

Detection of Nutritional Disorders in Pepper and Pomegranate Plants using MATLAB and LabVIEW

^[1]Raikar Saishree D^[2]Rohini S Patil^[3]Beerappa Tirlapur^[4]Pranav K^[5]C.L.Chayalakshmi
^{[1][2][3][4]}Student,^[5]Faculty

Department of Instrumentation Technology, Basaveshwar Engineering College,
Bagalkot, Karnataka, India – 587103

^[1]saishreeraikar@gmail.com^[2]patilrohini125@gmail.com^[3]tirlapur@gmail.com^[4]pvkotwal94@gmail.com,
^[5]chayalakshmi.cl@gmail.com

Abstract- This paper provides identification of the diseases at early stages in pepper and pomegranate plants using image processing techniques. Image processing and standard data base is extensively used in the proposed work. Various nutritional disorders of pepper and pomegranate plant lead to change in color of the leaf. These visual symptoms are derived from images of the defected leaves of pepper and pomegranate plants. By detecting nutrient deficiency with this method, plant life span and yield can be improved by providing proper and suitable quantity of manure. MATLAB and Laboratory Virtual Instrument Engineering Workbench (LabVIEW) are the used tools in this process. LabVIEW provides Visual programming methods for image acquisition, image processing. MATLAB and LabVIEW provide easy and convenient methodologies for image processing techniques.

Keywords: Nutritional deficiency, LabVIEW, Image processing, RGB color.

I. INTRODUCTION

As agriculture is India's backbone, it has played a key role in the development of human civilization. An attempt in this process is made to solve farmers' day to-day problems. The usual difficulty faced by farmers in controlling diseases is observation of diseases by naked eyes which leads to expensive threat to plants life span. Most dominantly this method is used in agricultural field, botanical research centers, agricultural authorities and plant nurseries.

Helps in detecting disorders in very early stages of growth leaf. Because of their medicinal, stimulus, edibility importance, pepper and pomegranate plants are selected in this process. Since this process helps in detecting nutritional disorders in earlier stages of the plant, it helps farmers to improvise their yield and produce efficient crops.

Vision and Development toolbox of LabVIEW, presents a complete set of digital image acquisition [1]and processing functions that work with higher resolution of the image with different algorithm. Our way of dealing with this problem is to have an algorithm designed regarding all the data we collected about pepper and pomegranate plants.

By detecting the defected region in leaf, masking is performed on that image to cover the leaf region with the standard green color that pepper and pomegranate leaves possess. Original image which contains defected leaf picture is subtracted from the image which is masked so that the difference is obtained. This difference is analyzed using data[6] and algorithms available.

If the input leaf is suffering with more than one deficiency then a healthy leaf model stored in database should be retrieved.

The evitable and expected fact is that same technique can be used in future with the knowledge of any other crop and its behaviors for related deficiencies.

Through the technique of image processing, it is possible to study about various deficiencies in plants by examining visual symptoms. These symptoms are derived from images of defected leaves. This is possible in MATLAB and LabVIEW.

OBJECTIVES

- 1) To provide a technology effective solution for concerned authority and farmers to identify the diseases at early stages in pepper and pomegranate plant by making use of image processing technique. This serves the immediate requirement of engineering and technology for the socio-economic benefit, in particular and economic development of country in large.
- 2) It is one of the non-invasive automatic method of detecting the deficiencies in leaf.
- 3) By detecting nutrient deficiency with this method, plant life span and yield can be improved by providing proper and suitable quantity of manure.
- 4) This method needs one time investment and looking into its long term and reliable use it is cost effective.
- 5) Color based image retrieval is an important research area in digital image processing through LabVIEW.

- 6) An opportunity for the team to learn image processing, requirements of algorithm like edge detection, color matching, color moment and feature extraction techniques.

