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Nitrogen content in rice leaf and weed in the crop row

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ABSTRACT

Nitrogen (N) estimation and detecting weeds are two different works in the agriculture. Nitrogen is the essential nutrient in the plant which gives the status of plants. Detecting weeds in the crop row is also an essential as it affects the crops yield [1]. In this work rice leaf images are considered to estimate nitrogen content based on Leaf Color Chart (LCC), this paper also discusses the detection of weeds in crop row field.

Keywords: *ANN, Otsu's method, LCC, Morphological operations, HSV, RGB*

1. INTRODUCTION

In this proposed system N is the key part in Estimation of Nitrogen section. It can affect plants from both higher and lower amount like an atmospheric problem and affects quality, the number of crops respectively. Another section of the system is detecting weeds from crop row field as weeds play an important role in affecting crop yield. Weed is an unwanted plant that grows in between crops and competes with crops to get nutrients like water and fertilizers.

Though both excessive N and insufficient N affects the status of crops there is a need in providing the right amount of fertilizers to balance N content in crops. To do so here is an image processing technique which uses Otsu's method and Morphological operations to provide a quality image for the right estimation of N. Original values that is acquired using SPAD meter which is based on features like R, G, B, H, S and V are taken from GKVK institute. SPAD values are based on LCC where around 190 images original values are taken and trained to ANN. The result of the system is given by comparing the fetched RGB and HSV with the trained ANN and the final result is presented with LCC equivalent.

Maintaining weeds in agriculture is the biggest problem in India. Removal of weeds consumes nearly three billion dollars. Another problem that farmers are facing is that they are not able to know the right amount of weedicides to be applied to remove weeds. The crop yield gets affected in the presence of weeds. To overcome this, here is a method which uses Image Processing techniques which takes crop row image and processes to give detected weeds density [2].

The final output is a crop row image with differentiated crops and weeds using box plotting technique.

2. EXISTING SYSTEMS

Some of the existing systems are SPAD meter, LCC and Dumas method for estimating nitrogen content from the leaf images of crops. SPAD meter being an efficient system in providing the presence of N content in leaf it also poses some of the disadvantages like they are very expensive which can't be affordable. Leaf Color Chart where a single image is matched with the chart to know the N deficiency in the field. Basically, LCC consists of four slots with yellowish green to dark green color placed horizontally. It is being cheaper and affordable the drawback is that it lacks in providing higher accuracy. The Dumas method a chemically tested method takes a long time to complete all the process the needs to be done. So disadvantages are time-consuming and need experts to do all the process properly for proper result. So to overcome those disadvantages an Artificial Neural Network (ANN) is used and trained with original SPAD meter values based on Leaf Color Chart (LCC). Then the output of N estimation part is based on LCC equivalent that is given by comparing with trained ANN.

For detection of weeds in a crop row field image there exist fuzzy logic and Hough transform methods [4] and [6]. Fuzzy logic can provide accurately detected weeds in a crop row image provided the logical experts in the creation of fuzzy. The disadvantage of fuzzy logic is that it is tedious in nature. Hough Transform method also detects weeds but with less efficiency and very delicate on noisy images [5]. To overcome the existing model's disadvantages this work is proposed which takes input to the system as crop row image and processed through Image Processing techniques provided distinguished crops and weeds from the input image.

In this paper set, the section two gives an overview of related work, section three gives an in detail of proposed module, section four gives dataset used and section five gives implementation.

3. PROPOSED SYSTEM

Two different an agriculture-related works are carried out in this proposed system. The first work is to estimate N content, not in rice leaf and second work is to detect weeds density in a crop row field.

