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MACHINE VISION FOR WEED DETECTION IN VEGETABLE CROP USING MODIFIED SUPPORT VECTOR MACHINE

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ABSTRACT

Weed plants are unwanted plants growing in between host plants. There are more than 8000 weed species in agriculture field. This is the global issues which leads to loss in both the quality and quantity of the product. So, attention has to be taken in prior time to avoid these losses and saving manpower. In this paper, the three procedures such as segmentation, feature extraction and classification, for weed plant identification were presented in detail. To separate the region of interest threshold segmentation method was applied. Then the important features such as shape and textures were analysed with the help of GLCM method which were discussed in this review. Finally, in the image classification method namely modified support vector machine was used to separate the weed and host plants.

Keywords: - Precision agriculture, weed detection, segmentation, feature extraction and machine learning

INTRODUCTION

Agriculture is very important in Indian economy. In recent years, due to climate change effects, diseases, pests, human error the agriculture faces many problems (Zhang et al., 2002).. So ,the most challenging task of agriculture is increasing both quality and quantity of the product from these critical issues (Li et al., 2014) (Sanjeevi et al., 2020). Accurate identification and precision treatment are needed for both types of plants such as weeds and crops. But both these treatment and identifications are subjected to predict the error in affect crops field. Hence, research in agriculture is focused to increase quality and quantity of the of the product. Manual diagnosis is challenging task for agriculture area. So automatic detection is needed for human error and man power saving. In recent years, the agriculture and farming systems has become a worldwide development with well-growing technology (Jones et al., 2017). With the help of image processing techniques automatic system is introduced in agriculture area.

Weeds are the most challenges in agriculture field because these weeds present anywhere in the crops field (Feyaerts & Van Gool, 2001). As a result of this weeds the crop yields get more loss. So, attention has to be taken to identify the weeds present in the crop field. Hence, the yield loss occurs due to unneeded weed plants, plant disease, nutrition deficiency and quality of yield. The farmers are benefited according to the well growing technology such as image processing and communication systems. The amount of well growing technology with computer vision applications are quality of yields, disease identification, monitoring irrigation and water stress management (Chen et al., 2002).

RELATED WORK

The weed detection and classification done with the following four methods

1. Image Acquisition: The images are taken in the direct field.
2. Image Segmentation: Based on the segmentation techniques weeds are detected.
3. Feature Extraction: After segmentation, the relevant features are identified for further classification.
4. Image Classification: At last, the weeds are classified based on the classification techniques.

(Desai, 2015) The Author proposed that the weed classification and identification play a major role in faming industries and has been considered as the most important technical and economic significance in the farming industry. weed are being extracted using images by image processing technique which is described using shape, color, and size features. These features mentioned here are used to classify weeds which are similar and also crop species which are similar. There are several techniques to differentiate between weed and crop these techniques are SVM, CNN, DA and methods like otsu method, 2G-R-B. The author worked on these different techniques to analyze the weed and crop and to detect the weed present in each and every crop by using the technique image processing.

(Shangp, 2010) The author detected that the weed can be visualized by using the machine vision technique. This technique uses a unique image processing technique. The weeds which are present on the agricultural land are detected by using different properties such as shape, size, spectral reflection, texture features. In this document they have used size feature has an important technique for weed detection. To get the clear image of the weed an excessive green algorithm was developed to remove the soil and other unwanted things from the image. to eliminate the noises from the image we use image enhancement techniques, then for extracting each component from the image, sized based on area-based features like area and perimeter. The label algorithm technique used to calculate selecting suitable threshold value for crop segmentation has been done to detect.

(Satish et al., 2016) The author concluded that controlling weed was very essential and a critical operation which could affect the crop yield. This document is proposed with 2 important method to differentiate between crop and weed which consist crop row detection in images from agriculture field. This crop row detection method includes 3 major processes which are – image filtering, image segmentation using the ostu's method and also crop row detection technique, further classification between the weed and crop is carried by using the technique box plotting. The proposed technique did not work against the lighting due to the environmental condition.

(Nathalia et al., 2016) The author proposed a application for detecting the unnecessary weed in crop from one area with extra agricultural impact using computer vision. to get the region of attention which was developed by image processing using processed neural network. the author proposed three methods like image acquisition, segmentation and ANN. they enhanced in the method by introducing herbicides, exacting case of this application, image processing. these were the important aspect since identification of regions of interest, light intensity, and it was major challenge.

