Sugarcane Leaf Disease Detection with Machine Learning Approach Using Fast Wavelet Transform

V. Raja Rajeswari[1], Mrs. R. Suganya[2]
[1, 2] Dept of Computer Science
[1, 2] Sri Krishna Arts and Science College, Coimbatore-641 008

Abstract- *Agricultural production is that aspect on which Indian Economic Development highly counts on. One of the most beneficial crops of India Is Sugarcane. India's sugar business is the second largest agriculture commerce, second just after the fabrics. But, standing a protracted durational harvest, sugarcane is accountable to the multitude affliction caused by pathogens that is fungi, bacteria, viruses and phytoplasmic organisms. strategy of Indian agriculture is proved to be by altering with Image processing techniques, a volume of study and applications like automated disease detection, drone based pesticides and fertilizer dispensing, assessment of yield, vegetative growth, fruit filtering etc. This analysis is carried out to research the convincingness of Image Processing and computer vision techniques for detection of disease in sugarcane plants by examining the leaves. Several primary diseases in sugarcane plant-like red rot, mosaic and leaf scald have been researched and detection algorithm for the equivalent has been executed in this analysis endeavor.*

I. INTRODUCTION

Plant maladies are of crucial significance to people because they harm plants and lessen plant generation on which people transmit for essential food merchandise. Therefore, consecutive and valid infection detection is in tremendous necessity and as a requirement to furnishing vital disease knowledge, by which beneficial plant insurance such as the optimal determination of fungicide spraying, thorough examination of plant pathology, potency examination of fungicide application can be stimulated. However, differences and elaborateness from real atmospheres resulted by natural sunlight, inhabiting plant growth and actions, and complicated area environment are of big challenge for image processing algorithms. Thus, this theory formulates a novel algorithm which can handle with the differences and complicatedness for athletic and consecutive disease detection.

A. Digital Image Processing

The digital image has a fixed set of fragments, named as picture elements or pixels, characterized by the mathematical function f (a, b), where a and b are the vertical and horizontal parameters. Image processing is a discipline for managing an image (Hlavac et al 1999). It includes a huge number of methods that are present in several applications. These techniques can improve or distort an image, highlight specific features of a picture, develop a new image from sections of other images, reinstate an image that has been degraded throughout or after the image acquiring the stage, and so on (Crane 1997).

B. Digital Image Processing In Agriculture

This analysis is initiated from both facets of agrarian demands and image-based strategies. Since non-chemical disease restraint managements such as plant reluctant cultivates, crop rotation or many fungicide application do not furnish sufficient disease deterence. Alternatively, fungicide sprinkling is the vastly significant tool for governing disease extent. Usually, optimal and efficient determinations for the timing and frequency of the adaptive fungicide spraying are rendered in tenures of disease stringency and regional climate circumstances ,by which both monetary penalties and chemical use can be lessened for accuracy plant preservation. Therefore, evidence of disease stringency examination is a crucial assumption for the decision-making process of fungicide sprays. The conventional path for CLS severity assessment is physical field monitoring. It is a procedure that experts instructed assessors first waddle into a field with time extents, and then evaluate the disease stringency by naked eye study based on a specific rating standard, such as a sole leaf scale based or a entire plant scale based .However, this naked eye and bare hand undertaking based filed monitoring have limitations is complicated, sporadic, some extent of prejudiced with the large-scale field, and imprecise with modest disease differences. Especially, the sporadic monitoring may result in elevated chances to late fungicide sprinkles and over broadened spray intervals, resulting in inefficiency in plant conservation.

