Plant Seedling Using Colour Segmentation Using CNN And SVM

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Abstract: It is used for detecting unwanted plants in crops which more helpful for the farmers and also which can improve crops yield by these that farmer can get more profits to detect these weed crops first we want to know what are the weed crops and that data need to be loaded to match with other crops second when we detect a crop there also some stones around it and to make our prediction accurate we need to avoid that stone pixels that we need take only green pixels because most of the weed plants will be green colour.
By the color segmentation metrics we can identify whether the plant is weed or original. We use colour segmentation using the CNN and SVM

The A Convolutional neural network **CNN** is a neural network that has one or more convolutional layers and are **used** mainly for image processing, classification, segmentation and also for other auto correlated data.

SVM is a supervised machine learning algorithm which can be used for classification or regression problems. It **uses** a technique called the kernel trick to transform your data and then based on these transformations it finds an optimal boundary between the possible outputs and give what crop we are trying to determine whether it is a weed or right plant.

Keywords: CNN, SVM, Machine Learning, Classification, Segmentation

1. Introduction:

We will try to solve this weed identification problem with Machine Learning. The aim is to build a computer vision classifier that recognizes plant species images and differentiates between crop seedlings and weed.
Manual weed detection, in contrast to the weed detection using machine learning, has been the traditional way of visual inspection, performed from above. After the field is flown and photographs are stitched together as shown in manual weed detection can start.

It requires the user to view the stitched, georectified image in an application such as Google Earth Professional. It also allows determination of the weed coordinates, which can be loaded into the combine or manually tracked by the grower on some other navigation device. This way, the grower can stop the combine before ingesting the weed into the combine and remove

Weed detection using Machine Learning is a game-changer as it allows us to significantly With the Picterra platform, it's possible to train and run the detector that will localize the exact position of the Johnsongrass. It doesn’t require any background in Machine Learning, Data Science, or even coding. All that needs to be done is to register on Picterra, upload good-quality In the training areas, the weed has been annotated with polygons. It has a different texture than the regular crops and a strong intensity in the near-infrared (NIR) band. Then, Eagle Eye Imaging LLC highlighted training areas without annotation to give the detector a counterexample – of plants that the user is not interested in detecting. Discrimination with animal tracks was also made as an example. The training of the detector took about 30min (each training iteration of the model takes about 1min30). Running the detector over the entire image took about 5min, which brings the total time to train the model and detect the weeds to less than an hour. The detector could spot all the weed plants localized manually by photointerpretation (recall =100%). Besides, it allowed weed detection of the plants which were missed at the photointerpretation time.

Clean plant images without stones in the background. Ready to be fed to the model and we will predict the weed plants. Most of the people who chose to do organic farming face the real issue of weed which results in the poor plant productivity which in turn results in a loss. So this becomes a major issue when there are a lot of them and people may not be able to recognize all of them. So solve this issue we want to make a project which detects the weed using colour based segmentation.

2.Literature Review:

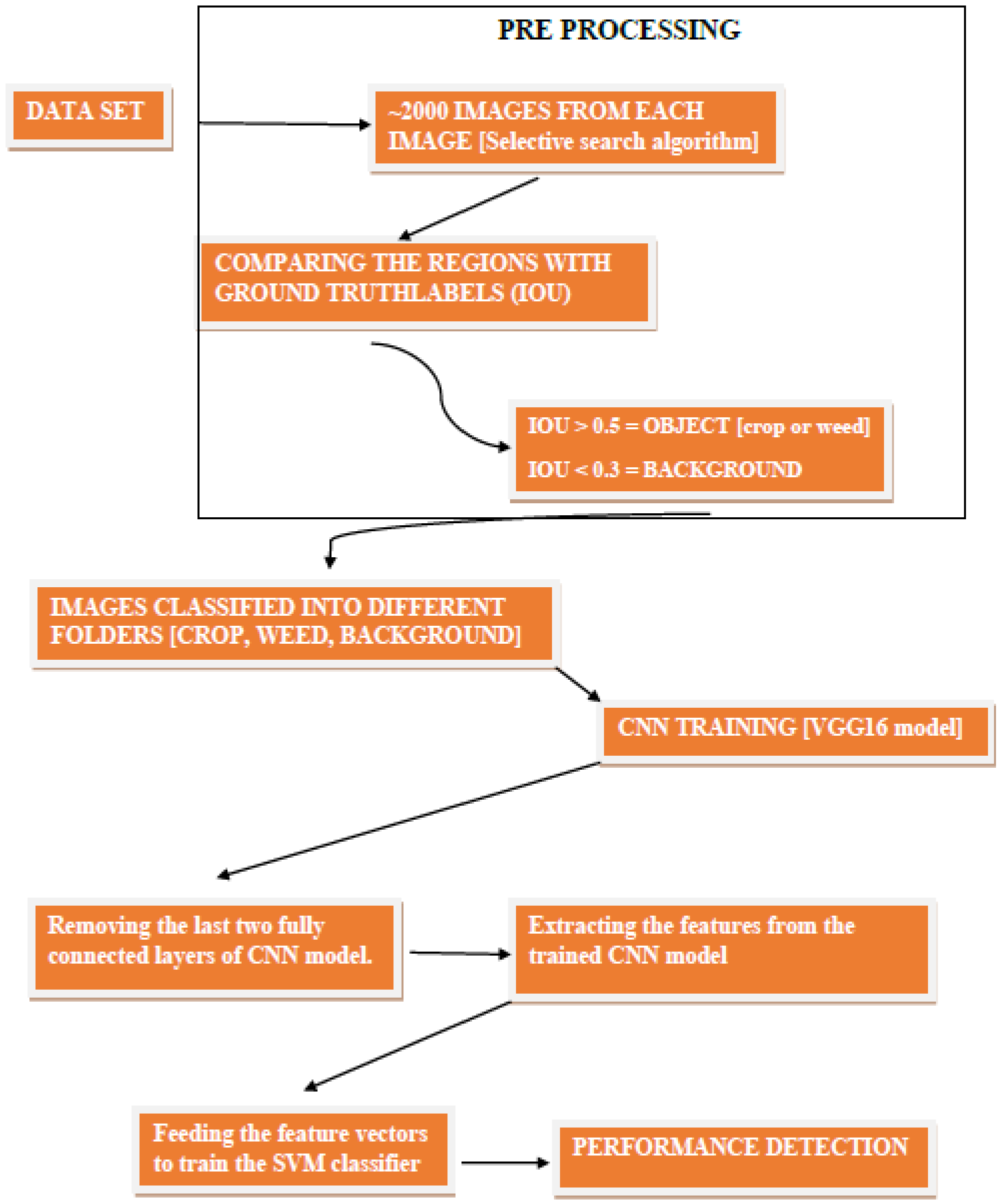
Below the tabular representation of the analysis and research made by collecting some domain related articles and did research work on them in the same domain and the results already published. This shows the various analysis of the dataset/domain which is very much useful for us and gave an insight on what and all are the evaluations to be considered while developing the work.

Title , Author	**Year , Publication**	**Techniques**	**Limitations**
Weed identification method based on probabilistic neral network. Author : Li Chen, Jin-Guo Zhang, Hai-Feng Su	2010 , International Conference on Machine Learninig and cybernetics , Quingdao	Image processing , Image Segmentation , Probabilistic Neural Networks	The weed identification was applicable to the conditions which corn seedling and weed passed across each other not seriously , when they pass across each other seriously the shape-based weed.

