Weed Detection System Using Machine Learning

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Abstract

Weeds are aggressive, need light, water, nutrients and space for crops, garden plants or lawn. Weed management usually consists of spraying herbicides throughout the agricultural sector. Most of them grow quickly and can take over many fields they are in. A rapidly developing area of research today is artificial intelligence, specifically deep learning. One of its many applications is object recognition using computer vision. This work proposes a deep learning with image processing framework for classification of various crops and weeds. A deep convolutional neural network (CNN) architecture is developed to implement this classification with improved accuracy by increasing the deep layers compared to existing CNNs.

Keywords—*Weed Detection; Machine Learning; Convolutional Neural Network; Accuracy*

INTRODUCTION

Invasive weed growth is difficult to control because it grows quickly and aggressively composts with another crop. Fungal bacteria and nematodes can be introduced, which is difficult to control and causes the grower to reduce crop yield and yield. Killing weeds with herbicide and reducing the edge of the cultivator is expensive. One of the most challenging challenges is weed control. Weeds compete with crops for sunlight and water. Cultural practices can minimize infestations, known as appropriate irrigation, fertilization and mowing. However, herbicides can offer a highly effective forage control process. Dynnana, Christiansen experimented with the identification and recognition of weeds in natural field conditions at early growth stages remains a research subject with unresolved issues. Depending not only on growth stage, but also on external factors such as wind, light and nutrition, weed seedlings change appearance, suggesting that optimal identification and recognition algorithms should be able to cope with such changes. Different weed classification strategies have different criteria for segmentation quality. If the purpose is to use shape-based features to decide the species to which a plant belongs. Additionally, the plant must be included to preserve sharp edges in the segmented image. Deep learning is currently one of the newest and most studied technologies. It is a tool used to build intelligent systems as close as possible to the human brain. This has a huge Agriculture is the oldest and most important means of human survival. Population growth in recent years. led to greater demand for agricultural products. Automation is being automated to meet this requirement without depleting the ecological resources that agriculture uses (Mehta141).Agriculture is one such example. where automation has found solutions to some of the challenges such as plant disease infestation, weed control, pesticide control, lack of drainage facilities, and lack of storage management The three main tasks that the paper aims to accomplish are:

1. Accurate classification using CNN for overlapping plants and weeds.
2. For real-time classification, the system must be reliable and robust.
3. To reduce the misclassification rate. The whole experiment is performed using Python programming and Keras and Python tensorflow libraries. The results can save significant time in the use of algorithms, reduce the cost of the breeder and increase its performance.

LITERATURE SURVEY

Bah et al (II) combined both the Hough change and basic direct iterative clustering. In this method, the center is on distinguishing plant lines: what does not happen in that line or is distinctive from its neighbors is considered a weed. To begin with, the setting is portioned and the shadows are evacuated by applying morphological operations to get the skeleton of the plant ancestry. This strategy gives an precision of 90%. classification of sunflowers and weeds. Unet is utilized to prepare 500 picture datasets for soil and vegetation classification. At that point, the foundation is disposed of and ROI is utilized for afterward classification to isolated plants and weeds. The thirteen-layer CNN show accomplishes 90% accuracy.

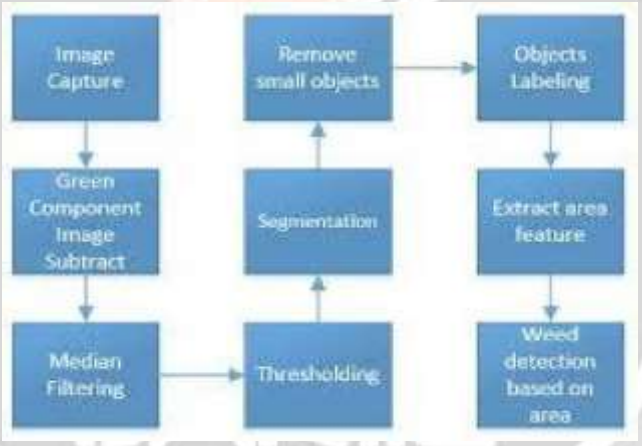
Tang et al actualized picture classification based on k-means calculation to recognize soybean plants from weeds. Here, 820 pictures were utilized to classify soybean plants and diverse weed species. The complete set gives an precision of 92.89%. SNET, LeNet, Alexnet and CNET convolutional systems were tried for the Raspberry CNET

convolutional systems were tried for the Raspberry Pi 3 camera, which captured 3600 corn pictures. Corodova et al. built the four convolutional neural systems recorded over. Among the four systems recorded, CNET accomplished 92.08% exactness. Miloto et al created a semantic division based CNN for sugar beet and weed classification. This test was tried with 10,000 images and required 48 hours to attain 94.74% precision. Chavan et al. created a cross breed adaptation of VGGNET and Alexnet. This show was tried for 5544 pictures with numerous plants and accomplished 93.64% exactness. The OpenCV stage, a back vector machine classifier was executed by Ambika et al. This forms the first or input picture and computes the geometric parameters (width, zone, length, breadth, and edge).

