ISSN No. 0976-5697

Volume 3, No. 3, May-June 2012

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Computing Performance Evaluation of Cotton Leaves Spot Diseases Recognition using Image Segmentation

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Abstract: In this model of work, a new computing technology has been proposed to help the farmer to take superior decision about many aspects of crop manufacturing process. Suitable evaluation and diagnosis of crop diseases in field is very critical for the increased production. Foliar is the most important fungal disease of cotton and occurs in all growing Indian cotton regions. In this work we express Technological strategies using mobile captured symptoms of cotton leaves spot images and classify the diseases using neural network. The classifier is being trained to achieve intelligent farming, including early detection of diseases in groves, selective fungicide application, etc. This proposed work is based on image pre-processing techniques in which, the captured images are processed for enhancement first. Then color image segmentation is carried out to get target regions (disease spots). Later, image features such as shape, color and texture are extracted for the disease spots to identify diseases and control the pest recommendation.

Keywords: Computing Technology, Foliar diseases, Cotton leaves diseases, Neural Network, Image Processing.

I. INTRODUCTION

India is an agricultural country; wherein about seventy percentage of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality product is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life.

Cotton," The White Gold" or the "King of Fibers" enjoys a pre-eminent status among all cash crops in the country and is the principal raw material for flourishing textile industry. It provides livelihood to about sixty million people and is an important agricultural commodity providing remunerative income to millions of farmers both in developed and developing countries. In India, in spite of severe competition from synthetic fibers it is occupying the premier position with a seventy percent share in the textile industry.

Cotton (*Gossypium* spp.) is a crop of warm climate and requires a regular supply of water either natural in the form of rainfall or assured through canals from the above surface and/or from underground sources. Although cotton is not a water loving plant, it requires a regular supply of water for maintaining growth and balance between vegetative and reproductive phase. About fifty five percentages of the world cotton area is under irrigation and the balance is rain fed. Country seventy percentage of the cotton cultivated area in India is under rain fed conditions. Water stressed seed or plant, will have poor growth leading to low yield as well as exposure to diseases.

A. The Image analysis in Agricultural:

The image processing techniques are extensively applied to agricultural science, and it has great perspective especially in the plant protection field, which ultimately leads to crop management.

Image analysis can be applied for the following purposes:

a. To detect diseased leaf, stem, fruit
b. To quantify affected area by disease.
c. To find shape of affected area.
d. To determine color of affected area
e. To determine size & shape of fruits.

This work develops the automatic system to identify the diseases using infected images of various cotton leaf spots. Images are captured by digital camera mobile and processed using image growing, image segmentation techniques to detect infected parts of the plants. Then the infected part of the leaf spot has been using for the classification purpose using neural network. The methods evolved in this system are both image processing and computing techniques.

II. TYPES OF COTTON LEAF SPOT DISEASES

The diseases on the cotton leaves are classified as

a. Fusarium wilt
b. Verticillium wilt
c. Root rot
d. Boll rot
e. Grey mildew
f. Circular dry brown lesions up to 10mm across may also be seen on the bolls. *A. alternata* causes usually purple specks or small lesions with purple margins on leaves and bolls.

g. Leaf blight
h. Bacterial blight
i. Leaf curl

III. SYMPTOMS OF COTTON DISEASES

A. Grey Mildew (Areolate Mildew/ Dahiya) - Ramularia Areola:

This disease initially appears on older leaves as the plants reach maturity, in the form of irregularly angular, pale translucent spots, 1-10mm (usually 3-4 mm) in diameter and with a definite and irregular margin formed by the veins of the leaf (called areolate). The lesions are light to yellowish green on the upper surface. As the spots grow older, the leaf tissues turn yellowish brown while a whitish frosty growth appears chiefly on the under surface but occasionally also on the upper surface. This is the conidial stage of the causal fungus. Lesions occur on the bracts subtending the bolls. As the leaf becomes chlorotic, the lesion turns reddish brown and defoliation takes place. Early and severe defoliation leads to premature boll opening and immature lint [1].

