Nutrient Deficiency and Syndrome Recognition in both Mango Leaf and Cotton Plant using K-means Clustering and BPNN

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***Abstract* - Cotton is the most substantial fiber crop that displays very important role in social concern of individuals, particularly in India but if ailment known as Alternaria Leaf Spot and absence of definite chief nutrients goes unobserved in then it can decrease as much as 30% of overall manufacture. This will be slightly valuable for growers to upsurge the manufacturing of yield and have enhanced revenue out of it. Amongst dissimilar diseases, attention has been ended on 'Alternaria Leaf Spot' as it is the greatest hazardous and commonly found disease on cotton plants in India. We have used the K-means clustering technique for separation purpose and Back Propagation Neural Network (BPNN) technique for the classification of the mango leaf disease and Cotton Plant, and so it has been planned in this research paper. Procedures that give best consequences have been designated and adapted when desirable. Template matching and color histogram procedures have also been used for discovery. Complete examination and assessment has been ended with formerly used systems. After executing the code on huge quantity of cotton images and mango leaves taken from diverse places, result and conclusion has been completed. Results display how this investigation is more convenient and virtually more achievable than previous investigates.**

***Keywords* - Cotton, Leaf, Image Processing, K-Means Clustering, Disease, Detection, Nutrient Deficiency, Color, BPNN, Mango**

I. INTRODUCTION

Mango

Mango is having a place with Family Anacardiaceous is the imperious fiscally industrialized natural invention crop of the country. It is called the king of fruits. The fruit is tremendously widespread with the multitudes because of its widespread diversity of litheness and luxuriousness in blend, tasty discrimination and extraordinary flavor. It is an amusing fountain of both the vitamin A and C. This fruit is expended raw or ready. Great mango collections comprise 25% of collective flush sugars. The destructive ingredient of ready reward biological product oscillates from 0.2 to 0.5% and protein ingredient is about 1%.

Cotton

Cotton has been refined in the Indus valley later 1300 B.C. and archaeological indication demonstrated that cotton plant invented in India. Cotton is the central fiber yield in India. So it is most imperative for Indians to produce very huge quantity of cotton every time. Indian cotton agonizes from numerous infections which diminutions creation to large level. From these infections, some are Anthracnose, Alternaria Leaf Spot, Bacterial blight, Insect Pests, Fusarium wilt etc. As designated former, concentration has stayed through on Alternaria Leaf Spot individually as that is the one that affects the creation mostly.

Image Processing

"Image processing is method of signal processing for which the idea is an image, for example a photograph or a video frame. The output of image handling can be either an image or a set of physiognomies or parameters connected to the image."

Key nutrients which distress cotton plants are Nitrogen, Chlorine, Potassium, Calcium, Molybdenum, Manganese, Zinc, Boron, Iron etc. This theory defines various machineries used from ages to perceive shortage of these nutrients. Not only description, but proportional investigation of dissimilar methods has been made in this theory. Some are pronounced here.

Micro Nutrients

Boron (B), Cobalt (Co), Copper (Cu), Manganese (Mn), Molybdenum (Mo), Iron (Fe), and Image handling approaches has been used after analyzing dissimilar methods like visual examination, image Processing, visual instrument technique and other approaches. Tabularized evaluation of these methods is exposed here [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11]:

Table 1: Evaluation of Methods

	Approaches		
	Optical Sensor	Visual Analysis	Image Processing

Properties	Cost	Very High	Very Low	High
	Components Required	Nutrient Analyzer, Sensors	Not Required	Camera, Network Equipment's
	Complexity	Very High	Very Low	Average
	Software Required	Related Software	Not Required	Visual Analytics
	Accuracy	High	Average	Very High
	Timing Constraints	Average	Very High	Low
	Scope of Research	High	Very Low	Very High

Template matching and color histogram methods have been applied on illustrations.

II. PROPOSED FLOW

Figure revealed below displays the flow chart proposed in this study.

