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DEEP LEARING BASED WEED DETECTION IN DIGITAL IMAGES

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Abstract – In plantation we are recognizing the uneven plant spacing between saplings of the crop and they are growing in the same way. Due to uneven plant spacing the researchers the facing many difficulties to identify the weeds int the vegetable plantation. We can find different species of weeds in our crop/plant such as Black Grass, Fat hen, Clevers, Charlock and many more. The aim of this research is to identify these kinds of weeds using the Image processing and deep learning techniques. In deep learning we have used the Alex Net model for the purpose of identifying the weeds and in addition Alex Net model we have added image processing techniques which helps the model in performing the operations effortlessly. We are using Python Version 3.11 to identify the weeds.

Firstly, we are training the Alex Net model to identify some sort of weeds and then we are fetching the input image to image preprocessor which simplifies the image data present in the input image by enhancing some image features or by suppressing the unwilling distortions important for further processing, the simplified image is carried on to the next block of preprocessing which is the Feature Extraction . Then the output the feature extraction block is fetched to the pre-trained Alex Net model as input where it classifies the given data and then image segmentation is performed by which it converts an image into a collection of regions of pixels and these are represented by a mask. After image segmentation the data is sent to the identification block where the species of weed are identified. The pre-trained

Alex Net model gives accuracy of 99.4%. We have achieved a higher percentage of accuracy by using the pre-trained Alex Net model compared to the other models such as Center Net model, Inception V3 and ResNet 50.

I. INTRODUCTION

. As living conditions rise, green vegetables are consumed more frequently, which increases their significance for our everyday lives and substantial economic value.

.When competing weeds and vegetables, the output of vegetables reduced from 45% to 95%. Chemical herbicides should not be used excessively since this pollutes the environment by over-applying them in regions with little to no weed infestation. Additionally, non-chemical weed management is necessary for the natural cultivation of crops.

In order to control weeds in vegetable plantations at the moment, manual weeding is still the main method available.

Various machine vision techniques for finding weeds. have been the subject of much research. In a collection of 224 photos, six weed species were identified by Ahmed et al. using Support Vector Machines (SVMs). With the optimal extractor setup, they were able to identify the weeds with 97.3% accuracy. A classification accuracy of 92.9% was achieved in a batch of 66 photos by Herrera et al.'s weed-crop classifier, which they built utilising form descriptors and fuzzy decision-making.

In the early phases of growth, crop often outpaces weed. By utilising a binocular stereo vision system, Chen et al. developed a crop and weed identification employing this height characteristic. With the use of the depth dimension analysis and a height-based segmentation method, it was possible to distinguish between crops and weeds. Plant spacing data was used to differentiate between the weeds and the crops for the relative higher weeds.

Recent evidence suggests that deep learning is incredibly effective at automatically extracting complex information from photos. It is commonly employed as a promising method for classifying images and recognising objects.Deep learning employs two different categories of methods for image detection. Prior to creating bounding boxes around photographs to classify the thing, the item is first classified.. Semantic segmentation, usually referred to as categorising object pixels, is the second category.

Averaging 95.1% and 95.7%, respectively, for classification accuracy,Olsen et al. classified images of sixteen distinct varieties of weed using the benchmark deep learning models. In order to recognise weeds in soybean crop photos and categorise them as either grass or broadleaf, convolutional neural networks (CNNs) were employed.

Sales prices have increased as a result of several labour expenditures. Previous crop weed identification techniques tended to concentrate mostly on weed identification directly.

. This approach may greatly minimise the amount of the training picture dataset and the difficulty of weed detection, improving the performance and accuracy of weed identification. This study's objective is to develop an algorithm for robotic weed elimination in vegetable plantationsbuilt on image analysis and deep studying. The key objectives were to

1) use deep learning to develop a model that could identify vegetable box boundaries.

2) using image processing and the colour feature, remove and segment weeds that are outside of the bounding bounds.

Chemical pesticides have been misused in places with little to no weed infestation, which harms the ecosystem by contaminating the soil and groundwater, among other things. The cultivation of organic vegetables also need non-chemical weed management. Therefore, at this moment, manual weeding is still the best way to control weeds in vegetable crops.

Deep Learning has an enormous number of architectural concepts, and these designs have a massive range of applications in a wide range of fields, consisting of "Natural Language Processing (NLP), Medical Image Analysis, Drug Design, Bioinformatics, Speech Recognition, Deep Neural Networks, Convolution Neural Network, Medical Vision, and Computer Vision." Image restoration is handled using convert or Convolution Neural Network.

Convolutional neural networks have several uses in the domains of "Image segmentation, Crop image analysis, Brain-Computer interface, and Image Classification." To distinguish the pattern in RGB and grayscale data, back-propagation is used to train a feed-forward, deep Convolutional Neural Network (CNN) using Inception- ResnetV2. The recent success of deep learning techniques in image processing is what spurred this study's development.

