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DETECTION OF NUTRIENT DEFICIENCIES IN CROPS USING SUPPORT VECTOR MACHINE (SVM)

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Abstract: *In an agricultural country like India, farmers are facing a lot of problems in detecting the causes of diseases& deficiencies in plants. Once the causes are identified then remedies can be found to treat them. With naked-eye observation it is difficult to classify the deficiencies present in leaves of crops. Image processing algorithm can be used to build a model to detect various types of deficiencies in the leaves. The colour and texture features can be used to recognize and classify the deficiencies. The combinations of features can be proving to be very effective in deficiency detection. This proposed system presents an effective method for detection of nutrient deficiencies in leaves using colour-texture analysis and k-means clustering.*

Key Words: Nutrient deficiency, Texture, Clustering algorithm, Image processing

1.INTRODUCTION

In an agricultural country like India, farmers are facing a lot of problems in detecting the causes of diseases& deficiencies in plants. Once the causes are identified then remedies can be found to treat them. With naked-eye observation it is difficult to classify the deficiencies present in leaves of crops. Image processing algorithm can be used to build a model to detect various types of deficiencies in the leaves. The colour and texture features can be used to recognize and classify the deficiencies. The combinations of features can be prove to be very effective in deficiency detection. This proposed system presents an effective method for detection of nutrient deficiencies in leavesusing colour-texture analysis and k-means clustering.

2. LITERATURE REVIEW

[1] A.K. Ghorai, S. Mukhopadhyay, S. Kundu, S. N. Mandal, A. Roy Barman, M. De Roy, S. Jash2 and S. Dutta. [2021][1]

In this paper author discuss about Image Processing Based Detection of Diseases Plants. The different steps of image processing based detection such as image acquisition, image processing, segmentation, feature extraction and classification with a classifier are discussed. The detailed procedure, principles involved in image based detection, crop diseases studied.

[2]T. Rajasekar, M. Arun Kumar, K. Mohamed Ismail, M. Sabarimuthu[2020][2]

In this paper author proposed Automated Farming and Nutrition Deficiency Detection using Swarm Bots, automation of farming can be used to get divest of day-to-day farming hitches. To contribute an elucidation to these glitches, the steered rover for drilling, seed sowing, and detection of victual rift using Artificial Intelligent system. Recovery system has been offered to lessen the human exertion and to speed up the work, henceforth weakening the measure of equipment required for its usage without bargaining the nature of administration. Surveying the leaf using image processing the farmer can easily be notified about the deficiency in the crops through communication protocol.

[3] Gaganjot Kaur -[2020][3]

In this paper author proposed Automated Nutrient Deficiency Detection in Plants, Nutrient deficiency is one such factor included. Different frameworks using digital image processing, computer vision, IOT is used to analyze the deficiency side effects a lot sooner than natural eyes could perceive. This empowers the farmers to implement remedial activity in time. This paper concentrates on the review of different techniques for diagnosing nutrient deficiency in plants.

[4] Amirtha T, Gokulalakshmi T, Umamaheswari P, T Rajasekar [2020][4]

In this paper Machine Learning Based Nutrient Deficiency Detection in Crops, This paper aims at designing an automatic robotic vehicle which detects the nutrient deficiency in crops just by simply capturing the image of leaves of the crop plants. The captured image is then processed by using the convolutional neural networks (CNN). This technique uses captured image, processing it by comparing it with the already available dataset. When the input image is matched or partially matched with any one of the existing images in the dataset, it will provide the result

of nutrient deficiency in crops, in terms of the percentage. The name of disease associated with nutrient deficiency and appropriate amount of fertilizer will be displayed in the LCD.

[5] Vignesh Dhandapani, S. Remya, T. Shanthi,R. Vidhy[2018][5]

In this paper author discuss Plant Health Monitoring Using Image Processing. We studied the using digital image processing techniques for detection, processing and identification of plant.

3.METHODOLOGY

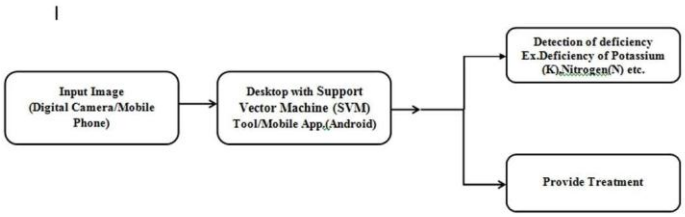
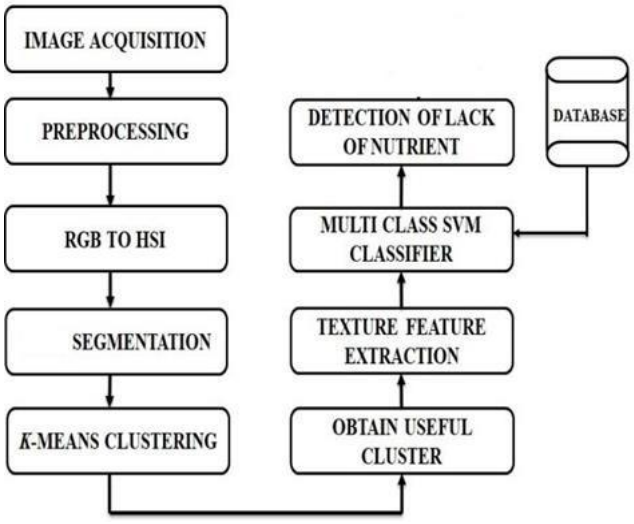


Fig.1 Block Diagram of proposed System.

