Machine Learning For Crop Disease Detection

Dr.D.Thamaraiselvi
Asst.professor, Dept of CSE
Scsvmv Kanchipuram

Abstract- *Plant diseases are generally caused by pest, insects, pathogens and decrease the productivity to large scale if not controlled within time. Agriculturists are facing lose due to various crop diseases. It becomes tedious to the cultivators to monitor the crops regularly when the cultivated area is huge that is in acres. The proposed system provides the solution for regularly monitoring the cultivated area and provides the automated disease detection using remote sensing images. The proposed system intimates the agriculturist about the crop diseases to take further actions. The objective of the proposed system is to early detection of diseases as soon as it starts spreading on the outer layer of the leaves. The proposed system works in two phases: the first phase deals with training data sets. This includes, training both healthy and as well as diseased data sets. The second phase deals with monitoring the crop and identifying the disease using Canny's edge detection algorithm*

Keywords- Wheat Disease, Cotton Disease, Machine Learning Technique, Remote Sensing data, Canny's edge detection algorithm

I. INTRODUCTION

Agriculture gave birth to civilization. India is an agrarian country and its economy largely based upon crop production. Agriculture is the backbone of every economy. In a country like India which has ever increasing demand of food due to the raising population, advances in agriculture sector are required to meet the need.

The agriculture sector needs a huge up-gradation in order to survive the changing conditions of Indian economy. For optimum yield, the crop should be healthy, therefore some highly technical method is needed for periodic monitoring of crop. Crop disease is one of the major factor which indirectly influence the significant reduction of both quality and quantity of agricultural products. A number of varieties of pesticides are available to control diseases and increase the production. But finding the most current disease, appropriate and effective pesticide to control the infected disease is difficult and requires experts advise which is time consuming and expensive.

The presence of disease on the plant is mainly reflected by symptoms on leaves. So there is a need of an automatic, accurate and less expensive Machine Vision System for detection of diseases from the image and to suggest a proper pesticide as a solution.

1.1 Plant Diseases

a. Wheat plant Diseases

The diseases which affect Wheat plant are (1) Leaf Rust (2) Powdery Mildew (3) Stem Rust and (4) Yellow Rust [2]. Leaf Rust causes small brown lesions on the leaves. These blister-like lesions are common on leaves but can occur on the leaf sheath, which extends from the base of the leaf blade to the stem node. Lesions caused by leaf rust are normally smaller, more round, and cause less tearing of the leaf tissue than those caused by stem rust. Powdery mildew causes white lesions on leaves and leaf sheaths. Glumes and awns also can be infected when the disease is severe. Fungal growth is largely limited to outer plant surfaces and can be easily wiped away by rubbing a finger across affected areas. Mature lesions may have dark, reproductive structures mixed with the white, cottony growth of the fungus [3]. Stem Rust causes blister-like lesions on leaves, leaf sheaths, and stems. Infection of glumes and awns is also possible. The reddish-brown spores of the fungus cause considerable tearing as they burst through the outer layers of the plant tissues. Mature stem rust lesions are more elongated than those of leaf rust. Yellow rust also known as stripe rust, is a fungal disease of winter wheat. It produces leaf lesions (pustules), which are yellow in colour and tend to be grouped in patches. Yellow rust often occurs in narrow stripes, 2–3 mm wide that run parallel to the leaf veins. Yellow rust is responsible for approximately 73-85% of recorded yield losses, and grain quality is also significantly reduced.

b. Cotton Leaf Diseases

1) Bacterial Blight

Bacterial blight is bacterial disease mainly caused by the bacteria "Xanthomonas Campestris pv. Malvacearum" [6]. The symptoms of Bacterial blight starts as Dark green, water soaked angular spot of 1 to 5 mm on a leaf with red to brown

border. At the beginning, these angular leaf spots appear as water-soaked areas which later on changes from dark brown to black color [7]. The spots on the lesion area of leaves may spread over the major veins of leaf and in later petioles and stems get infected and premature fall off of the leaves occur[8]

2) Alternaria

It is a fungal disease mainly caused by A. Alterneta or Alternaria macrospora [8]. The disease is most severe on the lower part of leaves as compared to the upper part and may get confused with the spots of bacterial leaf blight as the symptoms are nearly similar [9]. At the beginning, brown, gray-brown to tan colored small circular spots appears on leaves and vary from 1-10mm in size which later on become dry, dead with gray centers which crack and fall out [9]. Sometimes, old spots combine together and create irregular dead areas.