METHODOLOGY

This methodology is for identifying and classifying the weed plant in the farm. It involves several tasks such as image acquisition, segmentation, feature extraction and classification. Fig. 1. shows the general structure of weed plant disease identification and classification.

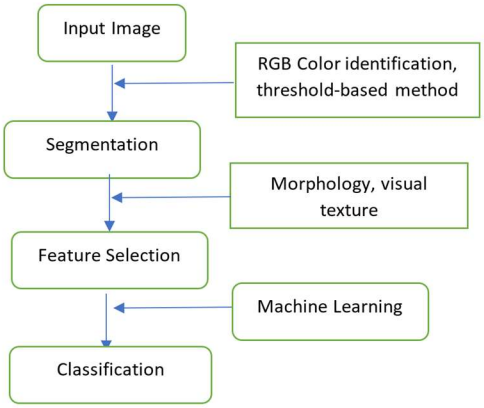

Fig.1 Architecture of weed detection

IMAGE ACQUISITION

The first step in weed identification is image acquisition. The input images are acquired through sensors camera mounted on drones. So, with the help of this camera the images are taken directly from the agriculture field as shown in the Fig.2. The important features of the camera are Sony 6000D with high resolution lens at 210 mm focal length at a speed of 1.4 m/s and 7 m above the ground. Hence this camera used to collect the image automatically (Wang et al., 2019). Based on the weather condition, climate condition high resolution digital camera was used to collect picture.

Fig.2 Input image of Corn plant

IMAGE SEGMENTATION

The images are captured under different lightning condition, due to that noises are addressed which is to be problematic during classification. Hence, the noises are removed using the adaptive median filter. The main objective of image segmentation is separate the weed plant from all plants using some various HSV methods as shown in the Fig. 3. Here, the weeds are identified by two approaches. The approaches here is one is inter-line and another one is intra-line approach. Generally, the plants such as sugar beet, paddy, maize are planted in line with clear spacing. But the weed plants are rowed outside of the line from the host crops (Reddy & Basha, 2017). Hence those weeds are identified easily from the host crops. Here, threshold (Fig. 4), histogram and edge detection method addressed to segment the region of interest from the background image by using the following formula.

$$I_{bin}(x,y) = \begin{cases} 0, IMedian(x,y) < t \\ 1, IMedian(x,y) \geq t \end{cases}$$

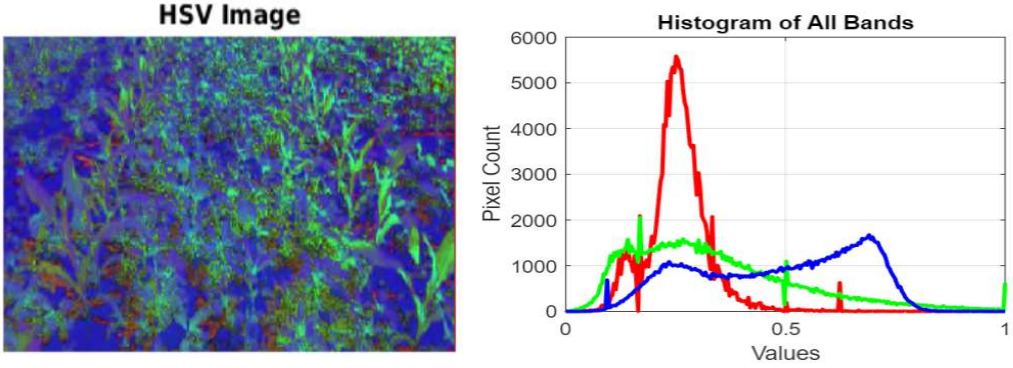

Fig. 3 HSV image and Histogram Image of Corn plant

FEATURE EXTRACTION AND CLASSIFICATION

Finally, to find the weed plants and host plants, the important features are involved to distinguish between two plants. The additional features such as shape and textures are selected and extracted from the input image to classify the weed and host plants (Asad & Bais, 2019). One of the most important features are texture analysis. The major characteristics of the textures such as structural features, model-based features, statistical features, and transform-based features were analyzes. Based on the region of interest the important information of textures is extracted from the image. Some other features such as area of interest from the shape features are analyzed. After extracting important features, all the features were combined to select the important feature to find the weed plants based on the trained models.

Finally, classification methods are used to distinguish between weed and host plants. Machine Learning approaches are used to automatically analyze to make decision. Finally support vector machine used to separate the host and weed plants (Basavarajeshshwari & Madhavanavar, 2017).