For Infection recognition, template matching procedure has been used in this study. Exercise set has been finished and by means of that leafs and so as contaminated plant will be noticed. For Insufficiency recognition of nutrients like phosphorous, sulphur, potassium, calcium, manganese and molybdenum the chemical possessions of the nutrients have been recycled. For example, Nitrogen absence sources pastel, yellowish-green plants with gangling stems. So in this study, we have used color histogram to detect nitrogen insufficiency.

Phosphorus insufficiency is frequently noticeable by dark green with roseate purplish leaf tips and limitations on older plants. Phosphorus undersupplied plants are reduced and grow further slowly than do floras with passable phosphorus. So, here also the color histogram will be used to notice phosphorous shortage in cotton plant. Color based partition has been working on the pictures and doing so deficiencies of nutrients have been detected.

Former papers were unfolding the documentation of several leaf infections as demonstrated and deliberated below. [1] This paper contains two stages to recognize the pretentious portion of the cotton leaf spot infection. Primarily Edge recognition based Image division is done and lastly image examination and organization of infections is achieved using our planned Homogeneous Pixel Counting Technique for Cotton Diseases Detection Procedure. The objective of this investigation work is identifying the infection pretentious portion of cotton leaf diversion by means of the image analysis method. This exertion finds out the computer organizations which examine the input images using the RGB pixel counting values structures used and recognize infection wise and subsequent using homogenization methods Sobel and Canny by means of edge discovery to recognize the affected portions of the leaf spot to identify the infections borderline is white lighting and then outcome is acknowledgment of the infections as output.

A. Recommendations:

Discussing agriculture authorities, suitable supervision component will be recommended to farmers after perceiving infection and shortage of nutrient suitable.
Subsequent orientations have been quantified after acknowledgment:

Alternaria Leaf Spot

The plant remains should be detached from the arena. And then Mancozeb 2.7gm, Carbendazim, Copper Oxychloride 3.1 grams in one liter of water must be scattered for 4-5 times in every 17 days break.

Nutrients

Individual nourishments should be used in appropriate measure. If nitrogen is lacking than nitrate fertilizer must be used.

