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NUTRITION DEFICIENCY DETECTION IN PLANT LEAVES: Comparative Study of Implementation Methods Using Image Processing Techniques

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ABSTRACT

Nutrition deficiency detection,extraction and representation is a crucial step for leaf image processing. How to extract ideal features that can reflect the intrinsic content of the images as complete as possible is still a challenging problem in computer vision. However, very huge research has paid attention to this problem in the last two decades. So in this paper, we focus our review on the latest development in image feature extraction technique and provide a comprehensive survey on how to detect nutrition deficiency in plant leaves. In particular, we explain the effectiveness of the color shape and texture features in automatic image annotation and content based image retrieval, including some classic models and their algorithms in the literature. Finally, we summarize this paper with some important conclusions and point out the future potential scope directions.

Keywords: **ARM7, RF Transceiver, Relay, Encoder.**

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I. INTRODUCTION

The farmers are facing the problem of malnutrition in their crop and they don’t know how to recover it (such as less growth, low production, low resistive power).They don’t know what quantity and type of fertilizer should be used for maximum productivity.Indian farmers are using conventional method to grow crops during the process they are using traditional techniques of fertilizing the crops, so our paper will provide the solution to this kind of problems.
The humans have the attraction of the images, photos, from the old age.
New age of smart phones is making naïve person techy and he can take quality photos anywhere. It’s very important to analyses and detection of image will be done properly, so the end user will be happy by the perfect solution nutrition deficiency.

II. MATHEMATICAL MODEL

Set Theory

1. S= { } be as system for Farm Buddy
2. Identify Input as $L=\{ L_1, L_2, L_3\ldots\ldots L_n\}$
   Where L_n=number of leaf image
3. Identify Das Output i.e. Deficiency identification

   $S= \{L_n, D\}$
4. Identify Process P

   $S= \{L_n, D,P\}$
   $P= \{L_n, D, C_e, L_m, C_c, F_l\}$
   Where C_e =Canny Edge
   L_m =Leaf morphology
   C_c =Color component
   F_l = Fuzzy logic
5. $S = \{ L_n, C_e, L_m, C_c, F_l, D \}$

SET DESCRIPTION:

Canny Edge**:**

Set C_e:
C_{e0}= Smoothing:
C_{e1}= Finding gradients
C_{e2}= Non-maximum suppression
C_{e3}=Double Thresholding
C_{e4}=Edge tracking by hysteresis

5.4.2.2. Leaf morphology**:**

Set L_m:
L_{m0}= Get image height and weight
L_{m1}= Get RGB values of pixel
L_{m2}= Get the axis distance
L_{m3} = Calculate co-axial ratio
L_{m4}=Create morphological vector
5.4.2.3**.** Color component

Set C_c:
C_{c0}=Get color module unsigned integer
C_{c1} =Get RGB color space value
C_{c2} =Identify the color differentiation of different region
C_{c3} =Find mean differentiation

Fuzzy logic
Set F_l:
F_{l0}=Crisp values
F_{l1}=Fuzzyfier
F_{l2}=Defuzzyfication
F_{l3}=If-then Rules
F_{l4}=Summary

Representation of Sets and its operation:-

Union Representation:-

A. Set $C_e = \{C_{e0}, C_{e1}, C_{e2}, C_{e3}, C_{e4}\}$

Set $L_m = \{L_{m0}, L_{m1}, L_{m2}, L_{m3}, L_{m4}\}$
Set $(C_e \cup L_m) = \{C_{e0}, C_{e1}, C_{e2}, C_{e3}, C_{e4}\ L_{m0}, L_{m1}, L_{m2}, L_{m3}, L_{m4}\}$

B. Set $C_c=\{C_{c0}, C_{c1}, C_{c2}, C_{c3}\}$

Set $(C_e \cup L_m \cup C_c) = \{C_{e0}, C_{e1}, C_{e2}, C_{e3}, C_{e4}\ L_{m0}, L_{m1}, L_{m2}, L_{m3}, L_{m4}\ C_{c0}, C_{c1}, C_{c2}, C_{c3}\}$

C. Set $F_l=\{F_{l0}, F_{l1}, F_{l2}, F_{l3}, F_{l4}\}$

Set $(C_e \cup L_m \cup C_c \cup F_l) = \{C_{e0}, C_{e1}, C_{e2}, C_{e3}, C_{e4}\ L_{m0}, L_{m1}, L_{m2}, L_{m3}, L_{m4}\ C_{c0}, C_{c1}, C_{c2}, C_{c3}, F_{l0}, F_{l1}, F_{l2}, F_{l3}, F_{l4}\}$