3) Cerespora

Cercospora is brought about by the Cercospora Gossypina [8]. The tainted leaf has red spot blemishes on the leaves which expand in distance across to around 2 cm. The spots are round or unpredictable in shape with yellowish, purple, dark brown or blackish fringes with white focuses [9]. The rakish leaf spot shows up because of the limitation of the lesion region by fine veins of the leaf. This malady influences more seasoned leaves of develop plants.

4) Grey Mildew

It is fungal disease generally caused by the Ramularia Areola Atk. in imperfect stage and Mycosphaerella areola in perfect stage [8]. At the initial stage, the infection appears as triangular, square or irregularly circular whitish spots of 3–4 size on leaves [9]. This disease primarily appears as irregular angular and pale translucent spots of diameter 1-10mm on older leaves of matured plant [10]. The infected regions are light to yellowish green in color on the upper surface. As disease infection increases, the small spots merge together forming bigger spots and the leaf tissues turn yellowish brown while whitish frosty growth appears on a lower surface but occasionally on the upper surface [10]

5) Fusarium Wilt

It is the fungal ailment largely caused by Fusarium oxysporum [8]. The organism can assault cotton seedlings, but the sickness for the most part shows up when the plants are more matured [9]. The influenced plants first get to be distinctly darker green and hindered [6]. Latterly, the yellowing of the leaves and loss of foliage is observed. At first, the manifestations show up on lower leaves around the season of first blossom and the leaf edges shrink, turn yellow initially followed by brown with inward movement.

II. LITERATURE SURVEY

Huang et al, studied the spectral characteristics of wheat and demonstrated a method to develop new spectral indices (NSIs) using RELIEF-F algorithm [2]. This method did not involve periodic monitoring of the crops.

Chenghai yang proposed a system describes the design and testing of an airborne multispectral digital imaging system for remote sensing applications. The system consists of four high resolution charge coupled device (CCD) digital cameras [4] this system involved huge maintenance cost.

Wenjiang Huang framed a systematic method for Canopy spectral characteristics of wheat infested by aphid [5], but this methodology involved tedious calculations.

Davoud Ashourloo, et. al.[11] proposed the machine learning techniques for Wheat Leaf Rust disease detection as well as evaluate the training sample size and influence of disease symptoms effects on the methods of predictions. This paper compares the performance of PLSR, v-SVR, and GPR with the PRI and NBNDVI. The combinations of disease symptoms at each disease severity level results in complex spectra which declined the accuracies of PRI and NBNDVI while they do not have adverse impacts on PLSR, V-SVR, and GPR performances. The GPR's performance using smaller training data set results in higher accuracy than other methods.

P. Revathi, et al.[12] proposed two phases to identify the lesion region of the disease. First Edge detection technique is used for segmentation and then image analysis and classification of diseases is done using the proposed HPCCDD Algorithm. This paper proposed RGB feature based techniques in which, the captured images are processed first and then color image segmentation is carried out to get disease spots. The edge features are extracted to identify the disease spots using Sobel and Canny filter.

III. PROPOSED APPROACH

The proposed system has two phases, first phase deals with training datasets. Both healthy and diseased leaf images are collected. Once the dataset is ready with healthy and infected image samples, the threshold is extracted for both aging and for diseases.

Periodically images are obtained by remote sensing. RGB values of the monitored images are extracted and compared with threshold images. If the threshold is greater or less than given value, histogram analysis and edge detection techniques are used to identify particular plant diseases.Different types of crops given as the input to the Training Model. For each crop, plenty of Healthy and defected crop images are considered. Set the threshold value for each crop. Train the model in a such a way that it should take the proper decision for all types of crops. Different spatial resolution images are obtained from different agricultural satellites such as NASA's TERRA satellite, RESAT-1,PSLV-C16 and PSLV-C36

3.1 Disease Detection

Reference image is given as input to DSS. This system makes use of trained model to take the further decision. Trained model uses the dataset to provide a proper suggestion.

