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Survey Paper on Broad Leaf Weed Detection in Ragi Crops using Supervised Learning

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ABSTRACT

Weed control in crops is a challenging problem which can be expensive and also environmentally unfriendly. Uncontrolled growth of weeds can severely affect the quality and yield of the crop. This system proposes a novel method for recognition of broad-leaf weeds in ragi crops such that precision weed control can be achieved with the reduced use of herbicide. The conventional machine learning algorithms and the deep learning methods have been explored and compared to achieve high rate of detection, accuracy and robustness in real-world environments. In crop grass/weed image data have been captured for classifier training and algorithm validation. Use of CNN algorithm produces highly accurate results.
Keywords: CNN, broad leaf weed, ragi crops.

INTRODUCTION

Weeds are of great trouble to the farmers and hinder the growth of crops. Weeds have a negative effect on crops which include sharing of water, light, and nutrients, increases production costs, causes difficulty in harvesting crops, depreciates the quality of the product, increases the risk of pests and diseases and leads to decrease in commercial value of cultivated areas. This results in a problem to the farmer because the weed plant consumes a larger amount of nutrition and water so that the other plant cannot grow in a good shape. Weeds can be found more in a plantation because in the plantations have all the nutrients and water required for the weed to grow. Herbicides playa crucial role in removing the weeds and it provides a good result at initial position but later the weeds dominate the field. The manual weed control, which is used in organic farming, without chemical or synthetic agricultural pesticide is the only way to protect our environment. It is mainly produce oriented and hence the profit or loss depends on the yield obtained At present these kinds of plants are being removed manually, wherever possible, or pesticides and weedicides are being sprayed uniformly all over the field to keep them under check. Many image processing approaches have been attempted so far. Deep learning has placed itself in the first position, by delivering maximum accuracy compared to all other simple techniques. Deep learning has an advantage over all the other machine learning-based algorithm since it can learn the features on its own and thus eliminates the need to compute and design features manually which saves the time, also for other techniques features tend to change if problem or dataset is altered. Another advantage of deep learning is its unlimited accuracy, better training or more data input could lead to better accuracy than other.

PROBLEM STATEMENT

The main objective is to train the system with images of ragi crops and broad-leaf weeds under deep learning framework which includes the method of feature extraction and classification. This system is implemented using Convolutional Neural Networks to develop a scalable, robust and real time weed detection system. Broad-leaf weed control in ragi crop is a challenging problem that is expensive and also environmentally unfriendly. This system proposes a novel method for the recognition of broad-leaf weeds in ragi crops such that precision broad-leaf weed control can be achieved with the reduced use of herbicide. In ragi crop grass/broad-leaf weed image data have been captured for classifier training and the validation of algorithm. Broad-leaf weeds are the major cause due to which farmers get poor harvest of ragi crops. Many algorithms are developed to classify broad-leaf weeds from ragi crops so as to autonomously destroy weeds among the crops. Supervised Learning is the technique which will be used to develop this system.

EXPECTED OUTCOME

System should be able to perform following actions.

- System must be able to differentiate broad leaf weed and ragi crop.
- System should allow the user to find crops and weed information.
- User need to register them self to use the system.
- Administrator should be able to add, delete and update the dataset.
- System should have well defined User Interfaces.
- System should be able to inform the farmer about the ways to deal with the weed that is if the weed has to be removed manually or if the weed has to be removed by spraying herbicides based on the density of growth.

IMPLEMENTATION

System has following functional modules:

- Image Selection: The images of ragi crops and weed are selected from the system. The input image will be then resized to 256x256 pixels. The construction of an image database depends entirely on the required application.
- Image Pre-Processing: Image pre-processing is used to enhance the quality of the image necessary for the purpose of further processing and analysis. It includes the conversion of color space and image enhancement.
- Image Segmentation: Image segmentation is the process which is used to simplify the representation of an image into a meaningful form, so as to highlight the object of interest from background.
- Feature Extraction: After segmentation has been performed, features are extracted from the image. Grey Level Co-Occurrence Matrix (GLCM) is the method which is used for investigating the texture which considers the spatial relationship of pixels.
- Classification: System will use the CNN algorithm to classify the images. CNN is used to compare the image piece by piece. The pieces that it looks for, in order to compare with the other images are called features. By finding the rough feature matches in approximately the same positions in two images, CNN gets better at identifying the similarity when compared to the whole-image matching schemes.

