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Implementation paper for Weed Detection in Agricultural Crops

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Abstract -When a plant is in a place where it shouldn't be, it is called as weed. Weeds are one of the major problems faced by the farmers because they result in reduction of yield. There are few algorithms developed to identify crops and weeds. In this paper, we focus on identifying the weed present between the crops which compete with the crops for nutrition, sunlight, water etc. The objective to develop such a model is that, if we identify weeds, we can find out which areas should not be sprayed with pesticides, water and other nutrition and eventually it will result in reduction of weed. In our paper, we have proposed a system in which we will pass a video and CNN, Yolo algorithms are used to identify the weed. The purpose of selecting Yolo algorithm is that it has become a industry standard for object detection due to its speed and accuracy and CNN helps us to reduce images in such a form that processing becomes easier, also this process does not result in losing any features that are critical for giving us good prediction. The contributions of this paper are to: study and present an approach to identify weeds that are present in crops, develop a method that can identify weed in plantations.

Keywords- Weed detection, Crops, Convolutional Neural Network (CNN), Image Processing, and Machine Learning.

I. INTRODUCTION

The agricultural industry plays a very important role in the economy of India. India ranks second largest in terms of population and also among the top agricultural produce exporters. But still in most of the areas, farming is done in traditional ways. One of the major problem faced that result in considerable decrease in yield is weeds. Weeds are basically those plants that grow at undesired areas.

Detecting weeds in agricultural crops is a problem that is faced because it is difficult to manually look out for weeds in such a large space where crops are present as well. There is always increasing demand for vegetables and crops but the yield gets reduced due to the weeds present. These weeds are harmful for the crops as they try to consume the nutritious elements, sunlight, water and pesticides that a meant to be used by the crops. The objective behind detecting weed is basically to improve the yield by bringing in the technology that can be used in agricultural areas to do patch spraying.

The proposed system identifies weed based on the dataset that is trained, where it is present, and draws a bounding box around it also describing the precision. This can be used with the sprayers for minimal spraying in such areas and maximum spraying on the crops. For Image Processing and machine learning based classification of weeds and crops, there are several proposed methodologies.

II.RELATED WORK

Image Processing and Machine Learning according to the stages of weeds and plants, a number of methods are proposed.

XIAOJUN JIN [1] suggested that the accuracy obtained by a trained CenterNet model during the field test was 95.6%. Here vegetables were found and cartons were drawn next to them and the items that were not tied to the boxes were considered weeds. Basically the first step taken here was the acquisition of the image. Here pictures of white Chinese cabbage were found for experimental purposes. Then a photo-enhancing technique was used to collect color, brightness, rotation and 1150 images were expanded to 11500. The hand annotation was used to draw the used vegetable binding boxes in Training CenterNet model. Then the model was trained and tested to get the desired result. According to the results of the study it was proposed that this method be able to identify weeds in vegetable cultivation.

The same weed processing method for weed detection can achieve 91.1% accuracy as proposed by Mother Shesher S [4]. The PWDS method is implemented using Convolutional Neural Networks. The exact values of crop diversity and weed detection are compared with the values suggested by S. Haug, J. Ostermann, and R. Bosch's paper A Crop / Weed Field Image Data set for Evaluation of Computer Vision Based Precision Agriculture Tasks and PWDS Model has more accuracy. The use of the neural

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network makes it more efficient because only pixels of the input image are used by the system as neurons.The use of hyper spectral data collection followed by label production and classification is a method proposed by Xiuping Jia [6] where the hyper spectral imaging system was used to collect study materials including Hyme, Alli, Azol, and Hyac. Then with the use of data augmentation the number of images increased by 2000 at each weed stage.The CNN model had 2FC layers. Structural configurations include a flexible layer, an indirect layer and a large integration layer. The recognition size of the 500 x 500pixel size is 21.83%, 250 x 250 by 24.43% and 125 × 125 by 21.57%.

III.PROPOSED SYSTEM

The proposed model detects the weeds from all the crops. In this model some machine learning algorithms along with image processing techniques will be used to detect the weeds in the crops. In the initial stage acquiring the images of the field is done. Getting the images of the field can be done manually or attaching a camera behind the tractor.

Module wise explanation-

Conversion of video(input) to frames-

The proposed system does not understand the video as input, so the very first step is to convert the video into number of frames(images). We need a folder in the same project location to store the converted frames from the video. If the folder doesn't exist then it creates its own folder and stores the frames. The frame creation will start from value 0 until the last frame.

