JCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Special Issue-8, Apr 2019 E-ISSN: 2347-2693

Detection of Unhealthy Region of Plant Leaves Using Texture Features

S. Malini[1*], T. Ratha Jeyalakshmi[2]

[1]Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-12, Tamilnadu, India
[2]Dept. of Computer Applications, Sri Sarada College for Women, Tirunelveli – 11, India

Corresponding Author: cutemalini19@gmail.com

DOI: https://doi.org/10.26438/ijcse/v7si8.4447 | Available online at: www.ijcseonline.org

Abstract-Crop cultivation plays a necessary function in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reduce the manufacture rate. Plant diseases have curved into a problem as it can cause chief reduction in both quality and quantity of agricultural products. Automatic detection of plant diseases is a critical research topic as it may prove benefits in monitoring large fields of crops, and thus automatically discover the symptoms of diseases as soon as they appear on plant leaves. The proposed approach consists of four main steps, first the input image is converted using color transformation into RGB image and then as a second step the green pixels are masked and removed by segmentation process using specific threshold value, the texture features are extracted then passed through the classifier.

Keywords— Feature Extraction, Segmentation, Transformation, Detection, Classifier.

I. INTRODUCTION

India is well-known for Agriculture that means most of the people are occupied towards agriculture industry. The agriculture industry act as an important role in the economic sectors. Most of the plants are infected by variant fungal and bacterial diseases. Due to the exponential preference of population, plant disease is also caused by climatic conditions. The major challenges of sustainable development are to reduce the usage of pesticides, cost to save the environment and to increase the quality. Precise, accurate and early diagnosis may reduce the usage of pesticides.

The various colored spots and patterns on the leaf are very helpful in detecting the disease. The past scenario for plant disease detection complicated direct eye observation, remembering the exacting set of disease as per the climate, season etc. These methods were indeed, incorrect and very time consuming. The current methods of plant disease finding involved various laboratory tests, skilled people, well equipped laboratories etc. These things are not accessible everywhere particularly in remote areas.

Automatic detection of plant diseases is an essential research topic as it may be advantageous in monitoring huge fields of crops, and detect the symptoms of diseases as soon as they appear on plant leaves [1] [2] [3]. Therefore the need for fast, automatic, less expensive and accurate method to detect plant disease cases is of great realistic significance [4] [5].

II.LITERATURE SURVEY

Al-Bashish et al. in 2011 [1] proposed a fast and accurate method in which the leaf diseases are detected and classified using k-means based segmentation and neural networks based classification. Automatic organization of leaf diseases is done based on high resolution multispectral and stereo images. Sugar beet leaves are used in this work.

In [6] Yang-Cheng Zangh et al (2007) projected fuzzy feature selection approach using fuzzy curves and surface to select features from tainted cotton leaves.

Anthonys et. al. [7] in 2009 proposed the classification between three diseases of paddy found in Sri Lanka. The feature extraction was performed using Color texture analysis and the format of membership function was used for classification.

Abdullah et al. [8] in 2007 presented classification of rubber tree leaf diseases through automation and utilizing primary RGB color model. Classification between three leaf diseases of rubber was carried out using the PCA technique for reducing input dimension and ANN for classification.

Shrutiet.al, [9] in 2014 examined in this paper [8] tomato crop which is attacked by the disease that turns the leaf gray,to white and black in the end. Scientifically, this disease is known as **"cercospora leaf spot"** or **"cercospora crucifer arum"**. This is a disease which often kills young seedlings.

Air is the medium through which fungus spread on the tomato plant. Hence tomato plants must be monitored regularly in order to check their quality. In this paper a novel technique has been proposed which visual the growth of plant from stem and check its type of fungus it is infected. The color depth, size of the fungus, location as well as locus of the fungus on leaves give a precise strength of crop quality under the soil.

Haiguang Wang, et.al, [10] in 2011 proposed in this paper a technique to recognize the disease of two plants. This investigation has been done on two grapes plants and two wheat plants to improve accuracy using image processing techniques. Back propagation (BP) networks were used as the classifiers to identify grape diseases and wheat diseases, respectively. The results showed that identification of the diseases could be effectively achieved using BP networks. While the dimensions of the feature data were reduced by using PCA, the optimal recognition result for grape diseases was obtained as the fitting accuracy was 100% and the prediction accuracy was 97.14%, and that for wheat diseases was obtained as the fitting accuracy and the prediction accuracy were both 100%.