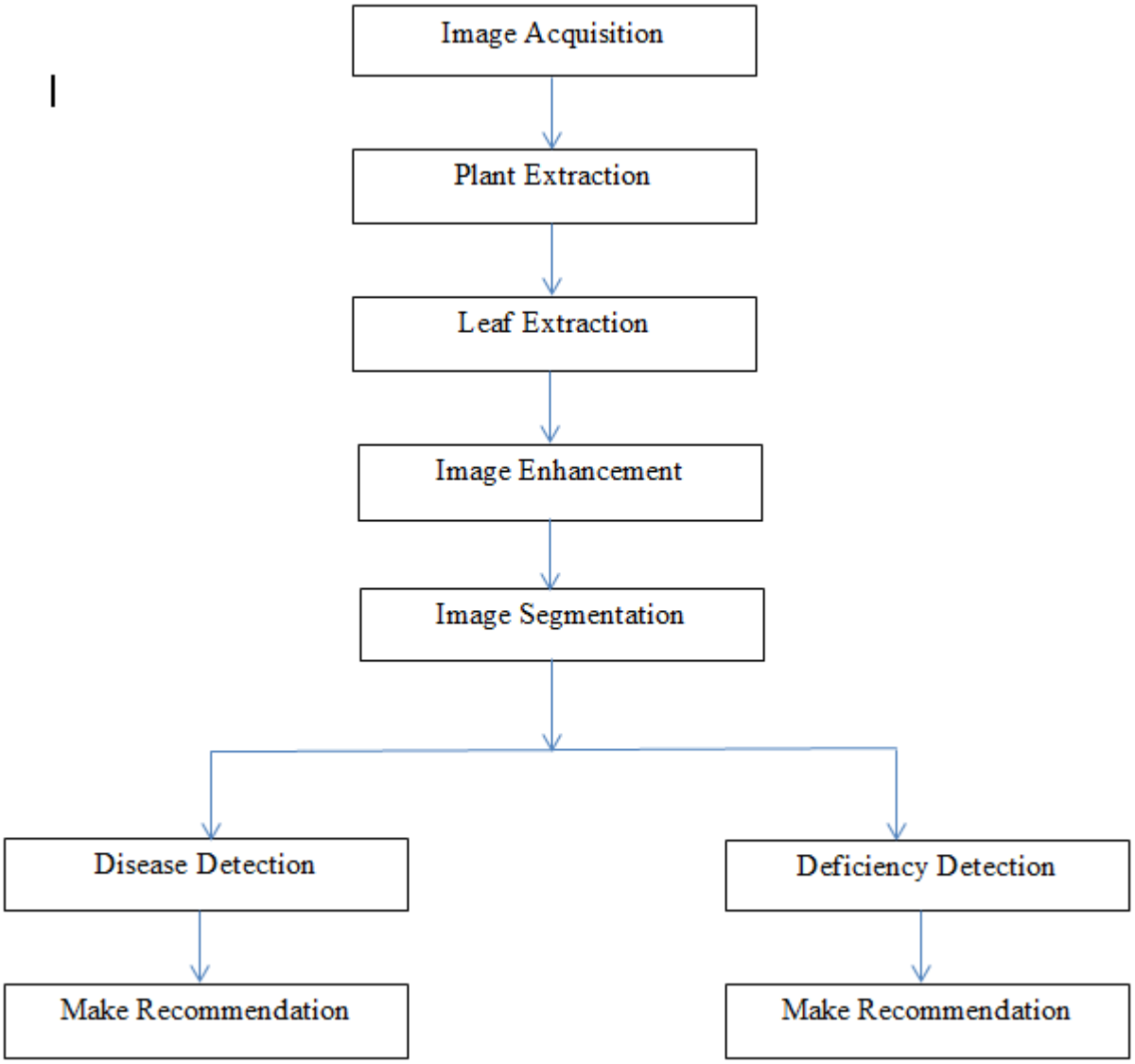


Fig 1: Proposed Work Flow

III. IMPLEMENTATION

Step 1: Image Acquisition

Mango leaf and cotton Plant pictures are captured from dissimilar areas by using digital mobile camera, Motorola G, 8 Megapixel and are used for exercise and testing the scheme then the background data are detached and deposited in standard jpg format.

Step 2: Feature Extraction

The following features are extracted to classify the disease:

1) Area: The real amount of pixels in the area of interest.
2) Equiv Diameter: It stipulates the width of a round with the same part as the province.
3) Orientation: The slant θ (in degrees fluctuating from - 90 to 90 grades) amongst the x-axis and the chief axis of ellipse that has the parallel additional moments as the province.
4) Convex Expanse: It stipulates the amount of pixels in 'Convex Image'.
5) Extent: It stipulates the proportion of pixels in the province to pixels in the total springing box.
6) Solidity: It stipulates the percentage of the pixels in the curving hull that are also in the province.
7) Number of Substances: It is the amount of white pixels which are disengaged to each other in binary picture.
8) MarorAxisLength: It stipulates the length (in pixels) of the chief axis of the ellipse that has the same standardized other central instants as the section.

Step 3: Image Pre-Processing

Image pre-processing comprises the subsequent three components:

1. Reaping leaf and plant image.
2. Resizing

3. Apply Median filter.

Step 4: Image Segmentation

Dissimilar procedures for image segmentation have been applied on image record and allowing to outcomes got, Arithmetical Region Merging procedure has been nominated for image segmentation.

Step 5: Template matching

Procedure for template matching has been employed to identify alternaria leaf spot in cotton herb and mango leaf. To do this, exercise matrix has been made using record of pictures. The images occupied from the farm have been associated with the record to detect alternaria leaf spot. As the pictures taken are principally fluctuating in size and figure, the exercise matrix has been completed with quantity of opportunities, so that no unhealthy plant goes unnoticed.

