Smart Agriculture: Image Processing-Based Automated Detection of Cotton Leaf Diseases

Prof. C. P. Lachake[1], Girish Khamkar[2], Kishor Handge[3], Aryan Kakade[4], Siddhant Gadkari[5]

[1]Associate Professor, Department of Computer Engineering, SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra

[2,3,4,5] U. G. Student, Department of Computer Engineering, SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra

---

Abstract:— Nowadays in India Cotton is considered one of the most important cash crops i.e. White Gold, as most farmers cultivate cotton in large numbers. Agriculture plays a vital role in the economic development of our country. Farmers face various challenges due to unexpected weather changes and plant diseases that reduce crop yield and quality. Cotton, one of the major cash crops, is highly affected by leaf diseases, which are often difficult to detect at an early stage using manual methods. To overcome this issue, the proposed system focuses on automating the detection and classification of cotton leaf diseases using image processing and machine learning techniques. In this project, images of cotton leaves are captured and processed to identify disease symptoms such as color variation, texture, and shape. Using trained machine learning models, the system can accurately classify the type of disease and provide information about suitable remedies or preventive measures. This approach helps farmers take timely action and reduce the cost spent on unnecessary fertilizers and pesticides.

Keywords: Smart Agriculture, Image Processing, Leaf Disease Detection, Classification, Segmentation, Leaf Image, KNN Algorithm, SVM (Super Vector Machine), etc.

I. INTRODUCTION

Recently, Agriculture is the prime occupation of India. Cotton called as 'White Gold' is a major agricultural crop in India, has a dominant impact on overall Indian agriculture sector. Indian cotton cultivation is also riddled with several attended doubts relating to crop cultivation, protection, picking, transportation, and storehouses. Nowadays there is a tremendous loss in quality and quantity of cotton yield because of various diseases affecting the plant. Plant disease classification is a critical step, which can be useful in early detection of pest, insects, controlling of diseases, increase in productivity etc. for this image processing techniques are used for very fast, accurate and appropriate classification of diseases. Symptoms of diseases in cotton predominantly come out on leaves of plants. Farmers recognize disease manually with foregoing symptoms of plants, and with the help of experts, the actual diseases are not identified with the naked eyes, which is time-consuming. There may exits more than one disease on a leaf which shows indistinguishable characteristics, so classification of such diseases is difficult, image processing and SVM classifier can be used for automatic detection of diseases on leaf. The wrong judgement of diseases by

farmers may lead to the imprecise or enormous use of pesticides, may damage the plants and its production.

The cotton leaf area monitoring is an important tool in studying physiological features related to the plant growth, photosynthetic & transpiration process. Also being helpful parameter in evaluating, damage caused by cotton leaf diseases and pastes, to find out water and environmental stress, need of fertilization, for effective management and treatment. This system also presents an automated system integrated with machine vision techniques that will assist the farmers get the accurate information about their crops using their system. The uploaded pictures of paddy captured by the mobile phones will be processed in the central server and the analysis report will be presented to an expert group for their opinion, who will then be able to send proper recommendations through a simple notification using the system, according to the severity of the situation.