C. Digital Image Processing Techniques Used

The set of impacted plant images that are saved in the database has to be the input. By continuously surveying the area these images are caught by camera. In this article already

caught images are taken. The quality of the image is increased by utilizing image processing techniques by providing images to the system. The accuracy is increased for discovering the disease is the assignment to be enhanced. The strategies used are classification, feature extraction, segmentation. With respect to size, color, shape based on the virus affected the indications of the disease vary. In this article solving the problem of feature extraction and preprocessing by enhancing the image quality a done. Lots of infected portion images from sugarcane plant are else downloaded from the Flickr and Google by the system and those images are attaining through the image processing techniques .The major aspect is to discover the disease faster with better accuracy. The major technique to inspect the affected region using threshold value is Image Segmentation. According to the pixel of the image the threshold value have to be allocated according to the pixel the system will compare with images that saved in the dataset. By using FWT algorithm the pixel of the image is to be compared and remove the unused pixels using Fourier transform by forming a matrix over the image. Most of the plants will be in green pixels if its changed means that part is affected by some virus or fungus. The proposed method is the improvement of the approach which will increase the accuracy and quality of the image along with less time. According to the harshness of the circumstance the system will give the simple suggestions and information to imply some pesticides and mention the fungus that is induced.

II. LITERATURE REVIEW

Red rot disease is so devastating in nature that it has been referred to as cancer of sugarcane. The first time, red rot is observed in the cultivars of Red Mauritius in the Godavari delta of Andhra Pradesh. The outbreak in Co 419 and Co 658 in Andhra Pradesh, Tamil Nadu, and Pondicherry indicated that those virulent races of the pathogen have got their foothold in these areas. The quest for the new varieties has probably been responsible for the migration of the pathogen from one state to another. In India, red rot is chiefly the disease of standing cane and caused by Colletotrichum falcatum Went. The red rot disease is a major constraint for sugarcane production in India and the subcontinent faced many epidemics in the past resulting in the elimination of many popular varieties from cultivation. It is because the pathogen has gained virulence in last. Prevalence of variation in C. falcatum Went. (Perfect state: Glomerella tucumanensis (Speg.) Arx and Muller) pathotypes are well known. The pathotypes exhibit distinct differential host interaction where certain pathotypes specifically infect their adapted host cultivars. Red rot can affect many commercial varieties during its course of infection and epidemiology. Eventually, all the varieties fell prey to red rot and had to be withdrawn from the general cultivation or had to be replaced by the new more tolerant genotypes. Mosaic disease of sugarcane has been known for long in many countries. It is continuously observed on the widely grown variety Co740 in Maharashtra although it is not known to have caused any serious damage to yields, due probably to the absence of virulent strains of viruses and tolerant nature of the varieties. Its annual recurrence is primarily through the planting of infected seed material and secondary infection is through insect vectors. Mosaic in association with RSD cause reported being more damaging in terms of yield and recovery.

Fig: Redrot

The symptoms as under:

- The characteristic symptom of the disease appears more prominently on the basal portion of younger foliage than the older ones. Generally, chlorotic or yellowish strips alternate with the normal green portions of the leaf giving the mosaic pattern.
- When young affected leaves held against bright light we observe yellowish spots of uneven stripes.
- In severe infections, the chlorotic area considerably increases over the normal green and symptoms also appear on the leaf sheath.
- Sometimes necrotic lesions are regularly produced in the parenchymatous tissues of the internodes and the entire plant becomes stunted and chlorotic control.

Fig: Mosaic

Leaf scald is a bacterial disease that has made its impact in the country in recent years. In India, it was first recorded in April 1961 by Egan during his short stay at I.A.R.I., New Delhi. However, this disease remained almost unnoticed till 1974 when it was reported from Anakapalle (A.P.). Hereafter, the disease has been recorded from different north Indian States, like Punjab, Haryana, Bihar, Uttar Pradesh, Uttarakhand and natural occurrence of this disease was noticed in several commercial genotypes. Prominent among the susceptible genotypes are BO 17, BO 70, BO 90, BO 109, Co 419, Co 1158, Co 62399, Co 7301, Co 8312, Co 8315, Co 8334, Co 93016, CoS 767, CoS 90269, CoLk 7710, CoLk 7901, CoLk 8001, CoLk 8102, CoLk 8901, CoJ 64, CoJ 81, CoH 56, CoH 72, CoH 92201, CoH 94201, CoPant 84211, CoPant 84212, CoPant 84213, ISH 40, etc.The disease is caused by the bacterium Xanthomonas bilinears. There are two distinct phases of the disease viz. (i) chronic phase –the most common phase, (ii) acute phase/ wilting phase – it is of rare occurrence. The distinguishing symptom of chronic phase appears on the leaf as a 'white pencil line'. The white lines are prominent in young leaves. Usually, one or two vascular bundles turn albino and appear as a white line. This is due to the effect of toxin 'albicidin' produced by this pathogen. The 'white pencil line' increase sideways with age and depending on the prevailing weather conditions scalding/drying of the leaves takes place. Occasionally some patches of the red area may occur on the white pencil line. The other most conspicuous symptom of the disease is the development of side shoots (germination of buds) in an acropetal fashion. The crown of the affected plants show inward curling of leaves and in canes having severe infection die prematurely.