Computer vision based segregation of carrot with weed identification in carrot field, Authors : Anjali Rani KA, P Supriya , Sarath TV	2017 ,IEEE	Binary Classification using SVM , Morphological Reconstruction	This algorithm works only for carrots .
Crop weed identification System based on Convolutional neural network. Author : Fengjuan Miavo, Siqi Zheng , Bairui Tao	2017 , ICEICT	Convolutional neural network	The crops and weed in the picture are infected to some extent, and the recognition accuracy needs to be improved .
A TRACEABILITY SYSTEM TO CROP OF SEEDLINGS IN GREENHOUSE, BASED IoT -Gustavo Ramirez-Gonzalez	IEEE. Translations and content mining (2018)	The traceability system in greenhouse structure. Experimental greenhouse structure.	Not cost efficient Without IOT systems or mechanisms it not possible to observe
Assessment of Plant Disease Identification using GLCM and KNN Algorithms Ch Ramesh Babu, Dammavalam Srinivasa Rao, V. Sravan Kiran, N. Rajasekhar	International Journal of Recent Technology and Engineering (2020)	Extraction from a plant leaf using GLCM algorithm (written algorithm to identify diseased plants) Preprocessing a data , knm classification and segmentation.	Accuracy(we can't detect when it is initial stage) Large amount of data is required to make the model more effficent.
Weed Detection in Rice Fields Using Aerial Images and Neural Networks Oscar Barrero, Diana Rojas, Christian Gonzalez	XXI Symposium on Signal Processing, Images and Artificial Vision (STSIVA) (2016)	Aerial Image Acquisition Creating Confusion matrices result of the NN training, validation and test.	Some times weed cant be detected because sample of that data not present It's a drone based project so it need to work for 27 hours for 12Mpixel data
Weed detection using svmAuthor:Sadia MurawwatArmishQureshiSaleha AhamadYousaira Shahid	2018	Svm,binary image convertion,color segmentation,image segmentation,blob analysis	Accuracy of algorithm varies for distant weed and crops.Categorization is done only into three segments1)Overlapping2)Non-overlapping3)Poised overlapping
Weed detection using image processingAuthor:Ajinkya Paikekari,Vrushali Ghule,Rani Meshram,v.b Raskar	2016	Code and color segmentation,edge detection,guassian techniques	Frequency estimation can be faulty due to theExistence of the crop and weed inThe same block

3.Proposed Methodology

This section presents the materials and methodologies used in the proposed weed detection method. the workflow diagram showing different stages between the initial stage of inputting RGB images and the final stage of detecting weed. The materialsand experimental methods of different stages are presented in the following subsections.



As mentioned in the previous section, recent research publications in the field ofagriculture have demonstrated successful applications of several imaging techniques foridentifying diseases and weeds, and monitoring host plants. Sensors and camera-mountedUAVs can be used to capture images of field crops for the purpose. Depending on thetype of camera, different types of images can be captured, such as RGB, thermal, multispectral,hyper-spectral, 3D and chlorophyll florescence. For our work, we have used RGB images captured by RGB cameras mounted in a drone (i.e., UAV). These images werecaptured over the chilli farm using a Phantom 3

Weed detection system

The approach of the project is achieving a baseline method for developing a real time weed detection system through binary classification when vegetation is detected, that is, to separate soil and plants, then, to apply a feature extraction for discriminating weed. First, Green plant detection algorithm is implemented to remove soil from image such that image information is reduced. The next steps of algorithm focus only on vegetation, then, median filtering removes noise as “salt and pepper” with advantage of preserving edges. Third, the previous output is converted to binary; at this point, small objects are removed in order to avoid outliers. After, the pixels connected around their neighborhood are labeled, thus, all objects in the image are identified. Finally, area calculation for each object is done. With the values obtained, we set a threshold to differentiate weed from crop, such that the method is a feature extraction criterion based on size.