II. PROPOSED METHOD:

A. System

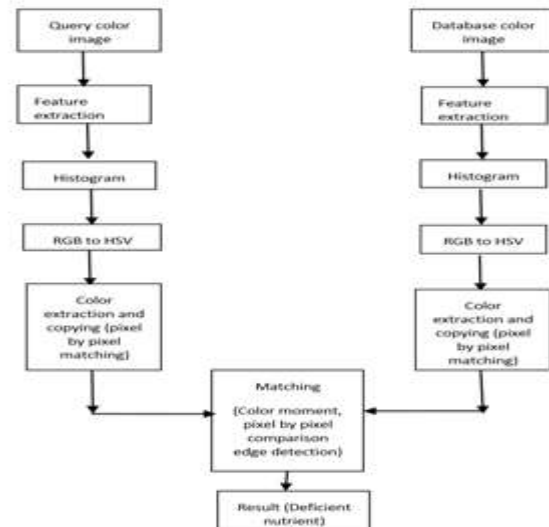
In this process, farmers can take a picture of infected plant leaves. The system so developed will be uploaded with this picture. The picture is analyzed to find the kind of disease the plant is infected and a proactive approach to stop the disease based on the system results will be informed to the farmers.

A process in which farmers are just required to capture the defected leaf and the same image is submitted to the system where the defected leaf is compared with real leaf model and hence giving out the results of their difference and indicates the kind of deficiency that leaf/ plant is suffering [4].

B. Working mechanism

Process will initiate with the defected leaf image which is given as input, further feature extraction (color properties, RGB values, shape of the leaf, color pattern of the defected region)[3] of image is done. This image is stored in the database created for the storage of the image obtained which is to be used for color matching and color moment parts of algorithm in fore coming steps. The image processing technique starts with the image histogram [3] (graphical representation of the tonal distribution in a digital image) and RGB (Red, Green, Blue) to HSV (Hue, Saturation, Value of intensity) conversion and if required to gray scale and binary images. When storing pixel values of an image [2] [5], conversions of data types like integer to double floating and vice-versa are also done.

The recognized image of the leaf is matched with the original image stored in the database. The method of image subtraction is used for matching process. The difference in the images is put into an algorithm to obtain the deficient nutrients as the final result. Some examples of programs are shown below with their outputs.



Block Diagram: Fig. 1. Block Diagram

Here are steps to be followed for proposed method:

- I. Image Acquisition
- II. Resize the image.
- III. Convert image into gray scale image.
- IV. Obtaining the edges of an image.
- V. Histogram and Conversions.
- VI. Image Subtraction.
- VII. Extract the features

Match the pattern for recognition

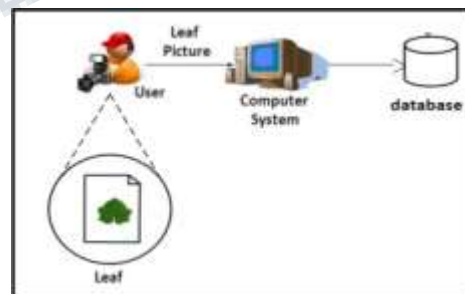


Fig. 2. Pictorial overview of proposed method.

MATLAB program for edge detection:

```

figure(1)
a = imread('pepper.jpg')
b = rgb2gray(a)
sob_im = edge(b,'sobel')
imshow('pepper.jpg')
figure(2)
imagesc(sob_im)
  
```

```
axis('square')
colormap('gray')
imshow(sob_im)
(output in fig.4)
MATLAB program for RGB to Gray conversion:
A = imread('image_name.image_type');
B= rgb2gray(A);
imshow(B)
```

(Output for the above program is in Fig. 5)



Fig.3. Input image



Fig.4. Edge detected image

RGB to GRAY conversion:



Fig.5. Grayscale image Masking



Fig.6. Masked Image

```
img = imread('pepper.jpg');
for R1=1:513
for C1=1:655
pix = img(R1,C1);
end
end
figure(1), imshow(img)
my_image =imread('ser.jpg');
for R=25:630
for C=25:332
pixel=my_image(R,C);
if pixel<50
pix=255;
elseif pix == pix;
end
end
end
for R1= 25: 630
for C1= 25:332
img(R1,C1) = pix;
end
end
figure, imshow(img)
```

Masking is done on image to cover the leaf region with the green color which healthy leaves possess.