Fig: Leaf Scald

III. METHODOLOGY

A. Image Acquisition

The actual moment images are provided instantly from the camera. For further examination, reasonable perception and simple examination of images, white background is established because most of leaves colour varies from red to green for exact segmentation.

B. Image Preprocessing

Image preprocessing is expected to resize caught image from high resolution to low resolution. The image resizing can be accomplished through the process of interpolation. Apprehended input image is being renovated into a grayscale image using colour conversion by the equation

$$\text{Image} = 0.3R + 0.59G + 0.11B$$

The caught image spotted in white background results in large differences between grey values of object and background. The application of computer vision technique to enhance the plant leave in order to detect diseases is referred. Computer vision image enhancement (Colour conversion and Histogram equalization) can be examining highly enhanced images with higher clarity than captured images. Captured infected sugarcane leaves images can be diagnose using Grayscale translation and histogram equalization.

C. Disease Segmentation

Disease Segmentation is a crucial step to give rise to something that is more vital and simpler to analyze. The objective of segmentation is to facilitate or alter the presentation of an image into multiple segments for further

analysis. We can observe objects or other suitable information in digital images. Through image statistics, maximum and minimum grey levels are obtained and threshold values are calculated by averaging the obtained values. These threshold values transmits the grey scale image to binary image.SVM techniques pursues a classification method where, image segmentation and SVM techniques named as Otsu's thresholding is utilized for plant disease classification involves all the possible threshold values through iteration and calculate threshold for each side of pixel level. Separate the pixels into two clusters, then find the mean of each cluster and finally squaring the difference of the means. Support vector machine discovers an image segmentation method using support vector machine and Otsu's method for apple sorting and grading. Results derive by this application of above mentioned technique, indicates segmentation error of 3% to 25% for rigid SVM and 2% for flexible SVM.

D. **Feature Extraction**

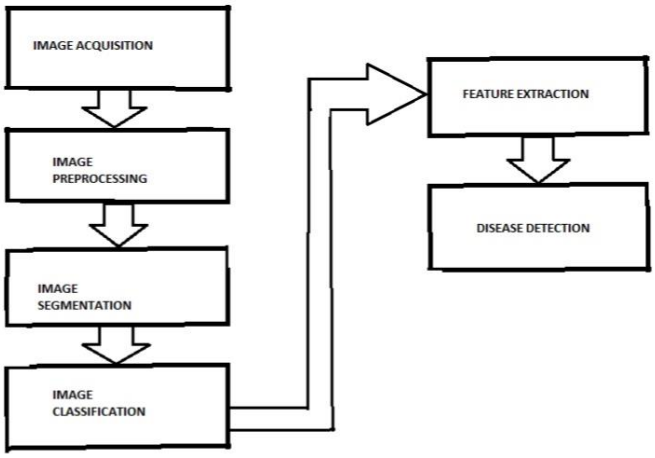
Feature Extraction is one of the extensively fascinating steps of image processing to lessen the valuable part of an image or dimensionally reduction of interesting parts of an image as a compact feature vector. Feature reduction articulation is useful when the image size is large and required to instantly finalize the tasks such as image matching and retrieval. Other common feature extraction techniques include:

1. Histogram of oriented gradients (HOG)
2. Speeded-up robust features (SURF)
3. Local binary patterns (LBP)
4. Haar wavelets
5. Colour histograms

Once the features have been extracted, they may be utilized to build machine learning models for proper object recognition or object detection. GLCM and PCA methods applies feature extraction to recognize leaf for plant classification. Various features are desired to characterize the several properties of the sugarcane leaves. For feature extraction of leaves recognition, gray-level co-occurrence matrix method is introduced. Gray-level co-occurrence matrix (GLSM matrices) is formulated to examine the spatial relationships between pixels.

E. **Classification of Image**

Classification of image consists of database that contains pre-defined patterns that are correlated with detected objects to classify them in a proper category. Classification will be executed on the basis of spectral defined feature such as density, texture etc. To classify an image infected crop disease, classification diagnosis sugarcane plant with symptom of signatures disease, detection of signature disease that is expressed as a number of rules that concern the colour, the shape of the spots, historical weather data.



F. **Disease Detection**:

The conclusive step of the detection of disease is based on the image, the affected part is observed and disease is recognized. The useful segments of the leaf are attained to classify the leaf diseases. The components are segemented using FWT algorithm.

G. **Dataset** :

The formulated melded notion is utilized to observe sugarcane plant leaf diseases. Which is considered the expert dataset having leaf of various types of diseases (Eyespot ,Leaf Scald, Mosaic, Orange Rust ,Pokkah Boeng ,Ratoon S-tunting, Red Rot ,Ring Spot, Smut, Yellow Leaf ,brown stipe). In this theory, the dataset images evaluated are of mainly fungal and bacteria, Viral affected leaf images. In this dataset, some healthy leaf images are also considered for the evaluation of results.

IV. CONCLUSION

In this paper, a computer vision-based technique to detect leaf disease in sugarcane plant has been enforced. Image processing is presently utilized for a volume of applications in agriculture. The assortment of feature extractions like color, size, and shape with several classifiers has enhanced precision to these applications. The three vastly widespread diseases existing in sugarcane plant in India are Red Rot disease, leaf scald disease, and mosaic disease. A detailed study of the factors and indications of this diseases is

illustrated in this examination article. Image classification is conducted by employing Decision tree (DT). Category of leaf dataset is performed according to disease by employing Image processing techniques along with segmentation techniques such as Fast Wavelet Transform (FWT) algorithm and classification is endorsed .Plant's Disease type is identified by contradicting the leaf's image with the image in database to find disease existing. In existing system DWT algorithm is employed to improve the disease detection by improving the pixel range of the image, here it is replaced with FWT algorithm which is faster comparitively. So, this presented image processing concept is productive ample to discern the sugarcane plant diseases.

REFERENCES

[1] Sannakki SS, Rajpurohit VS, Nargund VB, Kulkarni P. Diagnosis and classification of grape leaf diseases using neural networks, the Computing, Communications and Networking Technologies.
Fourth International Conference.2013.p. 15.

[2] Kanungo T, Mount DM, Netanyahu NS, Piatko CD, Silverman R, Wu AY.An efficient k-means clustering algorithm: Analysis and implementation. IEEE transactions on pattern analysis and machine intelligence. Jul 2002; 24(7):881–92.

[3] N.Schor; A. Bechar; T. Ignat; A. Dombrovsky; Y. Elad; S. Berman, "Robotic Disease Detection in Greenhouses: Combined Detection of Powdery Mildew and Tomato Spotted Wilt Virus", in IEEE Robotics and Automation Letters , vol.PP, no.99, pp.1-1, 2016.

[4] Shilpa Dantulwar, R.K.Krishna "PERFORMANCE ANALYSIS USING SINGLE SEEDED REGION GROWING ALGORITHM", International Journal of Innovative Research in Advanced Engineering, Volume 1 Issue 6 (July 2014), ISSN: 2349-2163.