II. LITERATURE SURVEY

- **Vishnu S, A. Ranjith Ram [1].** In this review paper we discuss the various methodologies for plant disease detection. Studies show that relying on pure naked-eye observation of experts to detect and classify diseases can be time consuming and expensive, especially in rural areas and developing countries. So we present fast, automatic, cheap and accurate image processing based solution. Solution is composed of four main phases; in the first phase we create a color transformation structure for the RGB leaf image and then, we apply color space transformation for the color transformation structure. Next, in the second phase, the images are segmented using the K-means clustering technique. In the third phase, we calculate the texture features for the segmented infected objects. Finally, in the fourth phase the extracted features are passed through a pre-trained neural network.
- **Pawan P. Warne, Dr. S. R. Ganorkar, [2]** This paper presents an approach for careful detection of diseases, diagnosis and timely handling to prevent the crops from heavy losses. The diseases on the cotton are critical issue which makes the sharp decrease in the production of cotton. So for the study of interest is the leaf rather than whole cotton plant because about 85.95% of diseases occurred on the cotton leaves like Alternaria, Cercospora and Red Leaf Spot. In this proposal initially preprocessing the input image using histogram equalization is applied to increase the contrast in low contrast image, K-means clustering algorithm is used for segmentation which classifies objects based on a set of features into K number of classes and finally classification is performed using Neural network. Thus image processing technique is used for detecting diseases on cotton leaves early and accurately. It is used to analyze the cotton diseases which will be useful to farmers.
- **Dimitri A. Lisin, Marwan A. Mattar, Matthe w B.Blaschko,[3]** Object recognition is a central problem in computer vision research. Most object recognition Systems have taken one of two approaches, using either global or local features exclusively. This may be in part due to the difficulty of combining a single global feature vector with a set of local features in a suitable manner. In this paper, we show that combining local and global features is beneficial in an application where rough segmentations of objects are available. We present a method for classification with local features using non-parametric Density estimation. Subsequently, we present two methods For combining Local and Global features. The first

uses a “stacking” ensemble technique, and the Second uses a hierarchical classification system. Results show the superior performance of these combined methods over the component classifiers, with a reduction of over 20% in the error rate on a challenging marine science application.

- **P.R. Rothe, and R. V. Kshirsagar, [4]** Feature extraction is a significant constituent of a pattern recognition system. It carries out two assignments: converting input parameter vector into a feature vector and or reducing its dimensionality. A distinct feature extraction algorithm makes the classification process more effectual and efficient. The allocation and recognition of cotton leaf diseases are of the major importance as they have a cogent and momentous impact on quality and production of cotton. In this work we present a snake based approach for the segmentation of images of diseased cotton leaves. We extract Hu’s moments which can be used as shape descriptors for classification. A theory of two-dimensional moment invariants for planar geometric figures is also presented. Three diseases have been considered, namely Bacterial Blight,
- **P. Revathi, M. Hemalatha, [5]** This Proposed Work exposes, a advance computing technology that has been developed to help the farmer to take superior decision about many aspects of crop development process. Suitable evaluation and diagnosis of crop disease in the field is very critical for the increased production. Foliar is the major important fungal disease of cotton and occurs in all growing Indian regions. In this work we express new technological strategies using mobile captured symptoms of cotton leaf spot images and categorize the diseases using HPCCDD Proposed Algorithm. The classifier is being trained to achieve intelligent farming, including early Identification of diseases in the groves, selective fungicide application, etc. This proposed work is based on Image RGB feature ranging techniques used to identify the diseases (using Ranging values) in which, the captured images are processed for enhancement first. Then color image segmentation is carried out to get target regions (disease spots). Next Homogenize techniques like Sobel and Canny filter are used to identify the edges; these extracted edge features are used in classification to identify the disease spots. Finally, pest recommendation is given to the farmers to ensure their crop and reduce the yield loss.

III. PROBLEM STATEMENT

In agriculture, determining the leaf disease is a challenging task that is use to prevent the serious outbreak. If the farmers are able to identify the health status of plant leaves it will be easy for them to continue the farming. So the objective of the project is to identify plant leaf and predict the disease of the leaf. In this proposed system, the early stage diagnosis of plant disease is an important task. Farmers require continuous monitoring of experts which might be prohibitively expensive and time consuming. Therefore looking for fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic significance.

IV. RELATED WORK (COTTON DISEASE)

The diseases on cotton are fungal, bacterial, viral diseases which not only appear on leaf of plant but also on cotton balls, cotyledons, seedling, root etc. To be familiar with the diseases found in the cotton we may able to know the sign and symptoms of disease and get most extreme thoughts with respect to the control

measures and administration of infection found in cotton, recognizable about the pesticides like fungicides, pesticides, bug sprays and their utilization in the product at various circumstances applying diverse technique. A few cotton diseases usually occur on cotton are:

1. **Bacterial Blight:** Bacteria Xanthomonas campestris pv. Malvacearum. is the root cause of this bacterial disease.