Sarmad Hameed et al [1] pointed out that as the world population increases, the demand for wheat also increases. In order to intensify the growth of wheat in wheat field, the weeds and barren land must be identified to reduce the weed growth so that the wheat growth can be increased.PROPOSED WORK

Image acquisition is taken from the crop field. Also online data set for weeds are used. High resolution camera is used for more accuracy in the color RGB format. Figure 1 displays the building block of the proposed work. All the images are stored in respective size and jpg format.

The weed images used here are corrupted by various factors such as poor resolution, noise, poor resolution, improper lighting variations and other background images. The given RGB images are converted to grayscale images during the pre-processing step. Various noises and unwanted background objects or images are suppressed using filtering techniques. Weed features are properly analyzed and extracted using feature extraction techniques, and weeds and plants are grouped separately in the classification process. Neural convolutional network technique is used for feature extraction. Different texture features such as energy, entropy, size, shape, red, green and blue color features are used to analyze the weed features. The classifiers are first trained, then validated and finally tested for many images using artifiial neural network. validated and tested with images of different weeds.



classifiers are artificial neural detailed version of the proposed work.

I

Parameter	Data set
Number of Images	879
Number of Patches	7750
Number of Crops	2054
Number of Weed	5695

convolutional layer, a rectilinear layer, a 2D maxpooling layer, a dropout layer, a flattening layer, a fully connected layer, a softmax layer, and an output layer. Table 1 shows the information of the dataset. The architecture of the proposed convolutional neural network shown in Fig. 3 includes an input image layer, four 2D convolutional layers.

layers provide the filtered images incorporating the padding process. The ReLu layer improves the overall speed of the network. Downsampling of images was performed with max-pooling layers. Fully connected layers with

different sized neurons are used to smooth the input image. The classification layer classifies the processed image into groups

The results show that a high true positive value means that the input images containing the target weed are accurately identified. A true negative value means that the same plants were perfectly identified. A false positive value means that the images without target weeds were incorrectly identified as weeds, and a false negative value means that the wrong plants are considered weeds. For the online data, the sea of plants is segmented separately from the weeds, as shown in Table 3. Figure 4 shows how the network evolves during the training phase. The upper part of this plot shows that the training accuracy improves each time a mini batch is introduced. The lower part shows the performance degradation of the poor mesh

Methods of Weed Detection

The weeds can be present in any areas of the field. But they are mostly present in between the crops and between the rows. In this paper the Weed between the Crops and Weed between the Rows are considered. Weed Detection Between Rows: In this Weed Detection method, the weeds present in between the rows of the crops are considered and the images are taken in it. Now the image processing technique is introduced to spray herbicides upon them. Weed detection Between Crops: In this method of Weed detection the weeds present in between the interval of two crops are taken. Those weeds are removed by sensing them through column weed detection process. If the crops are planted uniformly throughout the field. But if the crops are planted randomly or spread irregularly in the field they are done by the process of image processing. 1.1.2 Image Segmentation The process of image segmentation is partitioning the images taken from the field into set of different segments. These image segments are known as pixels. Segmentation makes the image easy to analyze. The lines and curves which are typically called as Objects and boundaries respectively are represented through image segmentation by assigning each and every pixel. These pixels share certain visual characteristics. The set of pixels in the output represents the entire image of the weed. The Image segmentation process will provide good quality output result. Segmentation Process involves many pre processing procedures. The pre processing step has undergone the process of De-Noising and Image Enhancement [6]. The De-Noising process is provided with a non linear filter called Rank Filter. They able to identify the weed by the data which we provided earlier as Shape, Edge, Boundary, Object etc. Methods for weed detection using image processing as follows: Image Acquisition: Images of weed are taken from online dataset or from crop field using high resolution camera for more accuracy in RGB format. Each obtained image is stored in respective size and in jpg format. Pre-processing: Obtained images are affected by the various factors such as noise, lighting variations, poor resolution of an image and unwanted background. In pre-processing some tools are used for RGB to Gray scale conversion, Gray scale images to binary image filtering techniques are used to remove the noise and unwanted objects from background. Feature Extraction: After pre-processing, features are extracted for detecting the weed. Feature extraction is process of defining a set of features, for the efficient representation of the information for analysis and classification [7]. Different types of features are texture features such as entropy, energy, contrast etc., size shape and color based features are to extract the features. Classification: Classification techniques are used to classify the weed. Feature vectors are passed as input to the classifiers. In classification classifiers are trained, validated and tested using images of different weed. Some classifiers are artificial neural network, probabilistic neural network genetic algorithm and edge based classifier etc

CONCLUSION

Weed detection is a critical task for agricultural productivity. This requires improved computational methods that allow faster response. Therefore, the proposed method has higher accuracy than the existing methods. The experiment was conducted for cultivation of lake seed with several weeds. The result shows 95% accuracy in classification using convolutional neural networks and maxpooling layers, supported by a lower rate of misclassification of weeds and plants. Future work can focus on identifying weed species that can be combined with this existing work.

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