B. *Bacterial blight (Xanthomonas Axonopodis pv. Malvacearum):*

Dark green, water soaked, angular lesions of 1 to 5 mm across the leaves and bracts, especially on the undersurface of leaves. Hence called angular leaf spot. Sometimes extensive dark green, water soaked lesions along the veins known as vein blight. Symptoms are usually more prevalent on lower leaves than on upper leaves. Lesions dry and darken with age and leaves may be shed prematurely resulting in extensive defoliation. Black lesions on the stem which girdle and spread along the stem or branch known as black arm. Dark green, water soaked, greasy, circular lesions of 2 to 10mm across the bolls, especially at the base of the boll under the calyx crown. As the boll matures the lesions dry out and prevent normal boll opening. This phase of symptom is called as "Boll rot".

C. Leaf Curl virus disease - Gemini virus:

The initial symptom is characteristic Small Vein Thickening (SVT) on young upper leaves of plants. Later, upward curling of leaves occurs due to the uneven growth of veinal tissues on the abaxial side of the leaves.Subsequently,formation of cup shaped or leaf laminar out growth called enations appear on the underside of the leaf. In severe cases and in plants affected at early age, reduction of inter-nodal length leading to stunting and reduced flowering/fruiting is observed.

D. Alternaria leaf spot - Alternaria Macrospora,A. Alternata:

Alternaria macrospora causes brown, grey brown or tan lesions 3–10mm in diameter, especially on lower leaves. Some times with dark or purple margins and with concentric zones. . Affected leaves develop an abscission layer, senesce and drop to the ground.

IV. OBJECTIVE OF THIS WORK

This Research work presents an effort of using intelligent computing technology (ICT) to overcome the information gap by:

a. Creating a sophisticated agriculture environment to support the farmers to easily identify the diseases and get control of it.
b. Attempting to automate disease identification process using Advance color image processing.

A. Agriculture recommendation Center:

The agriculture recommendation center being built is similar to that used in a modern Agriculture environment center and has the following features [2].

a. Uses state-of-the-art technology
b. Has a database of the farmer and farm
c. The database is constantly updated
d. Provides all the previous interactions with the farmer.
e. Integrates relevant information (like recent weather-history at the farmer's land, prices at nearby markets) and presents them on a dashboard.
f. Makes images of diseased crop available to assist in providing the advisory.
g. Gives the extension worker at the call center a virtual feel of being at the farm.
h. On an as needed foundation scientific and market experts are added to the conference call to provide specific recommended.

The agriculture recommendation center has an information repository of the individual farms collected using a mobile phone for data and image capture. Continuous updating of data is carried out and the interactions with recommendation center advisory are captured. Farmers can upload additional information and pictures of the crop using their mobile phones. The extension worker handles the calls from farmers and conferences in experts as and when necessary.

B. System Flow Diagram of Cotton Leaf Spot Diseases:

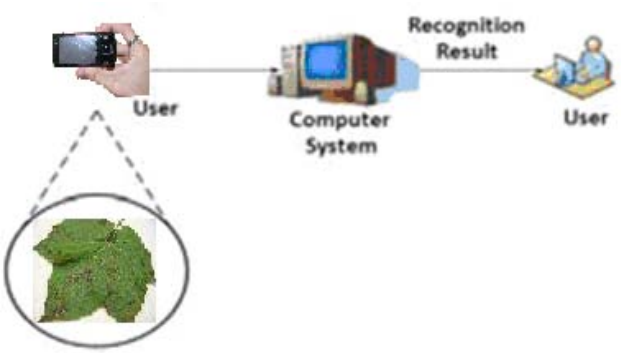

Figure1: Acquisition of Cotton leaves Image

Users acquire images of the leaves from the field using sensors and pass it to the computer system which analyze the input images using the homogenous edge detection algorithms and **diseases wise the pixels** call function logic used to diseases wise detect the affected parts of the leaves

to recognize the diseases and then result (recognition of the diseases and pest recommended) is given as output to the farmers in three languages.