   Symptoms: In Bacterial blight, leaf spots appear red to brown in colors with angular in shape. The precise appearance is caused by limitation of the sores by fine veins of the cotton leaf. Spots on contaminated leaves may disseminate along the significant leaf veins. As the ailment advances, leaf petioles and stems may end up contaminated, leading to loss of leaves.

Fig.1: Bacterial Blight leaf spot

2. **Fungal leaf spot:** It is a fungal disease also called as Alternaria macrospora of Alternaria Leaf Spots.

   Symptoms: Alternaria leaf spot is a leaf disease but, symptoms may also occur on cotyledons and bolls. Contamination on cotyledons, leaves, and bracts initially shows up as little, circular brown; grey-brown to tan spots which fluctuate in estimate from 1-10 mm. Developed spots have dry, dead, grey centers which regularly break and drop out.

Fig.2: Fungal Leaf Spot

3. **Corynespora Leaf Spot:** At early stage cause by organism Ramularia areola Atk. And at perfect stage Mycosphaerella areola. It is also known as Gray mildew.

   Symptoms: The parasite normally attacks the older leaves making irregular or angular, pale, translucent spots. They are typically restricted by the vein lets and show up for the most part on the lower surface of the leaf however once in a while on the upper surface. A few to over a hundred spots might be found on a solitary leaf. In extreme conditions the leaves turn yellowish darker and falls off rashly.

Fig.3 Corynespora Leaf Spot

4. **Rhizoctonia:** Rhizoctonia is also known as Magnesium Deficiency it is an injurious plant disorder occurs in strongly acidic, light and sandy soils where magnesium gets easily leached away.

   Symptoms: Magnesium Deficiency begins first at older leaves of plant where green leaves turns into purple in color. Mature or older leaves appear completely red in color which leads to reduction in production.

Fig.4: Rhizoctonia

V. PROPOSED SYSTEM

The In this project, we propose a web based application that helps farmers for identifying cotton leaf disease by uploading leaf image to the system. The system has an already trained dataset of images for the cotton leaf. Input image given by the user undergoes several processing steps to detect the severity of disease by comparing with the trained database images. First the image is resized and then its features are extracted on parameters such as color, color of wavelet transform. Next, classification is done to separate the image as infected or non-infected. Diseases are impairment to the normal state of the plant that modifies or interrupts its vital functions such as photosynthesis, transpiration, pollination, fertilization, germination etc. These diseases are caused by pathogens viz., fungi, bacteria and viruses, and due to adverse environmental conditions. Therefore, the early stage diagnosis of plant disease is an important task. Farmers require continuous monitoring of experts which might be prohibitively expensive and time consuming. Therefore, looking for fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic significance. The system consists of a web based application, which will enable the farmers to take images of plants and send it to a central server where the central system in the server will analyze and preprocessing the pictures based on visual symptoms using IP algorithms in order to measure the disease type.