If there is a huge change in the threshold of the Reference Image, then check whether its due to aging. If so, no need of intimating to the farmer. But if the change is due to disease that is deformities in leaves and color change in leaves will be identified then edge detection and histogram analysis will be carried out to give the proper solution.

3.2 Canny Edge Detection Algorithm

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

- Apply Gaussian filter to smooth the image in order to remove the noise
- Find the intensity gradients of the image
- Apply non-maximum suppression to get rid of spurious response to edge detection
- Apply double threshold to determine potential edges
- Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

3.3 Algorithm for Disease Detection

- Start
- Read the reference image
- Check the threshold
- If change in threshold due to aging then goto step 7.
- Else
- Convert the image into grayscale.
- Apply Canny edge detection algorithm
- Get the histogram value.
- Identify the particular disease for the reference image.
- Stop

IV. CONCLUSION

The proposed system periodically monitors the cultivated field. Crop diseases are detected in early stage by using edge detection and histogram matching. Machine learning techniques are used to train the model which helps to take a proper decision regarding the diseases. The pesticide as a remedy is suggested to the farmer for infected diseases to control it. In future the proposed system may be implemented by adding extra services like near by government stores, price list for the pesticides, near by open market and many more.

REFERENCES

[1] Adhao Asmita Sarangdhar , V. R. Pawar , " Machine Learning Regression Technique for Cotton Leaf Disease Detection and Controlling using IoT", International Conference on Electronics, Communication and Aerospace Technology ",ICECA 2017

[2] Huang et al., "New Optimized Spectral Indices For Winter Wheat Diseases", IEEE journal of selected topics in applied earth observations and remote sensing, pp. 128-135, 2014.

[3] Delwiche, M. S. Kim, "Hyperspectral imaging for detection of scab in wheat", Biol. Qual. Precis. Agric., vol. 4203, pp. 13-20, 2000.

[4] Chenghai Yang, "A high-resolution airborne four-camera imaging system for agricultural remote sensing", Computers and Electronics in Agriculture, pp. 13-24, 2012.

[5] Zhihao Qin, Minghua Zhang, T. Christensen, Wenjuan Li, "Remote sensing analysis of rice disease stresses for farm pest management using wide-band airborne data", Geoscience and Remote Sensing Symposium, pp. 7-13, 2003.

[6] P. R. Rothe, R. V. Kshirsagar, "Cotton Leaf Disease Identification using Pattern Recognition Techniques", International Conference on Pervasive Computing (ICPC) IEEE, pp. 1-6, 2015.

[7] Viraj A. Gulhane, Maheshkuma R. H. Kolekar, "Diagnosis Of Diseases On Cotton Leaves Using Principal Component Analysis Classifier", Annual IEEE India Conference (INDICON), 2014.

[8] Texa plant disease handbook, [online] Available: http://plantdiseasehandbook.tamu.edu/industryspecial tylfiber-oil-specialty/cotton/.

[9] Plant village Cotton, [online] Available: https://www.plantvillage.org/en/topics/cotton.
[10] P. Revathi, M. Hemalatha, "Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge detection", IEEE, July 2012.
[11] Davoud Ashourloo, Hossein Aghighi, Ali Akbar Matkan, Mohammad Reza Mobasheri, Amir Moeini Rad, "An Investigation Into Machine Learning Regression Techniques for the Leaf Rust Disease Detection Using Hyperspectral Measurement", IEEE Journal Of Selected Topics In Applied Earth Observations And Remote Sensing, pp. 1-7, May 2016.
[12] P. Revathi, M. Hemalatha, "Classification Of Cotton Leaf Spot Disease Using Image Processing Edge Detection Technique", International Conference on Emerging Trends in Science Engineering and Technology IEEE, pp. 169-173, 2012.