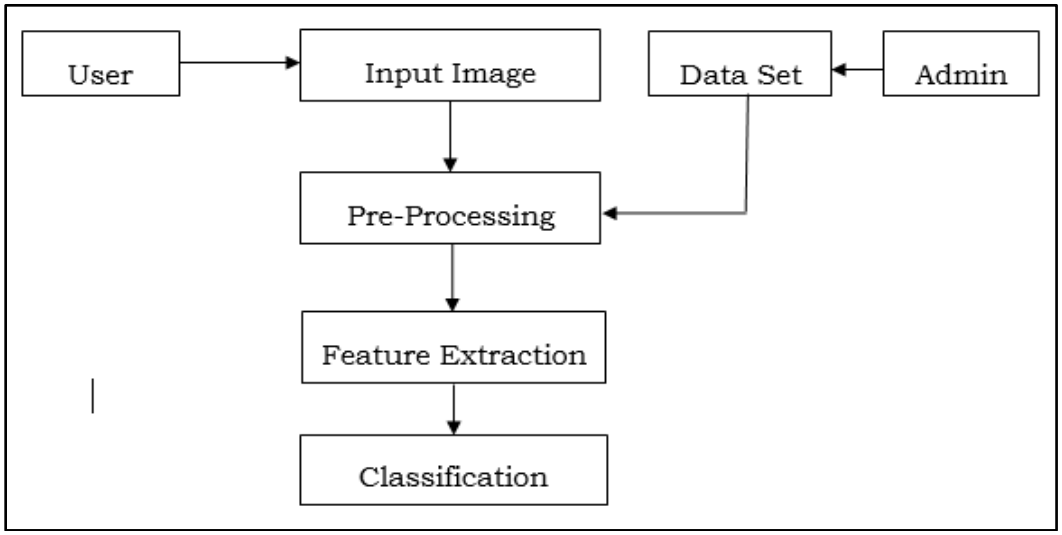

Figure: 1System Design

LITERATURE SURVEY

Image processing technique is used in the detection of weed [1]. Unmanned Air Vehicle (UAV) is used in order to acquire the data. The background detection technique was used for the detection of wheat. Better results can be obtained by using Convolutional Neural Network (CNN).

Parallel Image Processing [2] is one of the techniques used in the detection of weed. This system uses feature extraction and classification techniques of deep learning framework to train the system. The proposed system has the limitationof the bounding boxes which are used around the weed image that can overlap with the crops due to the appearance of close proximity.

Detection of crop and weed for variable-rate spraying [3] is used for spraying of pesticides in a suitable manner. The weed and crop detection was performed using Random Forest Classifier to produce a robust and real-time agrochemical spraying system. The problem with this system was that it did not calculate the density of weed.

To detect the weed which grows between crops using a deep learning technique and remove the weeds using an automatic cutter [4]. Convolutional Neural Network(CNN) was used where ReLU function was used for extracting the features of an image. From the resultant image, Region Of Interest(ROI) will be extracted.

Precision farming robots [5] is usedto reduce the amount of herbicides that are needed. CNN algorithm is used to exploit existing vegetation indexes.

CNN model for semantic pixel-wise segmentation [6] proposes a crop-weed classification system for potato is a model that incorporates spatial information by considering the image sequences. The weed cutter moves to the corresponding coordinate and defoliates the weed and this process is iterated for the whole farm.

The robot includes of motors, servo motors and a camera which is used to capture the image of the weeds and crops [7]. The robot is used to spray the weed herbicides straight to the area that have been detected with weeds. CNN uses variation of multilayer perceptron's aimed to use minimal preprocessing.

The Maximum likelihood classification and deep convolutional neural network [8] was a methodology that was developed to accelerate manual labelling of pixels. Themain aim is to map the weeds in order to estimate the weed densities for variable rate herbicide application.

Image Processing [9] proposes that the weeds which are present between the crops can be removed in two ways, they are Weed Detection between Rows and Weed Detection between Columns.

Weed detection and classification for autonomous farming [10] have chose a systematic way of sensing setup and cues that are used for classification of weed species in a wheat crop. An automatic cue selection followed by classification procedure has been proposed. The plant species considered here are Bidens and Lolium in a wheat crop. Cues included are, Hue, Saturation, Texture and their combinations. Texture reveals the spatial distribution of an image, normally repeated patterns. The common techniques of identifying texture are Gabor filter, runlength statistics and co-occurrence matrices.

Weed Detection Using Image Processing [11] mainly aims in detecting the weed among the crop by using image processing technique. Then the inputs of the weed areas is fed to an automatic spray pesticide only in those areas where the presence of weed is encountered. the images are fed to image processing technique where the image using MATLAB to detect the weed. Image Processing Algorithm prepares an image for further advanced processing and it includes of Loading the image from source, color segmentation, and edge detection.