VI. SYSTEM ARCHTECTURE

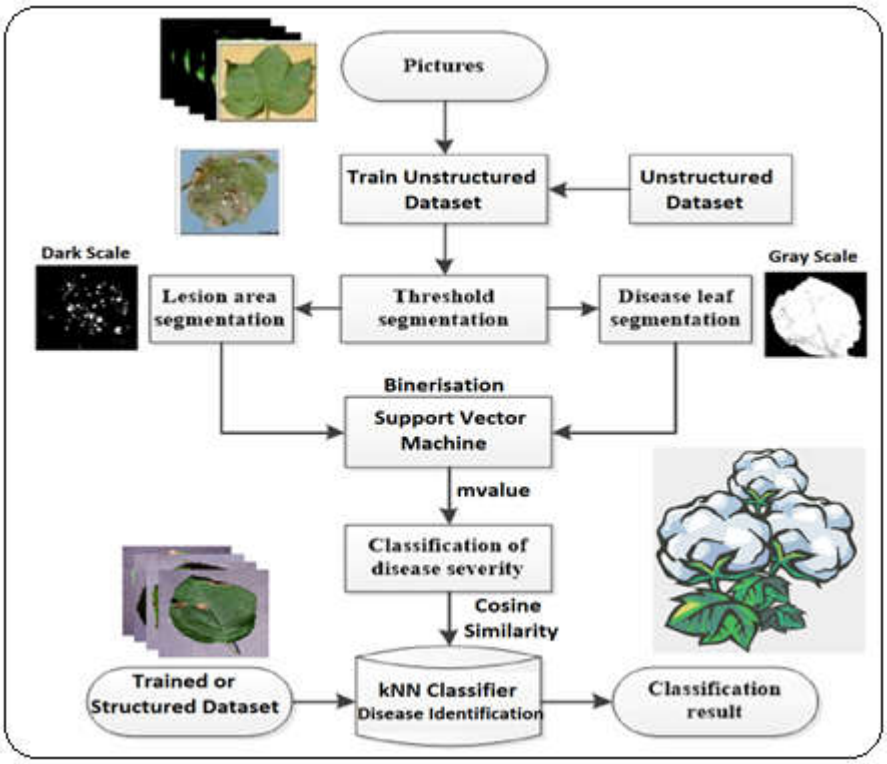

Fig.5: System Architecture

The proposed methodology for leaf diseases detection and classification using image processing consists of following steps:

A. Acquisition of RGB Image

B. Preprocessing of acquired Image

C. Image Segmentation

D. Feature Extraction of Segmented Image

E. Classification.

VII. CONCLUSON

In this proposed work we introduce a system that subsists of collecting the necessary database of different cotton diseases by surveying different fields. An image processing techniques along with segmentation and classification techniques are used for identification of cotton leaf diseases such as Bacterial blight and Magnesium Deficiency done using SVM. Color segmentation where RGB image is color space by using segmentation to extract diseased part (area of interest) from leaf images with efficient features. Features such as color, shape and texture are useful for pattern recognition; classification, accurate and error free classification are calculated. Finally k-nearest neighbor is use to classify with correct disease for train infected cotton leaf images. Future work will consists of developing a more efficient, robust machine vision system for early automatic detection of various types of diseases in plants. Classifier will base on selection of different features or fusion of different algorithms for rapid and detailed detection of diseases in future works.

ACKNOWLEGEMENT

I would prefer to give thanks the researchers likewise publishers for creating their resources available. I'm conjointly grateful to guide, reviewer for their valuable suggestions and also thank the college authorities for providing the required infrastructure and support.

REFERENCES

[1] A H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh. Fast and Accurate Detection and Classification of Plant Diseases. International Journal of Computer Applications (0975 – 8887) Volume 17– No.1, March 2011

[2] A. Meunkaewjinda, P. Kumsawat, K. Attakitmongcol et.al. Grape leaf disease detection from color imagery using hybrid intelligent system. Proceedings of ECTI-CON 2008.

[3] S. Vishnu, and A. Ranjithram, "Plant Disease Detection Using Leaf Pattern: A Review" International Journal of Innovative Science, Engineering Technology, Vol. 2 Issue 6, June 2015.

[4] M. Badnakhe, and P. Deshmukh, "Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering" International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 2 Issue 3, March 2012.

[5] D. Naik, and A. Vyavahare, "Disease Detection of Cotton crop using Image Processing Technique: A Survey," International Journal for Research in Applied Science Engineering Technology (IJRASET), Volume 3 Issue VI, 2015.

[6] P. Warne and S. Ganorkar, "Detection Of Diseases On Cotton Leaves Using K-Means Clustering Method," International Research Journal of Engineering and Technology (IRJET), Pp. 425–431, 2015.

[7] P. Rothe and R Kshirsagar, "SVM-Based Classifier System For Recognition Of Cotton Leaf Diseases," International Journal Of Emerging Technologies In Computational And Applied Sciences (IJETCAS), Pp. 427–432, 2014.

[8] P. Rothe and R. Kshirsagar "A Study and Implementation of Active Contour Model For Feature Extraction: With Diseased Cotton Leaf as Example," International Journal of Current Engineering and Technology, Vol. 4, No. 2, Pp. 812–816, 2014.

[9] Diseases Detection of Cotton Leaf Spot using Image Processing and SVM Classifier", IEEE, 2018.