IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.
PP 135-139
www.iosrjournals.org

Survey On Role Of Image Processing Techniques In Plants Pathology

Amrita A. Joshi[1], B. D. Jadhav[2]
[1](*PG student, E&Tc Dept, Rajarshi Shahu College Of Engineering/ Savitribai Phule Pune University ,Pune , India)*
[2](*Faculty E&Tc Dept, Rajarshi Shahu College Of Engineering/ Savitribai Phule Pune University, Pune, India)*

Abstract: *This paper presents a survey on different image processing techniques to identify and classify plant diseases. Growing pollution, nutrient deficiency, drought etc are the reasons because of which plants are prone to the different diseases. Diseases can be found on root, stem, branches, leaves, flowers, and fruits. To suggest appropriate remedy for corresponding disease, identification and classification of diseases is very important. Human Vision has limitations in identifying the diseases and it affects the accuracy. Accurate and timely identification/detection of the diseases keep away the plants from qualitative and quantitative loss. This paper explains different image processing techniques to detect the diseases.*

Keywords: *Co-Occurrence Method, Fuzzy entropy, Gabor filter, Seeded Region Growing algorithm Support Vector Machine.*

I. Introduction

Agriculture performs multiple functions in economics. Apart from producing food and fiber it is main source of economic development in most of the countries. Plants are the main source of energy for human beings and they keep environmental balance. Leaves of the plants are responsible for the process of photosynthesis through which they prepare the food. Plants Diseases result in significant reduction in the quality and quantity of the crop which leads to environmental unbalance and loss in the economy .In many countries human vision is used to detect the pests or diseases on the plants. Detection/Diagnosis of the diseases through human vision requires continuous monitoring of the leaves, stems of plants by the experts. This method is very difficult, time consuming and inaccurate. There are some diseases that do not have any visible symptoms and farmers are not having enough knowledge of few diseases. ,in these cases human vision fails to identify the disease. Therefore, there is a need to detect these diseases in early stage so that the remedies can be suggested according to the severity of the diseases. Currently, Digital image processing is being used in agriculture field from automatic leaf identification to classification of leaf diseases. Image processing techniques help in accurate, timely and automatic detection of diseases. The basic steps for identifying and classifying the plant diseases using image processing are:1)Image Acquisition 2) Image Pre-processing 3) Image Segmentation 4) Feature Extraction 5) Classification.

II. Methodologies

2.1. Fuzzy Logic/Fuzzy Entropy

Majid, K.; Herdiyeni, Y.; Rauf, A.[2] used fuzzy entropy to identify the rice plant diseases. Developed a mobile application based on android operating system and features of the diseases were extracted using fuzzy entropy. He proved with the experiment that the accuracy of the rice diseases identification with fuzzy entropy is near about 91.46% . The fuzzy logic toolbox has been used by Rastogi, A.; Arora, R.; Sharma, S [4] to grade the diseases into different classes. They formed the Fuzzy Inference system (FIS) and used the percentage of the infection as input and calculated the class of the diseases grade as input. Total five diseases classes are derived from fuzzy logic to grade the diseases. Yan-Cheng Zhang; Han-Ping Mao; Bo Hu; Ming-Xi Li[5] used the fuzzy set theory for feature selection. Fuzzy features like fuzzy curve and fuzzy surface was used to select the features of cotton leaf diseases and proposed fuzzy set theory to isolate the significant features and spurious features.

2.2. Clustering

In testing phase of the image processing, Rastogi, A.; Arora, R.; Sharma, S.[4] used the k-means clustering based segmentation and classification. In this method k number of clusters are generated from the

input image and RGB space is converted into L*a*B space because for the leaf image there no need to consider the luminosity factor while processing it.

Al-Tarawneh, Mokhled S [7] worked on an olive leaves spot diseases and proposed a novel technique which is a combination of auto-cropping segmentation and fuzzy c-means clustering. Automatic polygon cropping was used to crop the region of interest and this part was used for the segmentation. Fuzzy C-means clustering classifier was used to classify the diseases and the results were compared with k-means clustering with performance parameters like speed and accuracy. Fuzzy c-means clustering was found superior than the K-means clustering.