Step 6: Classification

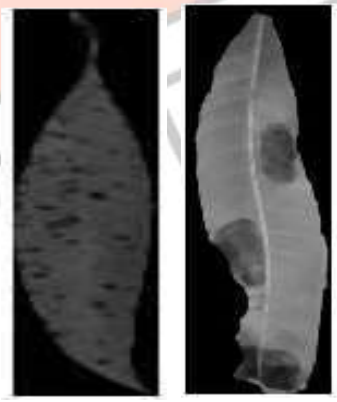
For the classification, the feed forward Back Propagation Neural Network classifier method is used which involves three Coatings specifically hidden coating, input coating and output coating.

Step 7: Disease Identification and Control Forecasting

The BPNN allocates suitable mango leaf and Cotton Plant infection class i.e. bacterial or red rust leaf spot. Then it suitable control forecast for the microbial leaf spot or red rust is also specified by the scheme spontaneously.

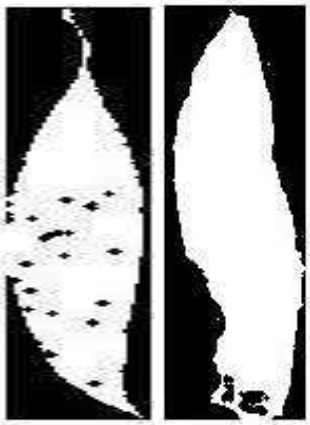
(a) (b)

Fig 2: The original diseased mango leaf images used for testing (a) Bacterial leaf spot (b) Red rust.



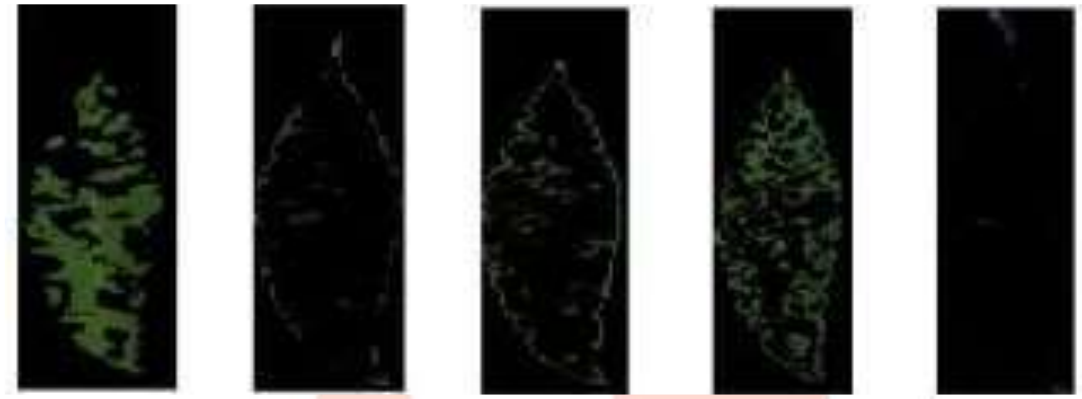
(a) (b)

Fig 3: Pre-processed test images of (a) Bacterial leaf spot (b) Red rust.



(a) (b)

Fig 4: Binary images of (a) Bacterial leaf spot (b) Red rust.