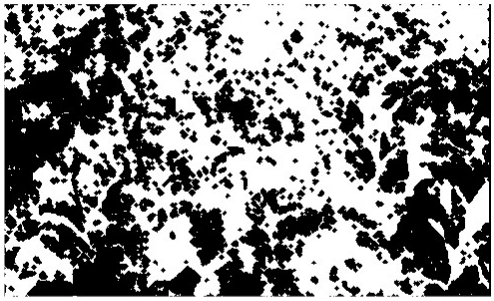

Fig.4. Threshold image of corn plant

RESULT AND DISCUSSION

For weed detection, two different types of datasets were used such as paddy and corn. The dataset such as paddy and corn were taken in direct field. Finally, these mixed datasets were utilized for experiment. The last procedure is to separate the different plant varieties such as crop and weed with proper classifiers. Hence, the algorithm used to classify the weed and plant is conventional neural network and the modified support vector machine (Tang et al., 2017). To estimate the proposed methodology, with the help of train data and the test data the accuracy level was identified. The result of the testing was arranged in confusion matrix with true positive, true negative, false positive and false negative (Onyango et al., 2005). Here, true positive identify the weed plants; true negative identifies the crops; false positive identify the incorrect weeds and false negative identify the incorrect crops as shown in Fig. Hence, in order to analyze the performance accuracy level was measured using this following formula.

$$\text{Accuracy} = \frac{\text{tp} + \text{tn}}{\text{tp} + \text{tn} + \text{fp} + \text{fn}}$$

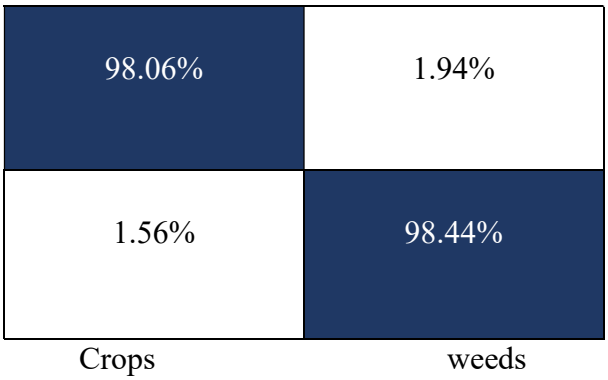

Fig 5. Confusion matrix of the crops and weeds

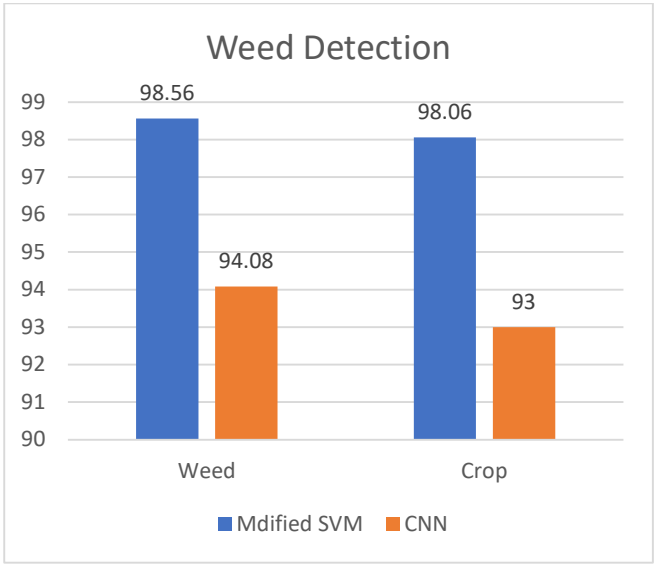

Fig 6. Performance analyzer for classifier

This modified SVM classifies weed and crop effectively. It is shown in the above Fig. finally, this modified support vector machine gives better accuracy compared to conventional neural network.

CONCLUTION

This paper presents the automatic detection of weed plants in image processing. The algorithm designed to automatically identify the weed plants in crop field. Here, the image processing technique is used to detect the weed plants through machine vision. In this paper, ta set of 150 image datasets was collected and done various processing such as segmentation, feature extraction and classification. Weed and the crops are detected through various methods and it is classified by using the methods namely modified SVM and the CNN. Finally, this proposed modified SVM was compared with CNN using performance analyze and produce high accuracy of 98.56% compared to existing systems.

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