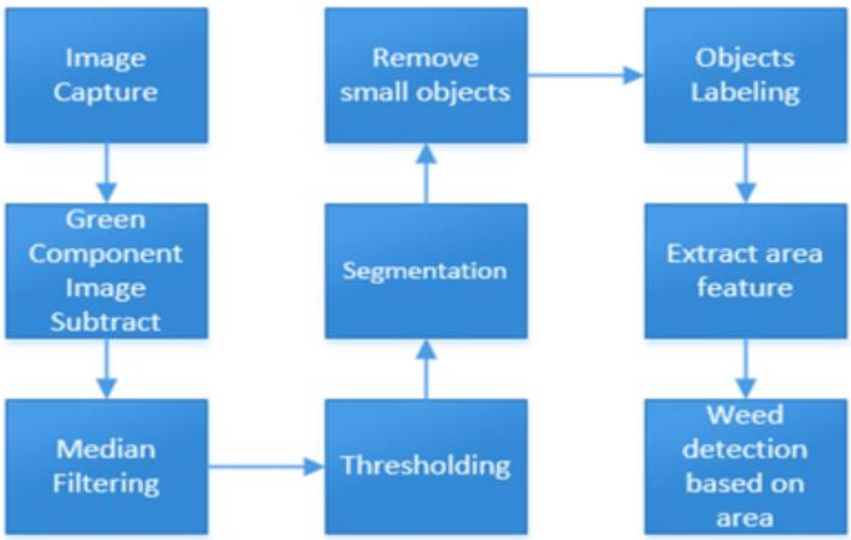


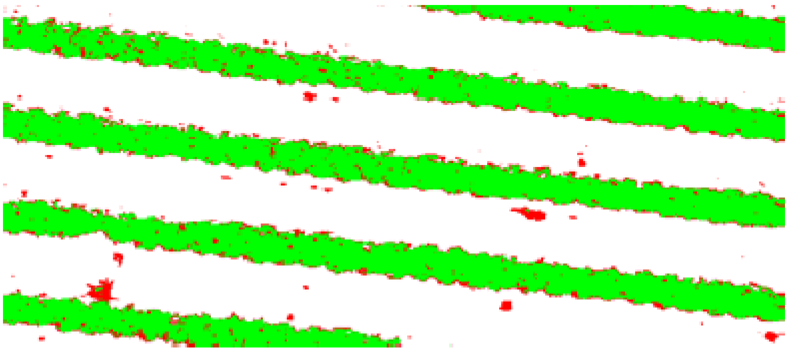
Image acquisition

The digital images were captured in outdoor light conditions with perspective projection over crop. Captures have 8MP resolution in RGB color space with JPG extension. The main idea of crop images acquisition is to avoid lighting and sharpness problems, therefore, color changes about vegetation are reduced. In this way, the accuracy of the first step of the plant classification algorithm increases provided that green color over objects is kept.

Input image

Labelling the Images

We need a labelled image to train our CNNand SVM algorithms. Here, we used ENVI classic software to label a small section of the image as weeds, crops and bare fieldso that we could use it as the training data for the three machine learning algorithms. InENVI, we manually labelled some of the areas as weeds, crops and bare field using ROIsRegion of interest and then used the neural network classifier to label rest of area in the image.shows a labelled image where the crops are labelled in green, weeds are labelled in red and bare land is labelled in white. This labelled image was used to train our CNN and SVM algorithms and detect weeds.



Labelled image to train the ML algorithms. (Crops are labelled in green, weeds are labelledin red and unwanted area is labelled as white).

Machine Learning-Based Classification

Support vector machine (SVM) classifier: SVM classifies data points based on hyperplane swhich optimally differentiate the classes based on training data . These hyperplanes are the surfaces defined by combinations of input features. SVM has been popularly used in literature to perform weed and crop classification

(CNN) classifier: KNN is a non-parametric algorithm, popularlyused for regression and classification. The input consists of the closest training examples in the feature space used the CNN algorithm for creeping thistle detection in fields.

SVM and CNN have been widely used for weed and classification hence we selected and used these algorithms in our study, and compared the results of these classifiers. We have classified three different classes, namely, weeds, crops and unwanted area bare land and plastic much in the chilli farm.

First of all selective search algorithm is applied to images and give us around 2000 region which might containing an object. Wrapped region is feed into CNN model(in paper, Alex net is used) which return (1,4096) size feature vector. This region feed into SVM classifier which give object class and confidence score. Than after we have to train one bounding box regression model for generating tight rectangle boxes for object in images.

Simulation Method and Parameters

PHYTON has been used for feature extraction from the pre-processed images andto simulate the machinelearning based algorithms. For RF, we used 2000 decision treesto generate the random forest algorithm, and we used the value of k = 4 for CNN. Forany machine learning technique, we need to use a training data to train the algorithm. Inthis study, we used the labelled image from ENVI to train the machinelearning algorithm. We used this training data in our CNN and SVM classifiers todetect weed in the chilli field. Additionally, we compare some performance metrics of CNN and SVM classifiers, such aaccuracy, recall (also known as sensitivity), specificity,
precision, false positive rate and kappa coefficient . We define the following parameters to be used in the performance metrics:

_ TP = True positive = number of records when weed is detected correctly.
_ TN = True negative = number of records when crop and bare land is detected correctly.
_ FP = False positive = number of records when weed is detected incorrectly.
_ FN = False Negative = number of records when crop and bare land is detected incorrectly.
_ P= Total positive = TP + FN.

N= Total negative = TN + FP.

Based on these formulas, we calculated the following performance metrics for RFclassifier and compared them with KNN and SVM classifiers. The classification accuracy,recall, specificity, precision, false positive rate and kappa coefficient

original RGB image of a small part of the farm; and the simulation results of identifying weeds in and within the rows of chilli using RF, KNN and SVM are shown in . We have classified three different classes: weedscrops and unwantedarea (bare land and plastic mulch).

