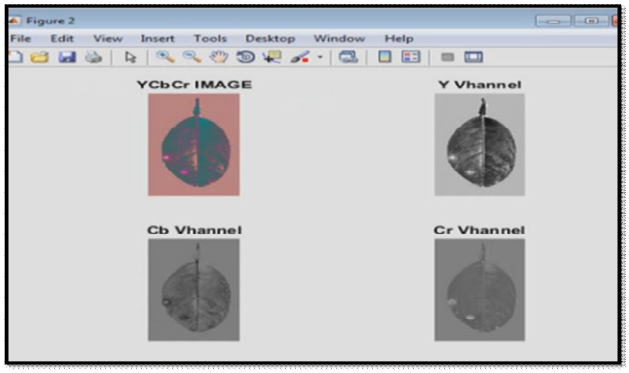


**Figure 3. Output of $YC_bC_r$ model**

After segmentation we need to perform feature extraction, we move on to extract the texture feature. For this purpose we make use of the discrete wavelet transform. The discrete wavelet transforms states to wavelet transforms that the wavelets are disjointedly appraised. A transform which limits a function both in space and scaling and has some necessary properties compared to the Fourier transform. The transform is centered on a wavelet matrix. Most notably, the DWT is used for signal coding, where the assets of the transform are exploited to signify a discrete signal in an extra redundant form, often as a preconditioning for data compression. The discrete wavelet transform has a vast quantity of applications in science, computer science, mathematics and engineering. The mean and standard deviation of the distribution of the wavelet transform coefficients are used to construct the feature vector.

We are able to detect the disease in leaves from the taken dataset to a great extent of accuracy. User is able to view the output on the webserver using his login credentials. We have designed the web page and site for the user to login on the portal and check the status of his farm condition and also he can connect to government site from there our site to get the latest information regarding the current trends in agriculture as shown in figure 5.

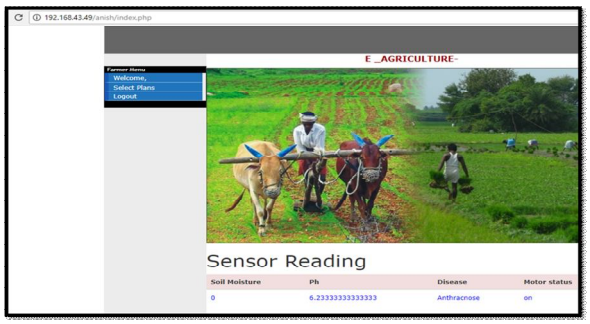


**Figure 4. User view after login**

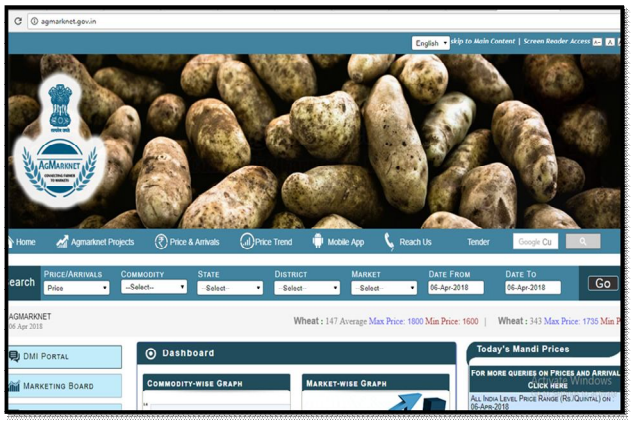


**Figure 5. Government website linked with user login**

## V. CONCLUSION

To sustain high productive growth in a sustainable manner in agriculture, there is a need to move from traditional intensive to technology and skill intensive agriculture techniques, with the advancement in the digital camera and smartphones, we can use leverage there images in image processing. The process of detection and diagnose of disease from such image has been active research area useful in development of several applications to help farmers to know about diseases affecting their yield and save cost needed for the expert suggestions. Despite of several techniques available for disease diagnose of plants, more scope of the project lies to develop computationally inexpensive, robust and high detection and recognition rate techniques.

## REFERRENCES

[1] Vibhute A and Bodhe SK., "Applications of image processing in agriculture: a survey", International Journal of Computer Applications. 52(2), pp. 34-40, 2012.

[2] Amruta A. Aware and Kavita Joshi "Crop and Weed Detection Based on Texture and Size Features and Automatic Spraying of Herbicides", *International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 6, Issue 1, January 2016.

[3] Amruta A. Aware and Kavita Joshi "Wavelet Based Crop Detection And Automatic Spraying Of Herbicides", *International Journal of Innovations & Advancement in Computer Science,* Volume 4, Issue2, February 2015.

[4] Vijai Singh and A.K. Misra "Detection of plant leaf diseases using image segmentation and soft computing techniques", *Information Processing in Agriculture* 4 (2017) 41–49.

[5] S.Raj Kumar and S.Sowrirajan "Automatic Leaf Disease Detection and Classification using Hybrid Features and Supervised Classifier" *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering* Vol. 5, Issue 6, June 2016 DOI:10.15662/IJAREEIE.2016.0506008.

[6] Dheeb Al Bashish, MalikBraik, and Sulieman, B., "A Framework for Detection and Classification of Plant Leaf and Stem Diseases",*IEEE International Conference on Signal and Image Processing*, 2010.

[7] Niket, A., Bharat Jadhav, Smeeta, N., "Detection and classification of plant diseases by image processing",*International Journal of Innovative Science, Engineering & Technology*, Vol. 1 Issue 2, April 2014.

[8] Arivazhagan, S., NewlinShebiah, R., Ananthi, S., Vishnu Varthini,S., "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", *CIGR Journal*, Vol.15, March 2013.

[9] GurpreetKaur, Himanshu, M., "Classification of biological species based on leaf architecture", *International Journal of Computer Science and Information Technology & Security* (IJCSITS), Vol. 2, No.2, April 2012.

[10] Sanjeev, S., Vijay, S., Nargund, V. B., Pallavi "Diagnosis and classification of grape leaf diseases using neural network", *IEEE-2013 4th ICCCNT*, July 4-6, 2013.

[11] Giritharan Ravichandran and Koteeshwari R S "Agricultural Crop Predictor and Advisor using ANN for Smartphones", *IEEE International Conference on Emerging Trends in Engineering, Technology and Science (ICETETS)*, February 2016.

[12] Malik, S., & Lone, T., "Comparative study of digital image enhancement approaches", International *Conference on Computer Communication and Informatics 2014*. http://dx.doi.org/10.1109/iccci.2014.6921749.