(a)

(b)

Fig. 5: Five clusters formed by K-means clustering method in segmentation (a) Bacterial leaf spot (b) Red rust

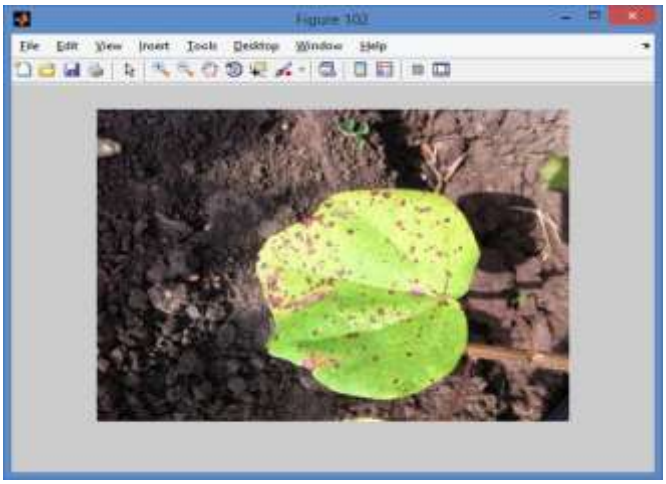


Fig 6: Plant Diseased with Alternaria Leaf Spot

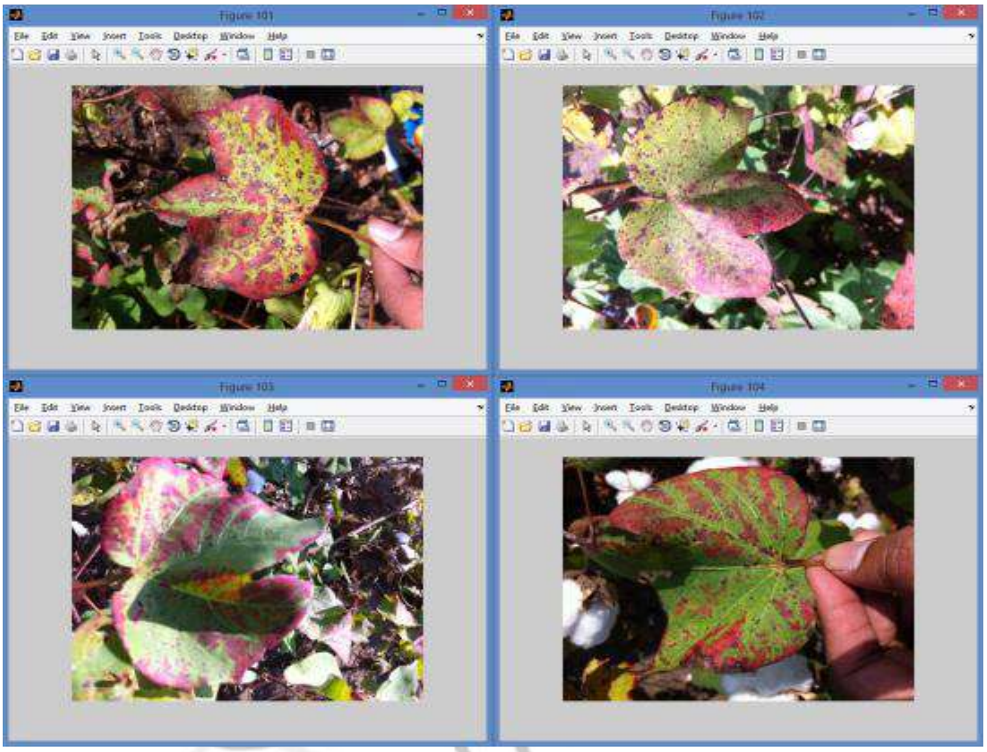


Fig 7: Potassium Deficient Plants

IV. CONCLUSION

After analyzing the outcomes got by applying the proposed system, it can be determined that with high correctness the scheme is identifying alternaria leaf spot infection in cotton plant and in mango leaf. After discovering, appropriate commendations have been given to overwhelm it. The scheme is also identifying insufficiency of Nitrogen, Potassium, Phosphorous, Calcium, and Calcium. After associating the outcomes of the planned scheme with prevailing schemes, it can be determined that the proposed scheme is more precise than the current one. Proposed system is more feasible than existing one as in this investigation, real pictures of cotton plants and mango leaf occupied from the farm has been used in employment. It is less time consuming also.

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