First I apply selective search algorithm and generated ~2000 region per images. Than I compare generated region with ground truth labels by mean of Intersection over union(iou) Which ever region has iou>0.5 is saved as positive example(it might object) and region which has iou<0.2 is saved as negative example.In RCNN paper it had take iou<0.3 for negative example but by this we get worst result for my dataset so we changed it to 0.2. NOTE: I didn't included all negative examples which has iou<0.2, we only selected random images and double of number of positive examples.

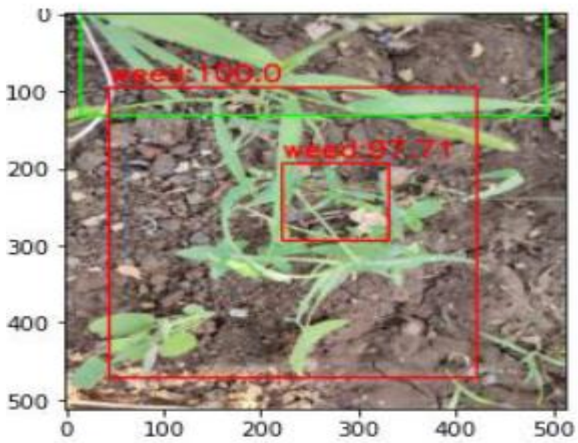
RCNN Model training is divided in three parts CNN fine-tuning CNN + SVM training Bounding Box regression

CNN FineTuning

finetuned VGG16 model with my generated region proposals. But in paper they used Alexnet. Input size of model is 224x224x3 and Output 3 classes (Crop, Weed and Background). Model perform very well and give 95.88% accuracy on test images. used kaggle platform to train my models for take advantge of free GPU.

```
2000it [01:25, 23.39it/s]


[[[16, 0, 476, 132], 0.9787509388993691, 'crop'],
 [[45, 96, 376, 375], 0.9999999536977948, 'weed'],
 [[222, 194, 109, 100], 0.9771339802316148, 'weed']]
```



CNN+SVM

Removed last two fully connected layers from fine tuned model and used CNN model as feature extractor. CNN model will returns (1,4096) size feature vector. Then we trained SVM model using feature vectors. SVM improves overall prediction of model.

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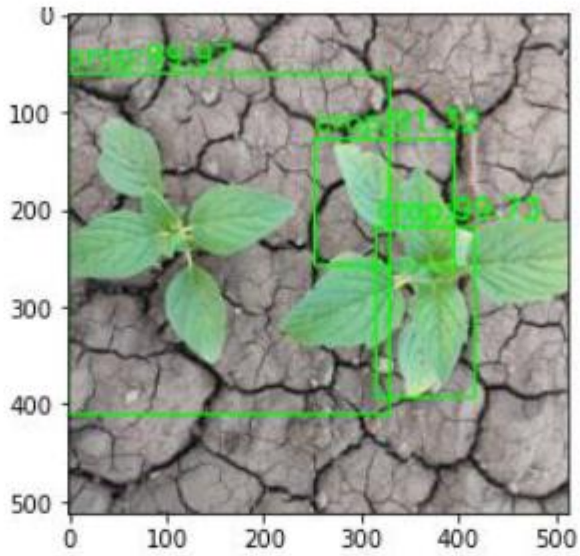
2000it [01:20, 24.95it/s]

[[[0, 61, 329, 349], 0.9997320483419034, 'crop'],
 [[315, 218, 101, 175], 0.9972676810132679, 'crop'],
 [[252, 128, 143, 130], 0.9131549874363585, 'crop']]
```



Conclusion

Early weed detection is crucial in agricultural productivity, as weeds act as a pest tocrops. This work aimed to detect weeds in a chilli field using image processing and machinelearning techniques. The UAV images were collected from an Australian chilli farm, andthese images were pre-processed using image processing techniques. Then features wereextracted from the images to distinguish properties of weeds and the crop. Three differentclassifiers were tested using those properties SVM, and CNN. The experimental results
demonstrate that CNN performed better than the other classifiers in terms of accuracy andother performance metrics. CNNand SVM offered 96% and 94% accuracy in weed detectionfrom RGB images, respectively, whereas KNN offered only 63% accuracy. In the future, wewill explore multispectral and hyperspectral UAV images, and will apply deep learningalgorithms to increase the accuracy of weed detection. The model that we chose is able to predict the given input which is a image and differentiate between the crop and weed in the image.

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