2.3. Neural Network

Grapes leaf diseases were detected by Meunkaewjinda, A.; Kumsawat, P.; Attakitmongcol, K.; Srikaew, A.[9]. They proposed three step processing (i) grape leaf color segmentation, (ii) grape leaf disease segmentation, and (iii) analysis & classification of diseases. First segmentation, that is grape leaf color segmentation was done using back-propagation neural network along with self organizing feature maps and genetic algorithm. With the back propagation neural network, color of the grape leaves was identified and then the grape leaf diseases is segmentation was performed. Same technique, Self organizing map (SOM) neural network, has been used by Santanu Phadikar and Jaya Sil for rice diseases classification [14]. Fast and accurate approach for detecting and classifying the diseases was proposed by Al-Hiary, H., et al.[10]. They used , K-means clustering, back propagation feed forward neural network and Otsu segmentation for clustering & classification of diseases. Orillo, John William, et al.[3] also used back propogation artificial neural network to identify the three rice diseases namely (1)Bacterial leaf blight, (2) Brown spot, and (3) Rice blast. Majid, K.; Herdiyeni, Y.; Rauf, A.[2] used probabilistic neural network for classifying the diseases. Images with extracted features using the fuzzy entropy were given as the input. Probabilistic Neural Network was used because it's training speed is faster than back propagation neural network [22].

2.4. Support vector Machine Classifier

Rakesh & Amar[11] proposed prediction approach for developing weather based plant disease detection model. This prediction approach is based on the SVM. They compared performance of conventional artificial neural network, multiple regression, (generalized regression neural network, back propagation neural network) and support vector machine (SVM) and concluded that SVM based regression approach provide better description of the relationship between the environmental conditions and disease level. This relationship is further used for disease management.

S. Arivazhagan, et al [15] used the support vector machine for 10 different types of plants.SVM classifier were used to classify the diseases. Minimum distance criterion for classification was first applied on the segmented and feature extracted image [23]. In Minimum distance criterion, the co-occurrence features for the leaves were extracted and compared with the corresponding feature values stored in the feature library. After this comparison SVM classifier was used. Accuracy after the use of Minimum Distance Criterion is 86.77% after the use of SVM classifier the detection accuracy is improved to 94.74% .Yao, Qing, et al [12] presented an application of Support Vector Machine (SVM) for detecting rice diseases. Rice disease spots were segmented and their shape and texture features were extracted. Shape and color texture features were selected as characteristics features for classification because the color features are affected largely by outside light. The SVM method was applied to classify rice diseases:

1) Bacterial leaf blight 2) rice sheath blight 3) rice blast. From the results they concluded that SVM could effectively detect and classify these diseases with an accuracy of 97.2%.

2.5. Principle Component Analysis

PCA is being used to reduce the extracted features or to reduce the dimensions. Jagadeesh D. Pujari, Rajesh. Yakkundimath, Abdulmunaf Syedhusain. Byadgi [13] applied the PCA to reduce the features of commercial crops like chili, cotton and sugarcane extracted using discrete wavelet transform.PCA has been used as it reduces the redundant data and the noise level.

2.6. Automatic SRG Algorithm

Sarkar, R.K.; Pramanik, A[17] worked on the color images and modified the automatic seeded region growing (SRG) algorithm which was initially proposed by Y. Shih and S. Cheng[16]. This algorithm was used for segmentation of plant leaf diseases. In this algorithm Euclidean distance metric is used to calculate the color

difference between adjacent regions. Automatic SRG algorithm is the region based segmentation method for the color images in which initial selection of the seed controls the region growing. [17] Proposed a novel look up table approach for labeling the neighbors for region merging. The look up table is two dimensional and is created by traversing the image vertically and horizontally. Any change in the labels of pixel is noted in this table. The integration of the table helps in better organization in region merging step and helps in further segmentation of the image. The algorithm was implemented in different color spaces like YCbCr, YCgCr, CIELAB and RGB to check the best performance of the segmentation algorithm. Automatic SRG algorithm with extension of Look Up table shows good leaf disease segmentation results in YCbCr compared to other color spaces.

2.7. Edge Detection Technique

P.Revathi and M.Hemalatha[6] worked on the cotton leaf spot diseases and classified them using Edge detection technique. Mobile captured images were used for detection of the symptoms of the diseases. Image segmentation was done using edge detection technique. Captured image is analyzed by using Image RGB feature ranging techniques and Sobel and Canny filter are used to identify the edges which are Homogeneous Pixel Counting Technique and helps in the classification of cotton spot diseases.

2.8. Color Co-occurrence Method

CCM is generally used to extract the texture feature of the target image. R. Pydipati et al. [18] offered algorithms which were based on Color co-occurrence methodology to identify and classify the citrus diseases. Al-Hiary, H., et al.[10] also proposed the same method to extract the texture features and applied neural network for classification. Experimental results proved that this method detect and classify the examined diseases with a precision between 83% and 94% and 20% increase in the processing speed.