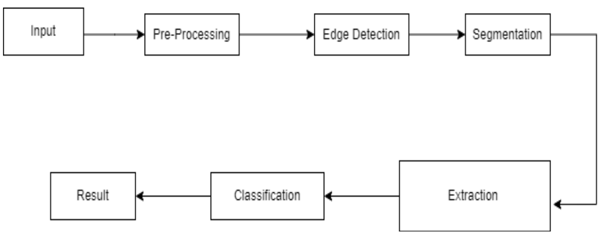

Fig.[1]: Proposed System

2. Conversion of the image into Greyscale image

-Once we have the images from the crops, our next step is to load the captured image of acquisition unit and do pre-processing on it. The RGB image is converted to Grayscale image. Using Grayscale instead of RGB can save your time. However, this might not be true for every case. Some images may be enhanced getting processed with colors. But for the proposed system we need to convert the images into grayscale images. Then our next aim is to find the threshold image. Thresholding produces a binary image, where we can see that all the pixels with intensities above (or below) a threshold value is turned on, while all other pixels are turned off. The binary images produced by thresholding are held in 2-Dimensional NumPy arrays, since they have only one-color value channel. They are Boolean so they contain the values 0 and 1

3. Classification-

Neural networks are designed as per our brains. When you give image as input data to the model, it takes the pixel values and gives the unique visual effects. When the images are given, CNN algorithm will detect the edges of the picture. After this the definition of the image will get passed to the next layer. In the next layer, corner and color groups will be detected and the definition of the image will get passed to the next layer and this cycle continues until a precision is made. The main role of CNN in our proposed model is to reduce the images into a form that is easier to process, for a good prediction.After this, non-linearity of the images is increased by RELU (rectified linear activation unit). The images are non-linear, so for that purpose RELU is done. After RELU, the pooling layer is done, which is another building block of CNN. The spatial size of our representation is reduced, so because of this the network complexity and computational cost is lowered. In the last step, flattening is done. Flattening creates a single long feature vector. This feature is used for the final classification.

4. Architecture Diagram

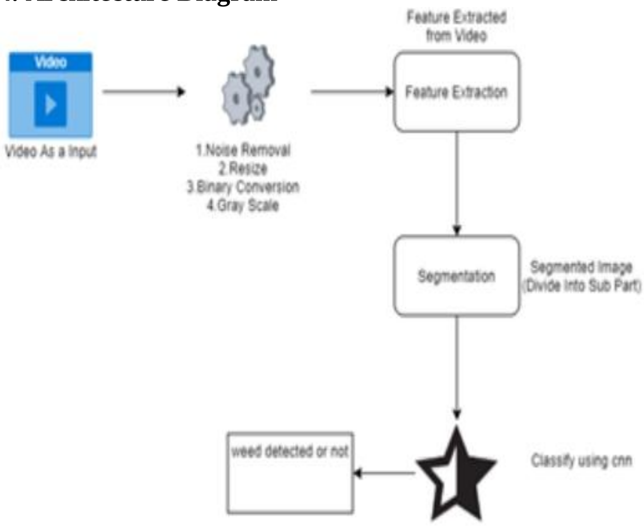

Fig.[2]: Architecture Diagram

5. Intersection over union (IOU)

Intersection over union (IOU) is a phenomenon in our model i.e., weed detection that describes how boxes overlap. This algorithm uses IOU to provide an output box that surrounds the unwanted crops perfectly.Each grid cell is responsible for predicting the bounding boxes. The IOU sets to 1 if the predicted bounding box is as close as the real box.

6.Working of YOLO in our model

In the very first step, the image is divided into grid cells. Each grid cell forecasts N bounding boxes and provides their scores. The cells predict the overall class probabilities to obtain the class of each weed.

Intersection over union ensures that the predicted bounding boxes are equal to the real boxes of the weeds. This phenomenon eliminates unnecessary bounding boxes that do not meet the characteristics of the weeds (like height, width and class). The final detection will consist of unique bounding boxes that fit the weeds i.e., all the unwanted crops perfectly.

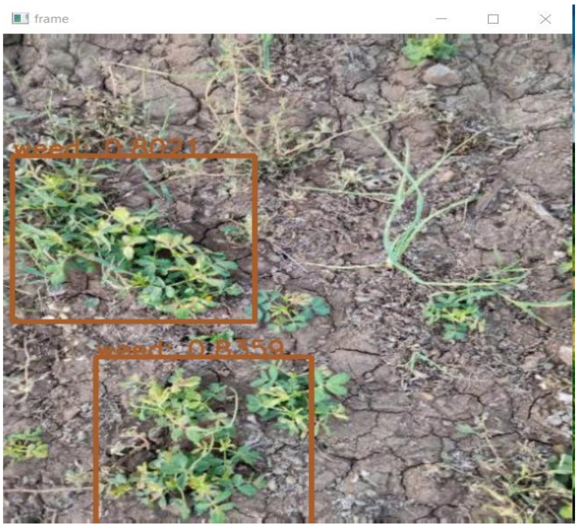

Fig.[3.1]: Output(Weed Identification)