In proposed system to detect the nutrient deficiencies in leaves the properties such as coloring and texture of leaves must be an analyzed so the properties for nutrient deficiencies are stored in a database called training database the properties of leaves which have to undergo the deficiency detection process are stored in a database called testing database A methodology called nutrient deficiency detection using image processing will be proposed.

4. FLOW DIAGRAM



RGB image acquisition

Initially the images of various types of leaves are captured using a digital camera

RGB to HSI transformation

The RGB images of the leaves are represented in Hue Intensity Saturation (HIS)colour model. The HIS colour space representation is widely accepted as it is related to human perception. The Hue component refers to the dominant. Colour of the image. Saturation gives the corresponding purity. It is the amount of white light added to the hue value. Intensity means the amplitude of the light present so in this proposed work the colour space is transformed from RGB to HSI representation. After the transformation, the H component is taken into account for further analysis.

Image segmentation

This step is divided into two parts:

- **Masking green pixels:** The pixel which are mostly green are identify first .Then a threshold value is calculated such as that if the green part of the pixel intensity is less than the computed threshold value, those pixel are to be masked. The red, green and blue components of pixels are made zero. The green pixel is masked so that they need not be taken for further analysis.

- **Extract useful segment:** The infected portion of the leaves are then segmented into patches of equal size of the patch is chosen such that the significant information is not lost. All segments do not have useful information. So the patches having more than 70 percent of significant information are considered for further analysis. For segmenting the essential parts of segments such as shape of leaf tips, intervening, and region between intervenes, sports etc. statistical region merging algorithm is used.

Feature Extraction: The main features extracted for consideration are: Texture,Colour.

- **Texture:** The texture of leaves is extracted using statistical region merging. They may include features such as death of tips and margin, curling, reddish purple tip etc. These features are stored in the testing database.

- **Colour separation:** The HSI (Hue. Saturation and Intensity) colour model is used for representing the colours of the images. The colour histogram represents the distribution of colour in images. Here we compute the intensity of the colours present in leaves and represent them in a histogram. Also, the

intensity of each colour is stored in testing database in percentage.

Creating Testing database

The features of the leaves extracted in the previous phase are stored in the testing database. For the proposed method the features such as types of leaves and colour of the leaves in appropriate regions and the difference in their texture are identified for each nutrient from the literature studied. They are recorded in the testing database for comparison with the experimental leaves.

Separate Normal and Deficient leaves

The K means clustering algorithm is used for clustering. Those leaves with maximum pixels masked are considered to be normal. The others which have values in the histogram are classified as deficient. Here clusters will be classified in two classes. Normal, Deficient

Identify the deficiencies for the deficient leaves

Only the deficient clusters from the previous step are taken as input for this step. Here K-NN algorithm is applied to identify the deficiencies. The features of leaves in the testing database are compared against the training database. If maximum features match with the features of a particular deficiency, then they are affected by that deficiency. Using this technique, the clusters are formed for the different deficiencies.

5. EXPERIMENTAL RESULTS

SAMPLE INPUT IMAGE DATASET

The images which are collected in the dataset are all of different leaf of rice crop. Images having leaves of various type of nutrient deficiency. Later when model is training if any new input data comes having same features as of these data images, then that image will also get included in the existing database. And model gets smarter by the new features of the input image which may useful to categorize future input data. Some of the sample input image data is shown in the figure

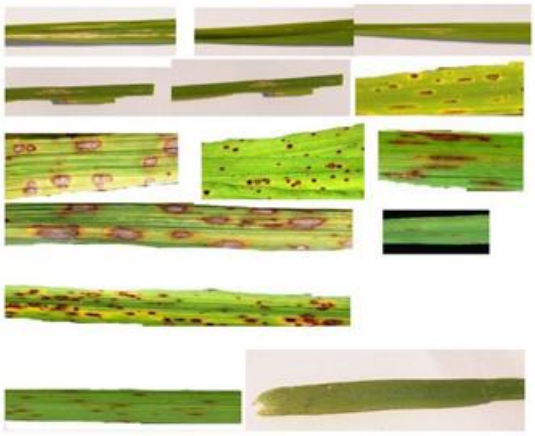
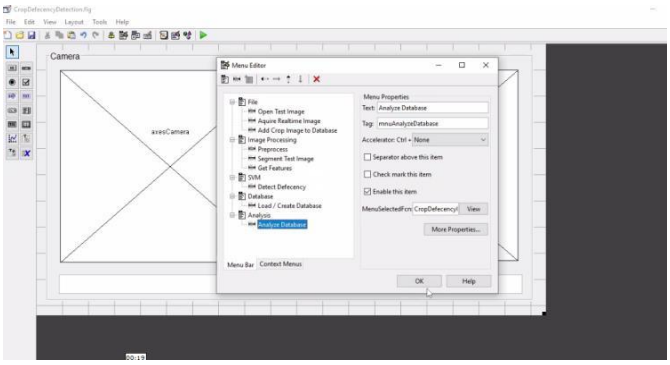