[5] Sungkur, R., Sunilduth Baichoo, and Aroun Poligadu. "An automated system to recognize Fungi-caused diseases of sugarcane leaves, Proceedings of Global Engineering, Science and Technology Conference, 3-4 October 2013.

[6] Patil, Sanjay B., and Shrikant K. Bodhe. "leaf disease severity measurement using image processing. International Journal of Engineering &Technology, vol. 3, no. 5, pp.0975-4024, October- November 2011.

[7] Chaudhari, P., et al. "Color Transform Based Approach for Disease Spot Detection on Plant Leaf", "International Journal of Computer Science and Telecommunications, vol. 3, no.6, June 2012.

[8] Yang, Xiaolu., Shen, Xuanjing., Long, Jianwu., Chen, Haipeng. "An Improved median-based Otsu image thresholding Algorithm, Conference on Modelling, Identification and Control AASRI Procedia, vol 3, pp.468 – 473, 2012

[9] Santosa, Budi, "Tutorial Support Vector Machine. Teknik Idustri, ITS.

[10] Rathore, Vivek Singh., Kumar, Messala Sudhir.,Verma, Ashwini. "Colour Based Image Segmentation Using L*A*B* Colour Space Based On Genetic Algorithm," International Journal of Emerging Technology and Advanced Engineering, vol. 2, issue 6, June 2012.

[11] https://www.google.co.in/url?sa=i&rct=j&q=&src=s&source=images&cd=&cad=rja&uact8&ved=0ahUKEwjw6ZqCtZHYAhVHP48KHc5EAvkQjRwIBw&url=http%3A%2F%2Fwww.cirad.fr%2Fen%2Fourresearch%2Fresearchresults%2F2011%2Fsugarcaneyelow-leaf-inthecaribbean&psig=AOvVaw3Nhyhb2wNuHLd1ficTfFUV&ust=1513612742601249

[12] https://www.google.co.in/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwii1crLtZHYAhXBpY8KHfHsAPkQjRwIBw&url=http%3A%2F%2Fwww.apsnet.org%2Fpublications%2Fimageresources%2FPages%2FSyllabusSugarcane.aspx&psig=AOvVaw0Nklr4SogizAG1PiDE8nj&ust=1513612876768109

[13] https://www.google.co.in/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjliMqCt5HYAhVKqo8KHevMCPIQjRwIBw&url=https%3A%2F%2Fwww.vsisugar.com%2Findia%2Fagriculture_divisions%2Fplantpathology%2Fredrotdiseasesugarcane.htm&psig=AOvVaw2oafEpkaxlm3XU2Y1bTFBO&ust=15

[14] A. Bultheel: Bull. Belg. Math. Soc.: (1995) 2

[15] S. G. Chang, B. Yu, M. Vetterli: IEEE Trans. Image Processing, (2000) 9 p. 1532

[16] S. G. Chang, B. Yu, M. Vetterli: IEEE Trans. Image Processing, (2000) 9 p. 1522

[17] Andreas Antoniou. Digital Filters. McGraw-Hill, second edition, 1993.Google Scholar

[18] Emmanual Bacry, Stephane Mallat, and George Papanicolaou. A wavelet based space–time adaptive numerical method for partial differential equations. Mathematical Modelling and Numerical Analysis, 26:793–834, 1992.zbMATHMathSciNetGoogle Scholar

[19] G. Beylkin, R. Coifman, and V. Rokhlin. Fast wavelet transforms and numerical algorithms. Comm. in Pure and Applied Math., 44:141-183, 1991. zb MATHMathSciNetCrossRefGoogleScholar

[20] G. Beylkin, R. Coifman, and V. Rokhlin. Fast wavelet transforms and numerical algorithms I. Communications on Pure and Applied Mathematics, XLIV:141–183, 1991. Transformation enondelettes.Google Scholar

[21] L. Blum. Lectures on a Theory of Computation and Complexity over the Reals. 18 Coloquio Brasileiro de Matematica – IMPA, 1991.Google Scholar.