Fig.[3.2]: Output(Weed Identification)

IV.EXPERIMENTAL RESULT

The experiment is performed with a well performing dataset for validation confirmation and for working on any impartial bias in dataset. The tests were performed in a series of separation of test training data. If the model is set training, 30% of the database is set for verification of training steps, therefore the database was divided into various trainings and groups of testing a data sets. Training and the test was divided into a 10:80 scale where 10% is of testing database and 80% training and remaining more 10% of the database is reserved for more cross-checking and for validation of the weeds to be identify. After train, test are performed some more anonymous photographs taken to show you weed in them which were not in the database for training. This learning model approach process has been able to predict weed accurately at 90 to 95%. Incorrect detection appear to be very close what a computer thinks it is. The detection function of this learning model was as good as it perfectly detect the weed , even with different backgrounds in such hand, soil and various natural conditions such as morning, afternoon and evening time. Here Picture shows a summary of the various results obtained weed detection in the affected test dataset.

1. Graph Result(Accuracy/Loss):-

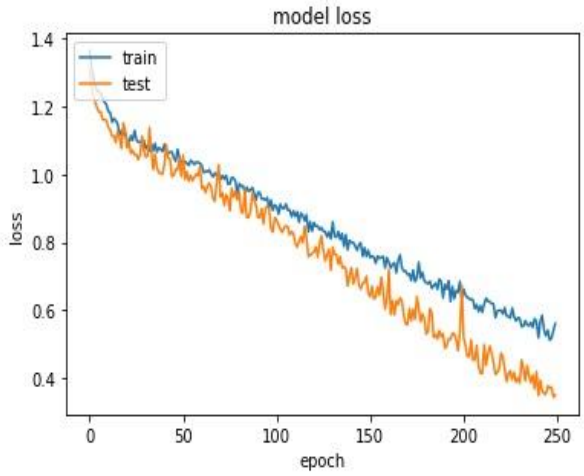

Fig.[4.1] : Model loss

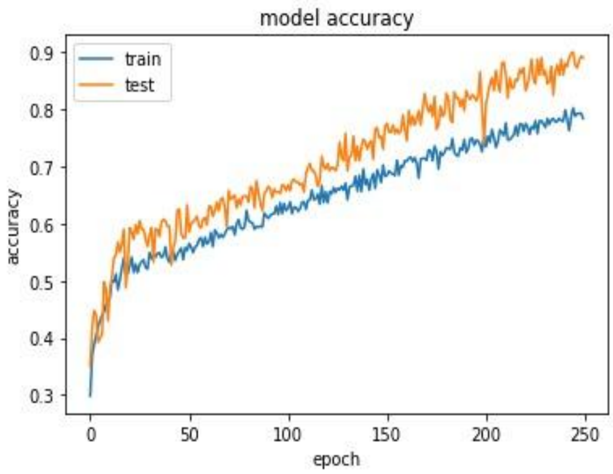

Fig.[4.1] : Model accuracy

V.RESULTS

To adjust the input required for the Hourglass frame, featured images resized to proper pixels.Collection size is set to 4 and a maximum of 250 epoch used for the purpose of better analysis of training process. Other parameters (momentum, initial learning rate, weight decay regularization, etc.) refer to the standard parameters in the model. In the training phase, we followed the pre trained data set for training the model, then we trained after setting up training boundaries. Then for image processing we have used CNN algorithm and YOLO algorithm for video processing. With the object finding function, test results can be divided into four types, which include true positive (TP), which is true negative (TN), false positive (FP), and false negative (FN).In this context, TP represents the responsible boxes it contains crops; FP means bounding boxes that do not contain the target crops and that are wrong identified as targeted crop; and FN shows targeted crops they are not identified as crop and there are no bounding boxes created. The precision, recall and F1 score are used as the performance indices of predictive ability.Precision and recall are as follows

$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Recall} = \frac{TP}{TP + FN}$$

VI.CONCLUSION

Weed detection, one of the most forefront techniques, can help evolve traditional activity at another level, since it carries one of the crucial livelihood factors. Manual work eradication is an exigency in this techno-oriented world as agricultural activity is a non-terminating processhence with widespread implementation range, also enhancing the accuracy levels weed detection is highly emerging out causing an escalation of crop yields in the market. And since bestrewing pesticides directly affects the yields, this needs to be looked after at high priority Hence this deep learning technique is of ultimate use in back acres, as there is no need of segmentation of crops and weeds manually, it needs to be built with the latest algorithms and techniques and also the pre-existing techniques need to be reconstructed with these.

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