2.9. Gabor Filter

A methodology for detecting pomegranate diseases early and accurately using diverse image processing techniques has been proposed by Anand H.Kulkarni et al. [19], where Gabor filter has been used for feature extraction and ANN based classifier has been used for classification with recognition rate up to 91%. Meunkaewjinda, A.; Kumsawat, P.; Attakitmongcol, K.; Srikaew,[9] used the gabor wavelet on the grape leaves. After grape color leaves Segmentation and diseases Segmentation Gabor wavelet is applied to filter the segmented images. Gabor filter allow for analyzing the plant diseases color features more efficiently.

2.10. Wavelet

For on-line identification of pip fruit pest damage Brendon J. Woodford, Nikola K. Kasabov and C. Howard Wearing [1] proposed a system based on the wavelet transform and neural networks. Fast wavelet transform with special set of Doubenchies wavelet was used to extract the important features of three pests, leaf-roller, codling moth, and apple leaf curling midge. Omrani, Elham, et al.[20] did a research on image processing techniques for identifying the three apple diseases namely alternaria, apple black spot, and apple leaf miner pest .Each type of disease has different symptoms and different features like color texture, shape. These different features have been used for identification and classification of the diseases. To obtain the texture features, especially energy and entropy discrete wavelet transform has been used. A total of 70 features, out of which 14 from color, 24 from wavelet, and 32 from gray level co-occurrence matrix technique, were extracted for each sort of disease.

2.11. Feature selection and rule generation techniques

A novel approach based on the fermi energy for segmentation is proposed by Santanu Phadikar, Jaya Sil, Asit Kumar Das [21].They worked on the rice diseases and features like color, shape and position of the infected part were extracted by developing a new algorithm. Important feature selection was done using rough set theory to reduce the complexity of classifier and to minimize the loss of information. A rule base classifier has been generated to classify the different disease and provide superior result compare to traditional classifiers [24].

TABLE 2.1. Classification Accuracy of different Image Processing Techniques

Application/Paper	Image Processing Techniques Used	Performance Parameters(Accuracy)
I-PEDIA: Mobile Application for Paddy Disease Identification using Fuzzy Entropy and Probabilistic Neural Network[2]	Feature Extraction Using Fuzzy Entropy Probabilistic Neural Network (PNN) as paddy diseases classifier	91.46%
Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features[15]	Co-occurrence matrix Minimum Distance Criterion with SVM classifier	Without Minimum Distance Criterion is 86.77% Minimum Distance Criterion and SVM classifier is 94.74%
Application of support vector machine for detecting rice diseases using shape and color texture features[12]	SVM Classifier	97.2%
Applying image processing technique to detect plant diseases [19]	Gabor filter for feature extraction ANN based classifier	91%
Fast and accurate detection and classification of plant diseases[10]	Color Co-occurrence K-means clustering Neural Network	94%

III. Conclusion

In this survey paper, different image processing techniques for identifying different pant diseases are listed and explained. Image processing techniques play an important role in plants pathology. Various segmentation techniques, feature extraction techniques, classifiers were proposed to increase the identification and classification speed and accuracy. Researchers have the scope to develop a novel hybrid algorithm using different image processing techniques in order to improve the performance of the system. They can also develop a system which will automatically suggest the appropriate remedies according to the type of plant, type of diseases and severity of the diseases.