We use color pattern matching to locate known reference or fiducial patterns in an image quickly. Pattern matching is the key to many applications. Color pattern matching can provide our application with information about the presence or absence, number, and location of the pattern within an image.

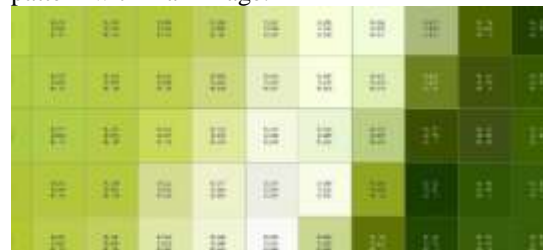


Fig. 7. Pixel value acquisition.

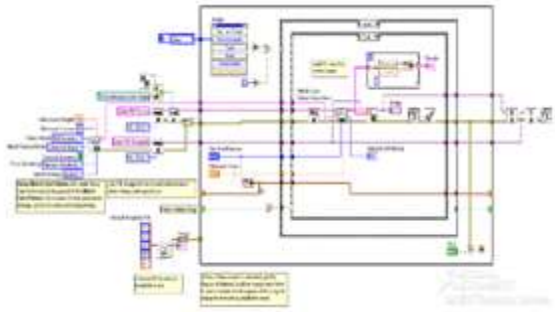


Fig.8. Color pattern matching

Program: While bringing algorithm out in terms of executable programs in LabVIEW, most of the Vis are written using mathscript module. And the further approach will be converting every mathscript code into VI using LabVIEW.

Deficiencies in pepper plant:



Fig.9. Signs of deficiency

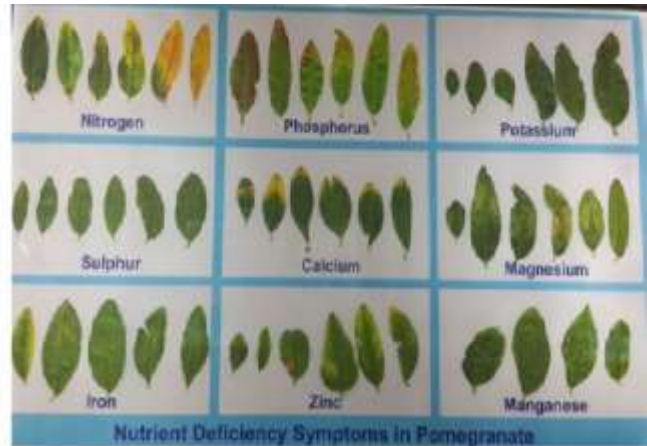


Fig 10: Deficiency in pomegranate leaf

Comparison of pomegranate leaf:

- 1. Fresh leaf
- 2. Nitrogen deficient



Deficiencies in pomegranate:

- 3. Nitrogen deficient
- 4. Calcium deficient



- 5. Potassium deficient
- 6. Iron deficient



- 7. Sulphur deficient
- 8. Zinc deficient



Table 1: Visual symptoms exhibited by pepper plant under nutritional disorders^[6]

