Identification of weed by using Convolutional Neural Network algorithm in Deep Learning

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***Abstract*— Weeds present in the crops are one of the major factors that lead to a decrease in crop production. Weed control is essential in agricultural productivity as weeds act as a pest to crops. The weeds take up nutrients, and water which leads to weight reduction in plants and decreases the grains per ear and grain yield. So a method needs to be developed which would detect these weeds in the field and then herbicide is sprayed on them to completely destroy them through the use of convolutional neural networks. The weed removal process is a vital part of the agricultural fields. The usual way to remove the weed is time-consuming and also requires more manual labor work. The aim is to remove the weeds in agricultural fields automatically. The proposed work is used to detect the weed which is grown between crops using a deep learning technique and remove the weeds with an automatic cutter. Deep learning is used to analyze the relevant features from the agricultural images. The dataset is trained for the classification of weeds and crops. In deep learning, Convolutional Neural Network(CNN) uses the convolutional layer with a ReLU function for extracting the features of an image and uses a max-pooling and fully connected layer with ReLU to classify the weed from the crop. Here, The pre-processed image is applied to the CNN network. From the resultant image, the Region Of Interest(ROI) is extracted, and also extract some features for training. After training, the classification is done. Thus the weed is detected using a deep-learning network. In this,100 images are trained to improve accuracy.**

Keywords: CNN Classification, Convolutional Neural Network, Image processing, Weed Classification,

I. INTRODUCTION

As the world population increases, so does the demand for food. Taking into account that land, water, and labor are limited resources, it is estimated that the efficiency of agricultural productivity will increase. When conducting chemical treatment of weeds, it is necessary to know the composition of the weed species in order to dose the herbicides optimally. When conducting mechanical weed control, it is necessary to know the location of the crop plants or the weeds in order to protect the crop plants while being able to remove the weeds effectively with a minimal use of energy. Agriculture is the backbone of India and the village people depend on agriculture and the profit of plants and vegetables will depend on the yield production. One way to get more profit, to remove the weed from the crop. The conventional way of weed removal is a time-consuming process and also requires more labor for removing weed from the crop. The use of herbicides affects the plant, soil. So, it is proposed to use an automated method to remove the weed in the crop. In automated method, the image is captured by the camera. Once the images are captured, preprocessing of images are done and the features are extracted. Based on the features, the network is trained for classification. Once the weed is identified, the controller operates the motor to cut the weed. The rest of this paper describes the existing work, methodology, classification and experimental results.

II. LITERATURE REVIEW

Many researchers developed weed detection by designing algorithms for Segmentation, feature extraction, representation, and classification. Some of the recent techniques presented in the papers are summarized in the following:

In [1] author describes Precision herbicide application can substantially reduce herbicide input and weed control costs in turf grass management systems. Intelligent spot-spraying system predominantly relies on machine vision-based detectors for autonomous

weed control. In this work, several deep convolutional neural networks (DCNN) were constructed for the detection of dandelion (Taraxacumofficinale Web.), ground ivy (Glechomahederacea L.), and spotted spurge (Euphorbia maculata L.) growing in perennial ryegrass.

In [2] author proposed Weed management is one of the most important aspects of crop productivity; knowing the amount and the locations of weeds has been a problem that experts have faced for several decades. This paper presents three methods for weed estimation based on deep learning image processing in lettuce crops, and we compared them to visual estimations by experts.

In [3] author Weeds presents the crops are one of the factors that lead to a decrease in crop production. The weeds take up nutrients, and water which leads to weight reduction in plants and decreases the grains per ear and grain yield. So a method needs to be developed which would detect these weeds in the field, and then herbicide is sprayed on them to completely destroy the use of new drone technology and deep learning in the field of convolutional neural networks.

In [4] author proposed Human community is educated about the environmental issues of pesticides and fertilizers used in agriculture. There is an ever-growing demand for food to be met by agriculture producers. To reduce environmental issues and address food security, IoT-based precision agriculture has evolved. Precision agriculture not only reduces cost and waste but also improves productivity and quality. We propose a system to detect and locate the weed plants among the cultivated farm crops based on the captured images of the farm.

III. PROPOSED SYSTEM

In our proposed system, we are working on the identification of weeds among the identifying plant crops with feature extraction value. Also, by using the CNN value of the feature mapping technique, we are ranging the feature values of different plants by analyzing them with deep learning algorithms. The complete process is divided into several necessary stages in the subsections below, starting with gathering images for the classification process using deep neural networks.

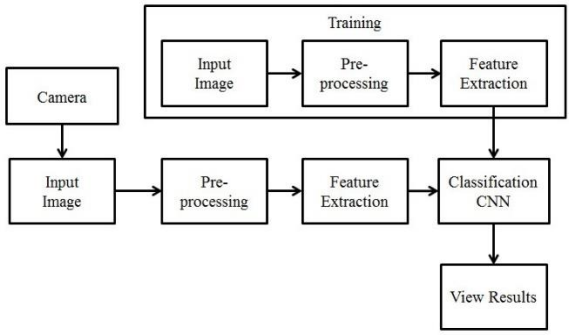

Fig.1: Block Diagram

IV. ALGORITHM DETAILS

The CNN algorithm is used to detect weeds in the crop. An input layer, an output layer, and numerous hidden layers make up a convolutional neural network. CNN, or feed-forward neural network, is a popular image identification and classification algorithm. Artificial Intelligence has made significant progress in closing the gap between human and computer capabilities. Researchers and hobbyists alike work on a variety of facets in the field to achieve incredible results. The field of computer vision is one of severals such disciplines.