III. PROPOSED METHODOLOGY

First, the images of various leaves are captured and then image-processing techniques are applied to the captured images to extract useful features for future analysis. Figure 1 explains the basic procedure of the proposed vision-based detection algorithm in this paper.

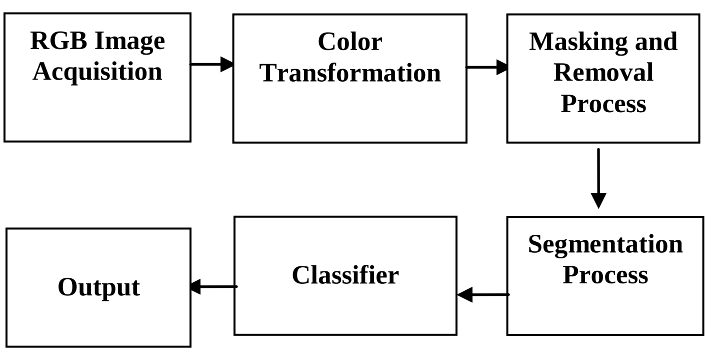

Figure 1. Proposed Work

The step-by-step process of the planned system:
1) RGB image acquisition.
2) change the input image from RGB to HSI format.
3) Masking the green-pixels.
4) Deduction of masked green pixels.
5) Section the components.
6) Get the useful segments.
7) Computing the texture features using Color-Co-Occurrence method.
8) Configuring the Neural Networks for gratitude.

3.1 Color transformation structure

First, the RGB images of leaves are changed into HIS color space representation. The reason of the color space is to help the requirement of colors in some standard, usually accepted way. HSI (hue, saturation, intensity) color model is a well-liked color model because it is based on human perception (Gonzalez and Woods, 2008). Hue is a color characteristic that refers to the main color as theoretical by an observer. Saturation refers to the relative purity or the amount of white light added to hue and intensity refers to the amplitude of the light. Color spaces can be tainted from one space to a different easily. After the alteration process, the H component is taken into account for more analysis.

3.1.1 Masking green pixels

In this pace we distinguish the green colored pixels. After that, based on particular threshold value that is computed for these pixels, the mostly green pixels are covered as follows: if the green component of the pixel amount is less than the pre-computed threshold value, the red, green and blue components of the this pixel is assigned to a value of zero. This is done in sense that the green colored pixels typically signify the healthy areas of the leaf and they do not add any precious weight to disease recognition. Furthermore this considerably reduces the processing time.

3.1.2 Removing the masked cells

In this step, the pixels with zeros red, green, blue values were totally detached. This is helpful as it gives more exact disease classification and much reduces the dealing out time.

3.2 Segmentation

From the above steps, the infected portion of the leaf is gained. The infected region is then segmented into a number of patches of equal size. The size of the patch is chosen in such a way that the important information is not lost. In this approach patch size of 32×32 pixels is taken. The next step is to remove the useful segments. Not all segments have major amount of information. So the patches which are having more than fifty percent of the information are taken into account for the further investigation.

3.3 Color co-occurrence method

The color co-occurrence texture analysis technique is developed through the SGDM. The gray level co-occurrence methodology is a geometric way to describe shape by statistically sampling the way certain gray-levels occur in relation to other gray levels (Argenti et al., 2008). These matrices calculate the probability that a pixel at one particular gray level will happen at a distinct detachment and orientation from any pixel given that pixel has a second particular gray level. The SGDM's are represented by the function $P(i, j, d, \theta)$ where I represent the gray level of the location (x, y), and j represents the gray level of the pixel at a distance d from location (x, y) at an orientation angle of θ. SGDM's are generated for H image.

3.4 Texture features

Texture features like Contrast, Energy, Local, homogeneity, Cluster shade and cluster distinction are computed for the H image. From the texture features, the plant diseases are classified into various types.