Venn diagram:

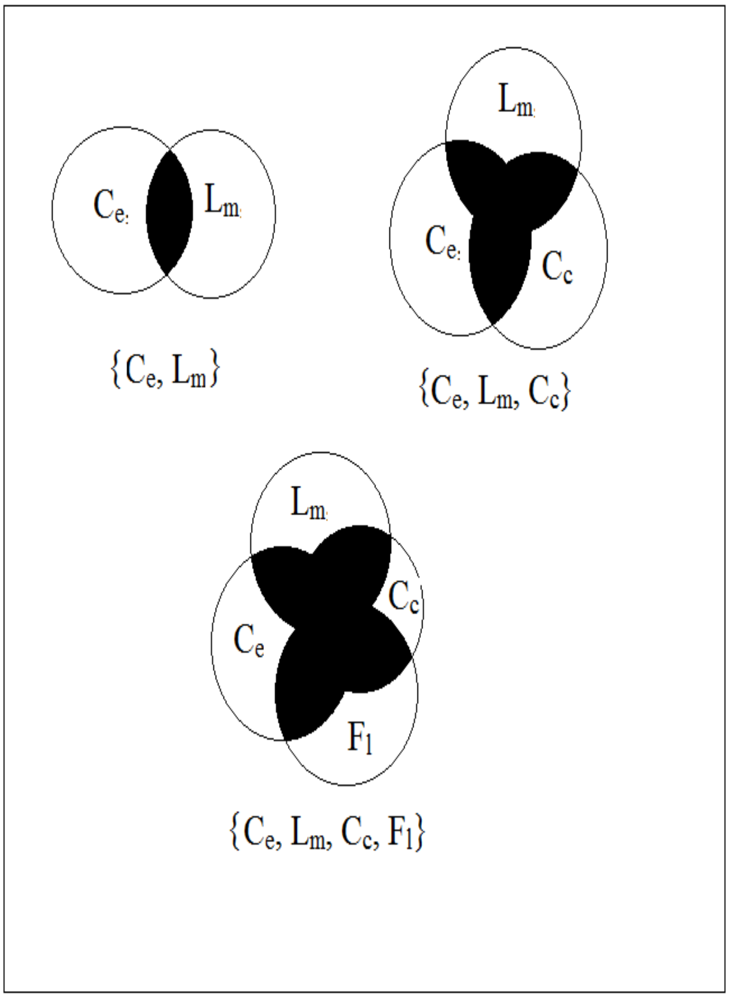

Fig. Venn diagram

III. ALGORITHM FOR LEAF SHAPE MORPHOLOGY IDENTIFICATION

Step 0: Start
Step 1: Get Image path.
Step 2: Get Height and width of the Image (L*W).
Step 3: FOR x=0 to width.
Step 4: FOR y=0 to Height.
Step 5: Get a Pixel at (x, y) as signed integer.
Step 6: Convert pixel integer value to Hexadecimal to get R, G, and B.
Step 7: if (R!=255 and G!=255 and B!=255) (checking for fire pixel)
Step 8: Get the Y value for the pixel
Step 9: Then ratio $R_{t=}$ Y/Height
Step 10: Add R_t into an array called RA
Step11: End of inner for
Step 12: End of outer for
Step 13 : Stop

IV. ALGORITHM FOR LEAF DEFICIENCY IDENTIFICATION THROUGH COLOR CLASSIFICATION

Step 0: Start
Step 1: Get Image path.
Step 2: Get Height and width of the Image (L*W).
Step 3: **count**=0, set threshold **T** for the respective deficiency and Deficiency protocol As **D**
Step 4: **FOR** x=0 to width.
Step 5: **FOR** y=0 to Height.
Step 6: Get a Pixel at (x, y) as signed integer.
Step 7: Convert pixel integer value to Hexadecimal to get R, G, and B.
Step 8: **IF**(R € D && R € D && R € D)
Step 9: **count**++
Step 10: **End** of inner for
Step 11: **End** of outer for
Step12: if (count>= T)
Step 13: Declare deficiency
Step 14: Stop

V. RESULTS AND DISCUSSIONS

To show the effectiveness of proposed system some experiments are conducted on java based windows machine using apache tomcat as server. To measure the performance of the system we set the bench mark by selecting the data of leaf images of different categories like crop, fruit and vegetables for identification of the nutritional deficiency using leaf structure identification and color difference process.

To determine the performance of the system, we examined how many relevant images are identified for the desired deficiency based on our color and shape difference technique approach.