Artificial Intelligence (AI) has been witnessing monumental growth in bridging the gap between the capabilities of humans and machines. Researchers and enthusiasts alike, work on numerous aspects of the field to make amazing things happen. One of many such areas like the domain of Computer Vision.

A. Input Image

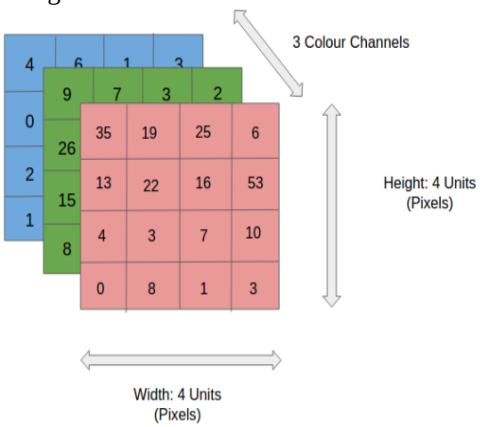

Fig.2: 4x4x3 RGB Image

B. Convolution Layer — the Kernel

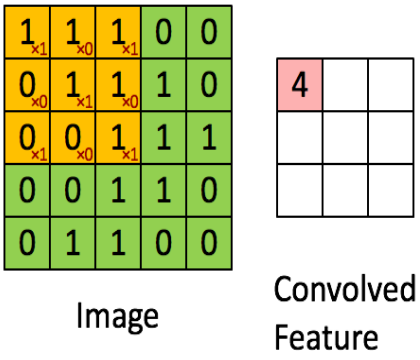

Fig.3: Convolution

C. Pooling Layer

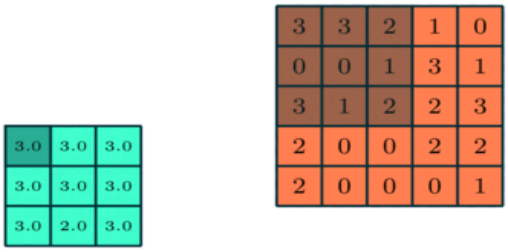

Fig.4: 3x3 Pooling Over 5x5 Convolved Features

V. RESULT

In the Below Figure, we can see the result of weed detection. By using CNN classifier we can detect the weed accurately given in this figure. This system predicts the result by using CNN classifier is weed detected in the given image as well as it also predicts the fertilizer that is in contact with herbicides.

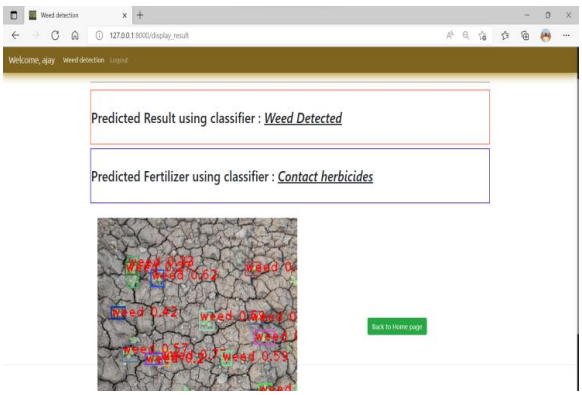

Fig .5: Result Weed Detection

The confusion matrix Class 1, and Class 2 training modules can be seen in the diagram above. In Class 1, the input photos are 909, and we achieved an accuracy of 98.46 % and a precision of 0.99 % while training the classifier as a train with the supplied input database. Because the 909 classifiers failed to classify 8 photos as an output form of class 1, the recall was reduced to 0.99 %, and the F1 score was also reduced to 0.99%.

In Class 2, the input photos are 391, and we achieved an accuracy of 98.46 % and a precision of 0.97 % while training the classifier as a train with the given input database. As a result of the 391 classifiers failing to detect 12 photos as an output form of Class 2, the recall has been reduced to 0.98 %, and the F1 score has been reduced to 0.97 %.

We can conclude that our system's performance is better with 98.46% after looking at the above performance parameters.

Results Class1 Class2

TP: 1280 Class1 901 8

Overall Accuracy: 98.46% Class2 12 379

Class	n(truth)?	n(classified)?	Accuracy	Precision	Recall	F1Score
1	913	909	98.46%	0.99	0.99	0.99
2	387	391	98.46%	0.97	0.98	0.97

Fig.6: Performance Parameters

V. CONCLUSION

In our system, we used CNN for the detection of weeds in the crop. The classification of weeds and crops is used to CNN by image processing, it has training and testing the data of weeds and gets accurate results as well as gets results fastly hence it is a time-consuming process. CNN is used to extract the more relevant features of an image. After the detection of weeds, our system can pro provide a solution. It is easy an detection process with accuracy. By using this system we give 98.46% accuracy.

VI. FUTURE WORK

In this work we used Convolutional Neural Network for the prediction of weeds in the crop and in the future we used the DNN, LSTM, and Design Tree as well as machine learning algorithms to detect the weeds in the crop.

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