Smart Herbicide Spryer robot can be used to conventionally kill weeds in a crop plantation [12]. This project was implemented using three steps. The first step was to acquire the images using a Raspberry-Pi camera, which was fixed on the chassis of the robot. The captured images were subjected to morphological modifications like erosion, thresholding and dilation. Finally the herbicide was sprayed in the ROI if the weeds were present.

The use of ToF cameras in organic farming is used widely for detection of weeds in crops [13]. Plant root exit point search algorithm is the method proposed here. The Laplacian edge detector is used to detect the vertical lines with the help of a matrix. The image acquired will then be transferred to an 8-bit scale space. The image was then explored using the bimodial histogram. A 3D model for a carrot dam was developed to implement this method in detection of weeds among the carrot crops. This was created in a Robot-Operating-System environment.

The use of DCNN [14] for the detection of weed in farm crops provides accurate results when compared to other methods. Berkley Caffe tools and AlexNet were used for the purpose of training and testing the dataset. Synthetic Imagery was used in order to produce images. The images were captured using an iphone 6 plus which was mounted on a Robotic rover. These images were then decoded and converted into RGB images. The use of DCNN produces robust and high accuracy results.

Use of Convolutional Neural Networks [15] is an effective way to get rid of weeds in plants. Python 3 and Tensorflow was used in order to write the program. The images for the training and testing dataset was obtained from the mobile camera.

The images obtained were labeled using graphical image annotation tool. Since Transfer learning method was used there was no feature extraction carried out in order to train the models. This paper only detects weeds and does not give any information about the density of weed detected and how to deal with the weed detected among the crops.

Robotic Weeding [16] is the method proposed in order to detect the weed and destroy them. A machine vision system was used. The drawback of this project is that the varying climatic conditions would affect the machine based weed system.

Infestation of Weed is a common problem in Agriculture. Detection of Salient Region of In-field Rapeseed Plant [17] is the main aim of this project. The first step here is the processing of images which consisted of decomposing images obtained form the input into a set of distinct feature such as color, intensity and orientation. The Saliency Region was detected by using MATLAB which was then fed into the visual attention model. The Rapeseed plant extraction played an important role here. This was done using the EXG Segmentation method. Binary mask images were produced using Otsu method. A good attention model is required which results in increased cost.Also there was no suggestion for the removal of weed after the weed had been detected is a major drawback of this project.

Image- Processing Algorithm is used to detect the existence of weeds among the crops in the site [18]. The main objective of using this algorithm was to obtain a formula which could be used in the binary classification of the images. The first step in this is to detect the images with green plants so that all the other images such as soil can be eliminated. Segmentation and elimination of unwanted images was done through filters for focusing on vegetation. Then the labeling of objects was done. The model loses its effectiveness when the size of the plant is similar to the size of the weed. This could be eliminated by using the classification method.

The identification of the weed growth and plant disease is a major issue in precision agriculture [19]. The main goal of developing this project was to identify the best method to position the optical sensors to get the bestpossible images. For this purpose the variant of SVD was used for feature construction. The first step is image acquisition. The aerial and portrait images were then subjected to preprocessing to adjust the images to have uniform size. It was then subjected to Single Value Calculations using Singular Valued Decompositions (MSVD). The images were then subjected to Threshold Classification. Of Aerial and Portrait Images. The intrusion detection algorithm was used to create a caution algorithm.

A survey on the Image Processing technique has been proposed here [20]. The first step here is to acquire the images. The images were captured with the help ofhigh resolution cameras in order to obtain better results. Here RGB images have been used. After the images have beenacquired they have to undergo pre-processing. Here the RGB images will be converted into Gray scale images. Gray scale images will then be converted into binary images and several filtering techniques will be used to remove noise, lighting variations and unwanted objects form background. After this step the next phase is feature extraction where features such as entropy, energy, contrast, size etc., are extracted. Next the images are classified using various techniques like artificial neural network, probabilistic neural.

CONCLUSION

Application of Deep Learning is a novel method used in the field of autonomous weeding application which promises higher accuracy than any other technique. There exists a potential research gap where deep learning methods can be applied in various crops for identification of weeds. In future, autonomous spray application can be used which will benefit the farmer in getting higher crop yield and control of weeds will be more accurate and robust also soil pollution will be avoided due to controlled herbicide spray application.

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