| <u>Nutrient</u> | <u>Deficiency symptoms</u> | <u>Excess/toxicity symptoms</u> |
|-------------------|--|---|
| <u>Nitrogen</u> | Plant development gradually slows down. Leaves start drying. Beginning at leaf margins of the ones between the lower leaf veins. The petioles bend and hang downwards, parallel to the stem. The plant develops few flowers and fruit setting is poor. The first appearance is that, middle may be small. Some times there is not fruit development on the plant at all, and in these plants the fruit, the fruit is deformed. | Plants are usually stunted; green in color, have abnormal foliage but with a restricted root system. Flowering and seed production can be retarded. |
| <u>Phosphorus</u> | Yellow chlorotic spots appear between leaf veins, firstly in the lower leaves. The rest of the area adjacent to these spots do not change their color. (This can be seen mainly in the upper parts of the plant). There is little fruit setting, and most much fruit, which is smaller than usual. | Usually not excessively affected by plants. Excessive potassium may lead to magnesium, manganese, zinc or iron deficiencies. |
| <u>Calcium</u> | Older leaves to become yellowish. | Reduction in growth and leaf size. Leaf symptoms often absent or poorly defined. Sometimes interstitial yellowing on leaf burning. |
| <u>Magnesium</u> | It is common in pepper plants. Yellowing of the leaves is apparent in the interstitial areas and veins remain green. The older leaves are affected first. Sometimes magnesium deficiency occurs when excess of potassium have been made. It may also show up, when extremely hot dry weather. | Very little information is available. |
| <u>Zinc</u> | Symptoms show in the later stages of growth. The young leaves pale and then become yellow in the area between the veins. The veins remain green. | Usually evident in natural conditions. Has been observed when foliar zinc sprays are used as a micronutrient. |
| <u>Manganese</u> | Chlorotic spots between the upper leaf veins. | Sometimes chlorotic necrosis chlorophyll distribution. Reduction in growth, lesions and leaf shedding early, shedding late. |
| <u>Iron</u> | The leaves become narrower and small in size. | Excessive zinc commonly symptoms and chlorotic in plants. |
| <u>Copper</u> | Appear later in the vegetative stage. The leaf margins curl and dry up. The leaves and the fruit become narrow and irregular. | Reduced growth followed by symptoms of leaf chlorotic staining, reduced branching, thickening and abnormal thickening of nodes. |

III. APPLICATIONS

As agriculture is India's backbone, and our project is also dealing with farmers' day-to-day problems and finding solution in cost efficient and an easiest way.

1. Most dominantly this method is used in agricultural field, botanical research centers, agricultural authorities and plant nurseries.

2. Helps in detecting disorders in very early stages of leaf growth.
3. This method is best used where the farmers are hard to reach authorities concerning medical care of their crops.

IV. CONCLUSION:

This system, will be a boon to the farmers as it provides accurate and quick solution to plant diseases at nominal or no cost to the individuals. After the complete implementation, we will have a great satisfaction of bringing technology to the use of farmers at the nearest possible way.

ACKNOWLEDGEMENT:

We are very much thankful to Dr. G. Manjunath of Horticulture University, Bagalkot, Karnataka, India for his constant support and help in collecting useful information and data pertaining to pomegranate plant and leaves.

REFERENCES:

- [1] K. Arthi, Mr. J. Vijayaraghavan, "Content Based Image Retrieval Algorithm Using Color Models," International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 3, March 2013.
- [2] B. Sathya Bama, S. Mohana Valli, S. Raju, V. Abhai Kumar, "Content based leaf image retrieval (CBLIR) using shape, color and texture features," Indian Journal of Computer Science and Engineering (IJCSE) ISSN : 0976-5166, Vol.2, Issue 2, April-May 2011.
- [3] Guang-Hai Liu, Jing-Yu Yang, "Content-based image retrieval using color difference histogram," Pattern Recognition 46 (2013) 188–198, May 2012.
- [4] Anand. H. Kulkarni, Ashwini Patil R. K, "Applying image processing technique to plant diseases," International Journal of Modern Engineering Research, Vol.2, Issue 5, pp-3661-3664, Sep-Oct. 2012.
- [5] Reshma Choudhary, A. M. Patil, "Content based image retrieval using color and shape features", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 1, Issue 5, November 2012
- [6] URL: http://www.haifagroup.com/knowledge_centre/crop_guides/pepper/nutritional_requirements/nutritional_disorders_in_peppers