3.5 Classifier – Minimum Distance Criterion

In the organization phase, the co-occurrence features for the leaves are obtained and evaluated with the corresponding feature values stored in the feature library. The arrangement is first done using the Minimum Distance Criterion - (Arivazhagan et al., 2010). Success of classification is considered using the classification gain (G) and is calculated using Equation (6).

$$G(\%) = C_{corr}/M * 100$$

where, $Ccorr$ is the number of images correctly classified and M is the total number of images belonging to the particular texture group.

IV. RESULT AND DISCUSSION

Totally, 200 images of plant species Tomato, Banana, Mango, Banana, Mango, Custard apple and potato leaves are taken for the proposed job. The acquired leaf images are distorted into HSI format. The co-occurrence features like contrast, energy, local homogeneity, shade and prominence are gained from the co-occurrence matrix. With these set of co-occurrence features the plant diseases are detected. Samples of leaves with various diseases like early scorch, yellow spots, brown spots, late scorch, bacterial and fungal diseases are shown in Figure 2.

A. Bacterial Disease in Paddy B. Blight Disease

C. Leaf Spot Disease D. Alternaria Disease

Figure 2. Sample Images of Infected Leaves

After mapping the R, G, B mechanism of the input image to the threshold picture, the co-occurrence features are measured. The co-occurrence features for the leaves are extracted and compared with the matching feature values stored in the feature records. The categorization is first done by the Minimum Distance Criterion. The classification gain obtained by Minimum Distance Criterion is 83.10%.

Table 1 minimum distance classifier Accuracy

Plant Species	No. of images used for Training	No. of images used for Testing	Detection Accuracy
Tomato	10	10	80.25
Banana	10	14	92.34
Mango	10	12	94.21
Custard Apple	10	10	86.98
Potato	10	11	90.23

V. CONCLUSION

A reason of texture investigation in detecting and classifying the plant leaf diseases has been planned 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 exact to those plants were taken for our approach. The experimental results point out the proposed approach that can identify and classify the leaf diseases with a little computational effort. By this method, the plant diseases can be recognized at the initial stage itself.

Control tools are real and able to be used to solve pest problems while minimizing risks to people and the environment. The reasons for misclassification are as follows: the symptoms of the diseased plant leaves vary (at the creation, tiny, dark brown to black spots, at later time, it has the phenomena of withered leaf, black or part leaf deletion), also the taken feature classification vectors need to further optimized. In order to get better disease detection rate at various stages, the training samples can be augmented and shape feature and color feature along with the optimal features can be given as input form of disease identification.

REFERENCES

[1] Dheeb Al Bashish, Malik Braik, Sulieman Bani- Ahmad, “Detection and classification of leaf diseases using k-means based segmentation and neural network based classification”, Information Technology Journal, ISSN 1812-5638, pp.267-275, 2011.

[2] Rampf T., A. K. Mahlein, U. Steiner, E. C. Oerke,H.W.Dehne,L. Plumer, “Early detection and classification of plant diseases with Support Vector Machine based on Hyperspectral reflectance”, Computers and Electronics in Agriculture, Volume 74, Issue 1, ISSN 0168-1699, pp. 91-99, October2010.

[3] Hillnhuetter C., A. K. Mahlein, “Early detection and localization of sugar beet diseases: new approaches”, Gesunde Pfianzen 60 (4), pp. 143-149, 2008.

[4] Prasad Babu, Srinivasa Rao, “Leaves recognition using back-propagation neural network – advice for pest and disease controlon crops”, Technical report, department of Computer Science and Systems Engineering, Andhra University, 2010.

[5] Camargo A., Smith J. S., “An image processing based algorithm to automatically identify plant disease visual symptoms”, Biosystems Engineering, Vol. 102, Issue 1, pp. 9-21, 2008.

[6] YC Zhang, HP Mao, B Hu, MX Li., “*Features selection of cotton disease leaves image based on fuzzy feature selection techniques*” In the Proceedings of the 2007 International Conference on Wavelet Analysis and Pattern Recognition, (ICWAPR'07), Beijing, China, Vol. 1, pp.124-129, 2007.

[7] G. Anthonys, N. Wickramarachchi, “An Image Recognition System for Crop Disease Identification of Paddy fields in Sri Lanka,” Fourth International Conference on Industrial and Information Systems, ICIIS 2009, 28 - 31 December, 2009, Sri Lanka.