Fig. 5.1 Datasets of rice crop leaf

The results for the project is as follows

In a GUI there are 6 virtual buttons appeared on the screen for Loading an image, Enhancing, Segmenting, features extraction, Detection of deficiency, Analysis.



The first step is loading an image as shown in figure 5.7 below

Fig. 5.7 load Input Image

The next step is enhancing an image, the image is enhanced by pressing enhance button on the screen and the image is shown in below figure 5.8

Fig. 5.8 Enhanced Image

The next step is to segment an image, the segmentation is done by using k-means clustering method. By pressing the segment image button three clusters appear on the screen. We need to select a cluster which is closely related to the original image. The clusters formed are shown Fig. 5.9 below. After selecting the cluster, the segmented image with the classification result and affected region of the leaf.

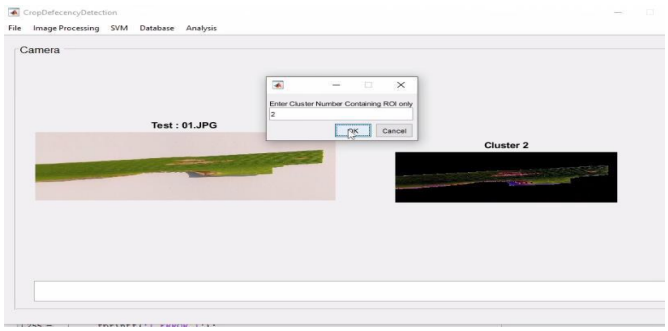


Fig.5.9 Clusters

After selecting the cluster, the segmented image is shown 10 in below figure with the classification result and affected region of the leaf.

The feature extraction values are displayed after segmentation process.

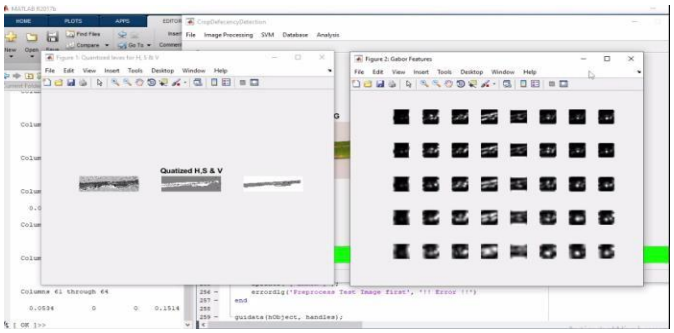


Fig. 5.10 Features Extraction

Last step to get results Nutrient deficiency of given input image. In below fig. 5.11 show the deficiency of Boron in given input of rice leaf also shows the remedies to cover this nutrient deficiency **(Antibiotics, Agrimycin 100, Agrimycin 500, Agric. Terramycin 17, A.S. 50 and Streptocycline, and fungicides, Brestanol, Fytolan and Vitavax)**

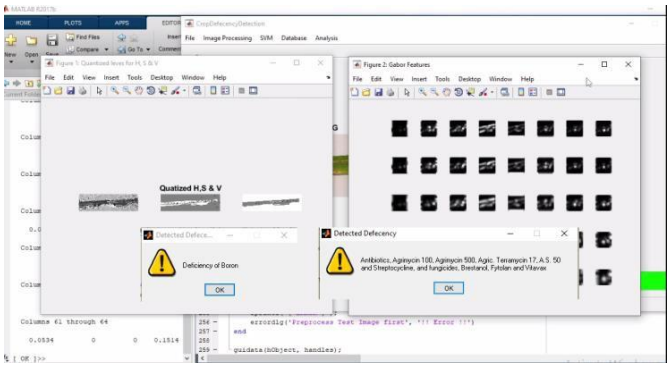


Fig. 5.11 Final result (Deficiency of Boron and Its Remedies)

CONCLUSIONS

Nutrient Deficiency detection is a system which identifies the unhealthy leaves and the nutrients which are deficient in them. This makes use of the image processing technique. Colours and texture of leaves are analyzed for detection. The proposed system consists of pre-processing.

Feature extraction, segmentation training and classification and finally. Identification. This project proposes a valuable approach which supports the accurate detection of nutrients which are deficient in the plant leaves.

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