References

[1] Woodford, Brendon J., Nikola K. Kasabov, and C. Howard Wearing. "Fruit image analysis using wavelets." Proceedings of the ICONIP/ANZIIS/ANNES. Vol. 99. 1999.
[2] Majid, Kholis, Yeni Herdiyeni, and Abdul Mannan Rauf. "I-PEDIA: Mobile application for paddy disease identification using fuzzy entropy and probabilistic neural network." Advanced Computer Science and Information Systems (ICACSIS), 2013 International Conference on. IEEE, 2013.
[3] Orillo, John William, et al. "Identification of diseases in rice plant (oryza sativa) using back propagation Artificial Neural Network." Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM), 2014 International Conference on. IEEE, 2014.
[4] Rastogi, A.; Arora, R.; Sharma, S., "Leaf disease detection and grading using computer vision technology & fuzzy logic," in Signal Processing and Integrated Networks (SPIN), 2015 2nd International Conference on , vol., no., pp.500-505, 19-20 Feb. 2015
[5] Yan-Cheng Zhang; Han-Ping Mao; Bo Hu; Ming-Xi Li, "Features selection of cotton disease leaves image based on fuzzy feature selection techniques," in Wavelet Analysis and Pattern Recognition, 2007. ICWAPR '07. International Conference on , vol.1, no., pp.124-129, 2-4 Nov. 2007
[6] Revathi, P., and M. Hemalatha. "Cotton Leaf Spot Diseases Detection Utilizing Feature Selection with Skew Divergence Method." International Journal of Scientific Engineering and Technology (ISSN: 2277-1581) 3 (2014): 22-30.
[7] Al-Tarawneh, Mokhled S. "An Empirical Investigation of Olive Leave Spot Disease Using Auto-Cropping Segmentation and Fuzzy C-Means Classification." World Applied Sciences Journal 23.9 (2013): 1207-1211.
[8] Doudkin, Alexander A., et al. "Three-level neural network for data clusterization on images of infected crop field." Journal of Research and Applications in Agricultural Engineering 52.1 (2007): 5-7.
[9] Meunkaewjinda, A.; Kumsawat, P.; Attakitmongcol, K.; Srikaew, A., "Grape leaf disease detection from color imagery using hybrid intelligent system," in Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology, 2008. ECTI-CON 2008. 5th International Conference on , vol.1, no., pp.513-516, 14-17 May 2008
[10] Al-Hiary, H., et al. "Fast and accurate detection and classification of plant diseases." Machine learning 14 (2011)
[11] Kaundal, Rakesh, Amar S. Kapoor, and Gajendra PS Raghava. "Machine learning techniques in disease forecasting: a case study on rice blast prediction." BMC bioinformatics 7.1 (2006): 485.
[12] Qing Yao; Zexin Guan; Yingfeng Zhou; Jian Tang; Yang Hu; Baojun Yang, "Application of Support Vector Machine for Detecting Rice Diseases Using Shape and Color Texture Features," in Engineering Computation, 2009. ICEC '09. International Conference on , vol., no., pp.79-83, 2-3 May 2009

[13] Pujari, Jagadeesh D., Rajesh Yakkundimath, and Abdulmunaf Syedhusain Byadgi."Automatic Fungal Disease Detection based on Wavelet Feature Extraction and PCA Analysis in Commercial Crops." International Journal of Image, graphics and Signal Processing (IJIGSP) 6.1 (2013): 24.
[14] Phadik, Santanu, and Jaya Sil. "Rice disease identification using pattern recognition techniques." Computer and Information Technology, 2008. ICCIT 2008. 11th International Conference on. IEEE, 2008.
[15] Arivazhagan, S., et al. "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features." Agricultural Engineering International: CIGR Journal 15.1 (2013): 211-217.
[16] Shih, Frank Y., and Shouxian Cheng. "Automatic seeded region growing for color image segmentation." Image and vision computing 23.10 (2005): 877-886.
[17] Sarkar, R.K.; Pramanik, A., "Segmentation of plant disease spots using automatic SRG algorithm: a look up table approach," in Computer Engineering and Applications (ICACEA), 2015 International Conference on Advances in , vol., no., pp.1-5, 19-20 March 2015.
[18] Pydipati, R., T. F. Burks, and W. S. Lee. "Identification of citrus disease using color texture features and discriminant Analysis." Computers and electronics in agriculture 52.1 (2006): 49-59.
[19] Kulkarni, Anand H., and R. K. Ashwin Patil. "Applying image processing technique to detect plant diseases." International Journal of Modern Engineering Research (IJMER) 2.5 (2012): 3661-3664.
[20] Omrani, Elham, et al. "Potential of radial basis function-based support vector regression for apple disease detection." Measurement 55 (2014): 512-519.
[21] Phadikar, Santanu, Jaya Sil, and Asit Kumar Das. "Rice diseases classification using feature selection and rule generation techniques."Computers and electronics in agriculture 90 (2013): 76-85.
[22] Paithane, A. N., and D. S. Bormane. "Analysis of nonlinear and non-stationary signal to extract the features using Hilbert Huang transform." Computational Intelligence and Computing Research (ICCIC), 2014 IEEE International Conference on. IEEE, 2014.
[23] Paithane A. N. and D. S. Bormane. "Electrocardiogram signal analysis using empirical mode composition and Hilbert spectrum." Pervasive Computing (ICPC), 2015 International Conference on. IEEE, 2015.
[24] Paithane A. N., D. S. Bormane, and Sneha Dinde. "Human Emotion Recognition using Electrocardiogram Signals." International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 2 Issue: 2.