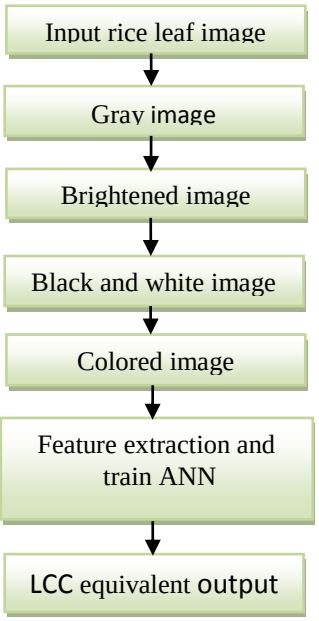


Fig. 1: A general process for estimation of Nitrogen

To overcome the drawbacks of existing systems here is the system which uses image processing techniques refers to figure 1 to provide cheaper and accurate estimation of N content. The input to the system is an image of rice leaf captured from the camera. The input image is then converted into the gray image as processing speed increases though gray is of eight bits. The features like HSV of it's the value of each pixel are fetched and calculated average to compare it with trained ANN. To remove noise in the gray image brightness is added with contrast adjustment which helps in getting sharpen the black and white image. Otsu's method and Morphological operations are applied in the next step to get pure black and white image by removing all the imperfections or noises. Image segmentation provides a colored RGB image, in this step RGB of each pixel are fetched and its average is calculated to compare the value with trained ANN. The original values that are measured using SPAD meter which is mainly based on RGB and HSV are collected from GKVK institute to train ANN [3]. The result of this proposed system is an image which is equivalent to LCC.

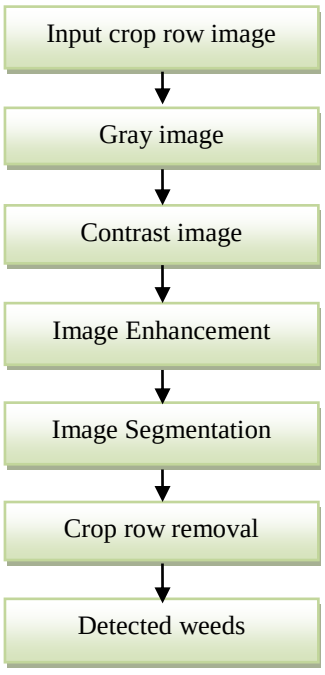


Fig. 2: A general process for detection of weeds

Existing systems of weed detection pose some of the problems, to overcome that here is the proposed system using image processing techniques refers to figure 2. The input to this system is crop row field image captured in camera is converted into a grayscale image and then to contrast image to remove noise that is present in the captured image. In the image, enhancement image is converted into black and white using Otsu's method to get the binary image. Then morphological operations are applied to remove imperfections left in the processed image. The image is segmented to produce removal of crop row image and then with the final image of differentiated crop row and weeds image.

4. DATASET

In this proposed system the output is based on LCC so the input to the system is given based on LCC to check the performance. The SPAD values for each image based on LCC is taken and trained to ANN. Leaf images are selected by comparing it with LCC which ranges from yellowish green to dark green. The qualified LCC consists of four strips which are named as LCC1 (0-29) refers to figure 3, LCC2 (30-39) refers to figure 4, LCC3 (40-78) refers to figure 5, LCC4 (79-120) refers to figure 6. Below given LCC equivalent images of rice leaf.

Fig. 3: LCC1 image

Fig. 4: LCC2 image

Fig. 5: LCC3 image

Fig. 6: LCC4 image

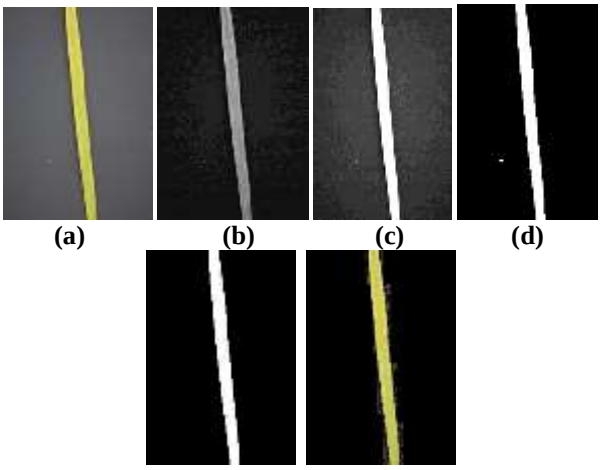
5. IMPLEMENTATION

For implementation, Net Beans is used as a tool and worked with Java language. To create and train ANN SQLyog is used to store original values that are SPAD values taken from GKVK institute.