V. LITERATURE REVIEW & RELATED WORK

Existing papers are describing to diagnosis the cotton leaves using various approach suggesting the various implementation ways as illustrated and discussed below. [3] WEB-based Intelligent Diagnosis System for Cotton Diseases Control has been developed in a BP neural network as a decision-making system to establish an intelligent diagnosis model. and [4] Next research Carried out the cotton foliar diseases presented a method for automatic classification of cotton diseases used Wavelet transform energy has been used for feature extraction while Support Vector Machine has been used for classification. [5]existing the research work described in the features could be extracted using self organizing feature map together with a back-propagation neural network is used to recognize color of image.[6] In earlier paper the fuzzy feature selection approach fuzzy curves (FC) and surfaces (FS) - is proposed to select features of cotton disease leaves image. In order to get best information for diagnosing and identifying, a subset of independent significant features is identified exploiting the fuzzy feature selection approach used. [7] Presented work carried out CMYK based image cleaning technique to remove shadows, hands and other impurities from images. The images are subsequently classified using two indigenous techniques RPM and Dis Bin and compared with the classical PCA based technique.

A. Analysis the Problem:

Presently, in the recent agricultural system, various computation techniques have been developed to help farmers (or) agricultures to monitor the proper development of their crops. In our early agricultural system, during the harvesting process of the crops, the exposed eye observation of farmers or experts is the main approach adopted in practice for the detection and identification of crop diseases under microscopic conditions in the laboratory. However, this requires continuous monitoring of experts which might be prohibitively expensive in large farms. Further, in some developing countries, farmers may have to go long distances to contact experts, this makes consulting experts too expensive and time consuming. The basic problems regarding with crop is on the field, a fast and accurate recognition and classification of the diseases is required by inspecting the infected leaf spot images also identify the severity of the diseases. There are two main characteristics of plant-disease detection machine-learning methods that must be achieved, they are: performance and accuracy.

Proposed Research work will describe the process of automatic recognition of leaf spot diseases as this can gives much benefit in monitoring large fields of crops and detect the symptoms of diseases. In this work we have to find out the computer systems which analyze the input images using the homogenize techniques to detect the affected parts of the leaves to recognize the diseases and then result (recognition of the diseases and pest recommended) is given as output to the farmers.

B. Proposed System:

First, the digital images are acquired from the circumstances using a digital mobile camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that, some analytical perceptive techniques are used to classify the images according to the specific problem at hand. In this work farmers can to take decision immediately at the time they want to get the best solution to diseases and pest recommendation is 3 languages Tamil, English, Hindi, Production can be improved, the yield loss can be reduced, they minimum cost of ultimate system very useful to farmers and we can increase the economic of the country.