To measure this precision and recall are considering as the best measuring techniques. So precision can be defined as the ratio of the number of relevant images are identified for the proper deficiency to the total number of irrelevant and relevant images are identified for the proper deficiency . It is usually expressed as a percentage. This gives the information about the relative effectiveness of the system.

Whereas Recall is the ratios of the number of relevant images are identified for the proper deficiency to the total numbers of relevant images are not identified for the proper deficiency and it is usually expressed as a percentage. This gives the information about the absolute accuracy of the system.

The advantage of having the two for measures like precision and recall is that one is more important than the other in many circumstances.

For more clarity let we assign

• A = The number of relevant images are identified for the proper deficiency,

• B = The number of relevant images are not identified for the proper deficiency, and

• C = The number of irrelevant images are identified for the proper deficiency

So, Precision = (A/ (A+ C))*100

And Recall = (A/ (A+ B))*100

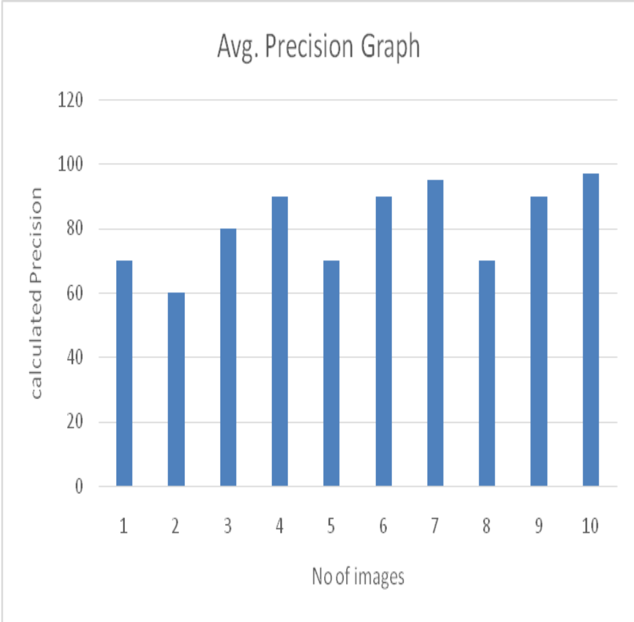

Fig. 20. Average precision of the proposed approach

In Fig.20, we observe that the tendency of average precision for the images are identified for the proper deficiency is about 0.82, this is a good result to identify the deficiency of the leaves for any system.

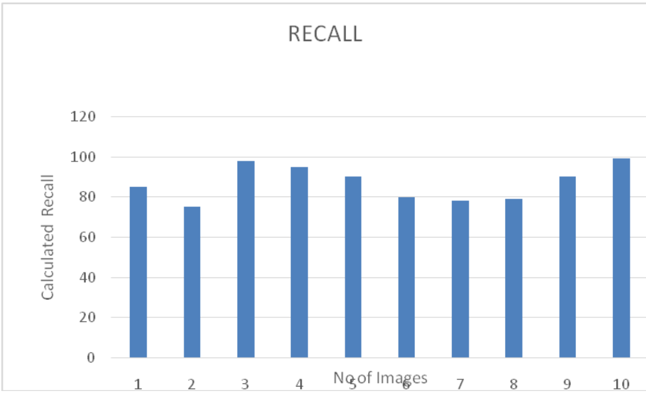

Fig. 21. Average Recall of the proposed approach

In Fig. 21, we observe that the tendency of average Recall for the images are identified for the proper deficiency is about 0.869, This is a good result to identify the deficiency of the leaves for any system.

VI. CONCLUSION

Proposed method is efficiently shows the malnutrition detectionfrom the uploaded plant leaf image using this system.In plant leaf malnutrition detection and providing correct solution, which plays a crucial role in farming community. So in this project, we provide a comprehensive study on the latest development in image feature extraction and image of plant leaf. Particularly, we analyze the effectiveness of the color, shape and texture features in image of plant leaf processing, including some classic models and their illustrations.

There are a number of interesting techniques in image processing which should be used for detecting deficiencies in plant leaf. This report includes the literature, analysis and design towards malnutrition of the crop leaf. Proposed an idea to find out the malnutrition in crop and provide the solution. This system will be very useful for farmers, agricultural students, NGO's, Agricultural advisors.

VII. FUTURE SCOPE

The proposed system can be enhancing to implement in android/ IOS platform. This makes the system to access completely in all possible types of smartphones and to handle the vast quality of images if provided cloud access.

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