Fig. 7: Proposed system GUI

Fig. 8: Estimation of N rice leaf system

Above image is the first part of the proposed system that estimates the N content in rice leaf with provided right fertilizer refers to figure 8.

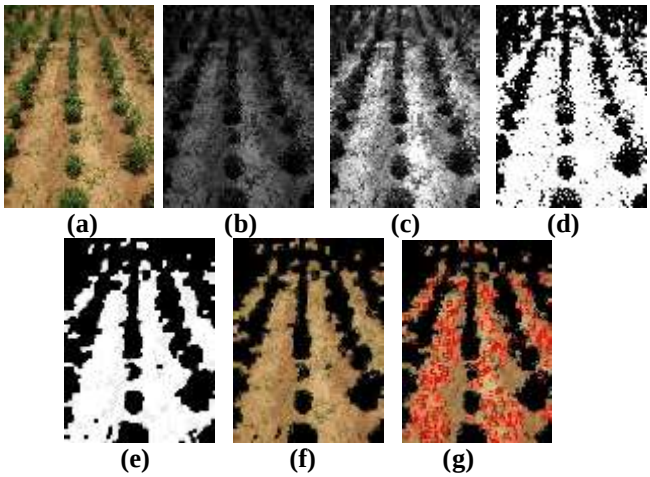


(a) (b) (c) (d) (e) (f)

Fig. 9: Processes rice leaf image a) Original image b) Gray image c) Contrast image d) Otsu's image e) Morphed image f) Output image

Figure 10: Detection of weeds system

Weeds detection system which gets crop row field image as input and gives an output of an image with differentiated crop row and weeds density refers to figure 10.



(a) (b) (c) (d) (e) (f) (g)

Fig. 11: Processed images, a) Original image b) Gray image c) Contrast image d) Binary image e) Morphed image f) Segmented image and g) weed detection

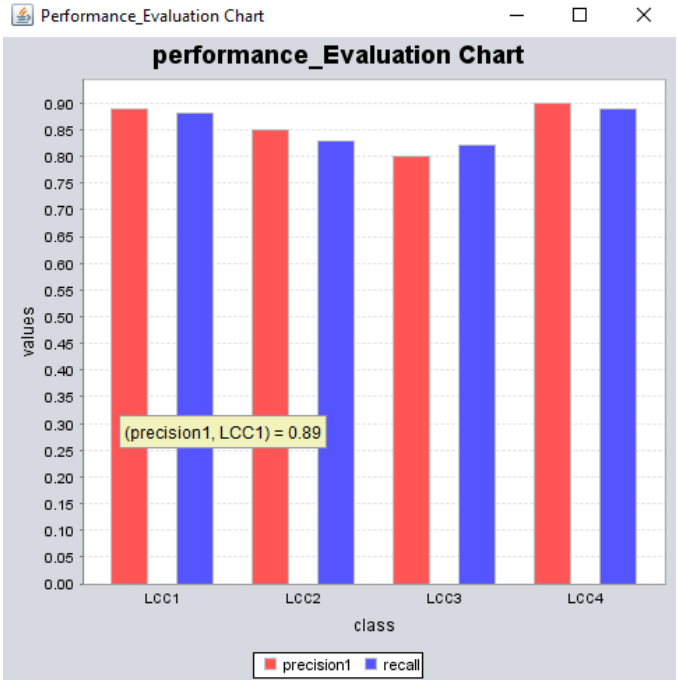


Fig. 12: Performance evaluation chart

The red and blue bars in figure 12 refer to 'numbers of selected items are relevant' and 'numbers of relevant items are selected' respectively.

6. CONCLUSION

In this novel work, an efficient approach is used to estimate the nitrogen content in the rice crop and also to detect the weed in crop row field using Image Processing techniques. Based on the work suitable fertilizers are guided. The weed detection help to remove the weed from crop field automatically.

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