[8] Noor Ezan Abdullah, Athirah A. Rahim, Hadzli Hashim and Mahanijah Md Kamal, “Classification of Rubber Tree Leaf Diseases Using Multilayer Perceptron Neural Network,” The 5th Student Conference on Research and Development -SCOReD 2007 11-12 December 2007, Malaysia.

[9] Shruti and Nidhi Seth, “Fungus/Disease Analysis in Tomato Crop using Image Processing Technique”, International Journal of Computer Trends and Technology (IJCTT) volume 13 number 2 July, 2014.

[10] Haiguang Wang, Guanlin Li, ZhanhongMa, Xiaolong Li, “Image Recognition of Plant Diseases Based on Backpropagation Networks”, 5th International Congress on Image and Signal Processing (CISP 2012)2011.

[11] Ramakrishnan.M and Sahaya Anselin Nisha.A “Groundnut Leaf Disease Detection and Classification by using Back Probagation Algorithm” IEEE ICCSP conference, pp. 978-1-4 799-8081-9/15, 2015.

[12] Prakash M. Mainkar, Shreekant Ghorpade and Mayur Adawadkar “Plant Leaf Disease Detection and Classification Using Image Processing Techniques” International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 4, e-ISSN: 2394 – 3343, p-ISSN: 2394 – 5494, 2015.

[13] Prajakta Mitkal, Priyanka Pawar, Mira Nagane, Priyanka Bhosale, Mira Padwal and Priti Nagane “Leaf Disease Detection and Prevention Using Image processing using Matlab” International Journal of Recent Trends in Engineering & Research (IJRTER) Volume 02, Issue 02, [ISSN:2455-1457], February– 2016.

[14] Anand Singh Jalal, Shiv Ram Dubey “Detection and Classification of Apple Fruit Diseases Using Complete Local Binary Patterns” IEEE Third International Conference on Computer and Communication Technology, pp. 978-0-7695-4872, 2012.

[15] Monika Jhuria, Rushikesh borse, Ashwani Kumar “Image Processing for Smart Farming: Detection of Disease and Fruit Grading” Proceeding of the IEEE Second International Conference on Image Information Processing, pp. 978-1-4673-6101, 2013.

[16] Mrunmayee Dhakate, Ingole A.B. “Diagnosis of Pomegranate Plant Diseases using Neural Network” IEEE pp. 978-1-4673-8564, 2015.

[17] Ridhuna Rajan Nair, Swapnal Subhash Adsul, Namrata Vitthal Khabale,Vrushali Sanjay Kawade “Analysis and Detection of Infected Fruit Part Using Improved k-means Clustering and Segmentation Techniques” IOSR Journal of Computer Engineering (IOSR-JCE), pp. 37-41, 2015.

[18] Ashwini Awate, Damini Deshmankar, Prof. Samadhan Sonavane “Fruit Disease Detection using Color, Texture Analysis and ANN” IEEE International Conference on Green Computing and Internet of Things (ICGCIoT), pp. 978-1-4673-7910, 2015.

[19] Pujitha N, Swathi C, Kanchana V “Detection Of External Defects On Mango” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 7, pp. 4763-4769, 2016.

[20] Bhavini J. Samajpati, Sheshang D. Degadwala “Hybrid Approach for Apple Fruit Diseases Detection and Classification Using Random Forest Classifier” IEEE International Conference on Communication and Signal Processing, pp. 978-5090-0396, 2016.

[21] Sherlin Varughese, Nayana Shinde, Swapnali Yadav, Jignesh Sisodia “Learning-Based Fruit Disease Detection Using Image Processing” International Journal of Innovative and Emerging Research in Engineering Volume 3, Issue 2, p-ISSN: 2394-5494, 2016.

[22] Khot.S.T, Patil Supriya, Mule Gitanjali, Labade Vidya “Pomegranate Disease Detection Using Image Processing Techniques” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 5, Issue 4, p-ISSN: 2320-3765, 2016.

Authors Profile

S. Malini is currently pursuing full time Ph.D in Computer Science at Sri Sarada College for Women, Tirunelveli. She did her PG in the same institution in 2017 and M.Phil (Computer Science) from Manonmaniam Sundaranar University, Tirunelveli in 2018. Her current field of interest is Leaf Diseases Detection with Image Processing Techniques. Her areas of interest include Cloud Computing and Network Security.