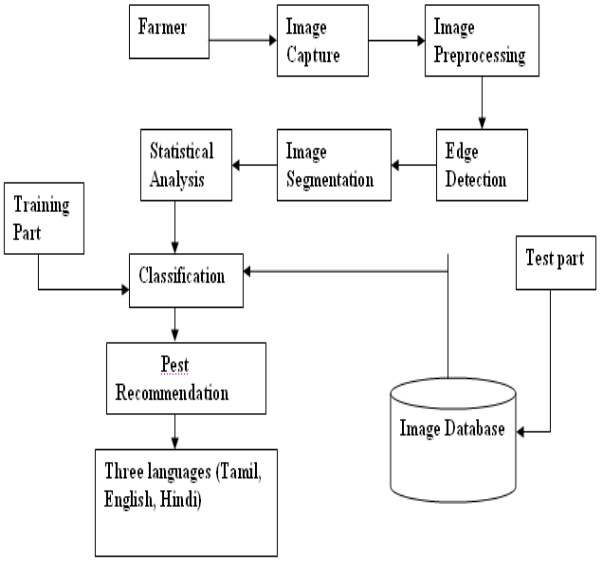

Figure 2: Proposed System Architecture

C. Algorithm for Proposed Homogeneous Pixel: counting technique for Cotton Diseases Detection (HPCCDD):

a. RGB image acquisition
b. Create the color transformation structure
c. Convert the color values in RGB to the space specified in the color transformation structure.
d. Apply Color Filtering
e. Masking green-pixels
f. Remove the masked cells inside the boundaries of the infected clusters
g. Find Edge detection (using Homogenous techniques)
h. Calling the pixel counting function to calculate the features (diseases)
i. Texture Statistics Computation
j. Configuring Disease Reorganization and Pest Recommendation.

D. Limitation of Previous Works (Computer Society):

a. Getting results is very difficult. Because they have to work with bulk Images, which is stored

in the database and have to analyze the data using different methods.

b. High dimensionality and accuracy very less.
c. Time consuming.
d. There is no clarity in the Main objects.

E. Limitation of Previous Work (Agriculture Society):

a. Some developing countries, farmers may have to go long distances to contact experts (or) the experts will go to field to observing the disease. It's too expensive and time consuming.
b. Farmer take samples and visits the Experts, that time they are very busy.
c. Pest recommendation System for farmers is not available in the North, Central and South India.

F. Analysis of Existing Algorithms:

The Existing work has taken cotton diseases and control system, [3] WEB-based Intelligent Diagnosis System for Cotton Diseases Control has been developed in BP neural network as a decision-making system to establish an intelligent diagnosis model is 89.5%, [8] and another related work was Thai Herb leaf Image Recognition System used KNN and accuracy is 76%62, next related [9] study Fast and Accurate Detection and classification of plant Diseases used in k-means and NN and found results is 94%.and k-means and NN Is better than other related research studies.

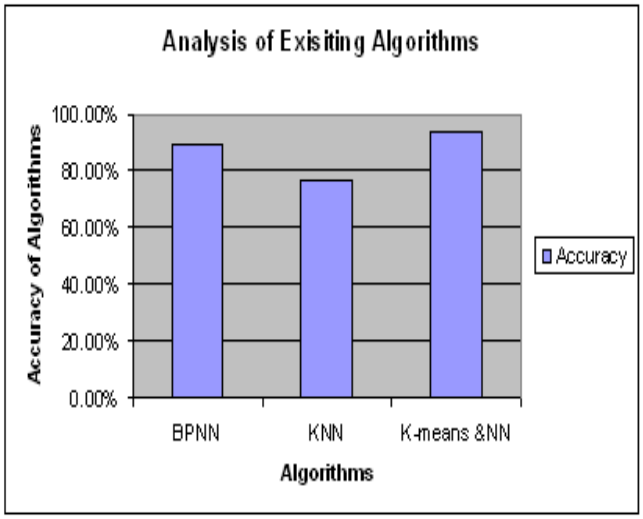

Figure 3.Performance of Existing Algorithms

VI. ACKNOWLEDGMENTS

I would like to express my special thanks of gratitude to Dr.S.Nakkeeran Sevugapperumal , Associate Professor (Pathology) Department of Plant Pathology of Tamil Nadu Agriculture University,and my guide Dr.M.Hemalatha,Head of Dept Software System in Karpagam University had given valuable ideas in my Research work. I thank and I will be gratitude them for overall supports.

VII. CONCLUSION

The proposed system consists of three main parts cotton leaf color segmentation, Edge detection based Image segmentation, analysis and classification of diseases. The goal of this research work is to develop an automated system that can identify the disease affecting a cotton leaf, boll or flower by using image analysis. Predict the diseases and pest recommendation to three languages like Tamil, English, and Hindi. Production can be improved and yield loss can be reduced. In this system identify diseases very accurate.

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