After that, the test Images' grayscale, L channel is used to train the neural network to forecast the two a* and b* chroma channels. The fusion layer, which takes into consideration both local and global data, enables CNN to colourize pictures with rich detail.

For the purpose of evaluating the estimated colour image's quality in comparison to its ground truth, two objective functions—mean squared error (MSE) and peak signal-to-noise ratio (PSNR)—are used. The model is trained using our own dataset of 1.2 K historical photos, each with a resolution of 256 by 256 and made up of antique and ancient images of Nepal.

Fig:1 Crop with Weed

Fig:2 Crop without Weed

The model's accuracy is determined to be 75.23%, 34.65 dB, and 6.08% lower than the MSE, PSNR, and loss, which are all measured in decibels. In addition to showing the training outcomes, a user study is used to evaluate the produced images' perceived acceptability or subjective validity. In this investigation, the model's naturalness score was 41.71% when analysing colorization results.

II. LITERATURE SURVEY

[1] J. Long, E. Shelhamer and T. Darrell, "Fully convolutional networks for semantic segmentation,"2015. Convolutional networks are powerful visual models that yield hierarchies of features.

[2] G. Hinton et al., "Deep Neural Networks for Acoustic Modeling in Speech Recognition: The Shared Views of Four Research Groups 2012.

[3] E. Hamuda, M. Glavin, and E. Jones, ‘‘A survey of image processing techniques for plant extraction and segmentation in the field,’’ Comput. Electron. Agriculture 2016. The paper reviews recent image plant segmentation-based methods (from 2008-2015).

[4] M.J. Aitkenhead, I.A. Dalgetty, C.E. Mullins, A.J.S. McDonald, N.J.C. Strachan, Weed and crop discrimination using image analysis and artificial intelligence methods, Comput. Electron. Agric., 2003.

[5] U. Gayathri and V. Praveena, "A Survey Paper on Weed Identification Using Deep Learning Techniques,"

III. THE PROPOSED SYSTEM

the designed system includes the subsequent technique and the Models. There are two steps involved in weed identification. Using the cutting-edge AlexNet algorithm in the first stage, To train the neural network, plant images are gathered and utilised as input data. The bounding box coordinates and associated class probabilities are produced as an output by the trained neural network, which is utilised to identify objects and draw bounding boxes around them. During the second stage, weeds in the image are visually classified again.

This research is carries out four stages:

- The first stage consists of a preprocessing unit, where picture acquisition is the initial stage of image processing. In image processing, this stage is often referred to as pretreatment. where the supplied image is transformed into a digital format.
- The process of converting raw data into numerical features that can be processed while keeping the information in the original data set is conducted in the second stage of the system, called feature extraction.
- •The Alex Net model is trained in the third step, after which the generalised output is supplied to the weed identification unit. In this stage, the input is categorised and simplified before being sent to the Alex Net model.
- Our system's final stage finds the weed's species type after having detected it.

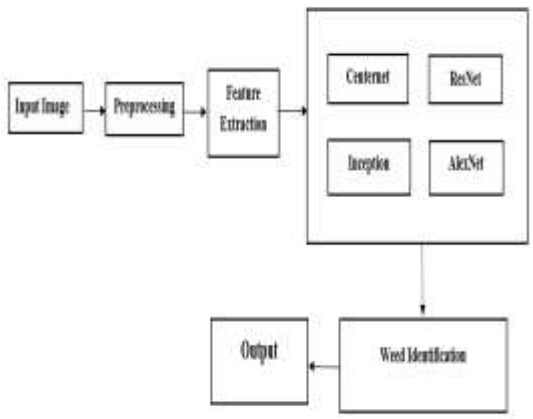

Fig: 1 Block Diagram

In the block diagram input images are taken then the preprocessing is done then features are also extracted then by using deep learning algorithms we are going to identify the weed in the image and the output will be displayed.

In this project we have used 4 different type of modules in that AlexNet has more accuracy compare to other models,

Alex Net:

Specifically created for image categorization, AlexNet is a convolutional neural network architecture. In order to extract features from pictures, it employs convolutional and pooling layers as well as dropout to avoid overfitting.

CenterNet:

CenterNet is a different type of architecture that focuses on object detection by predicting being at its centre an object and its physical boundaries. It is known for its high accuracy and efficiency, and has been used in object detection, pose estimation, and tracking.

Res Net:

Res Net is a deep neural network architecture that uses skip connections to improve gradient flow and prevent vanishing gradients.

Semantic segmentation, object recognition, and picture classification are just a few of the computer vision tasks where it has been demonstrated to be effective.

Inception v3:

To decrease the amount of parameters and increase accuracy, Inception v3 combines 1x1, 3x3, and 5x5 convolutions.

It was designed for image classification and is known for its high accuracy and efficiency.

let us see the bar graph of comparing accuracy of 4 different models.

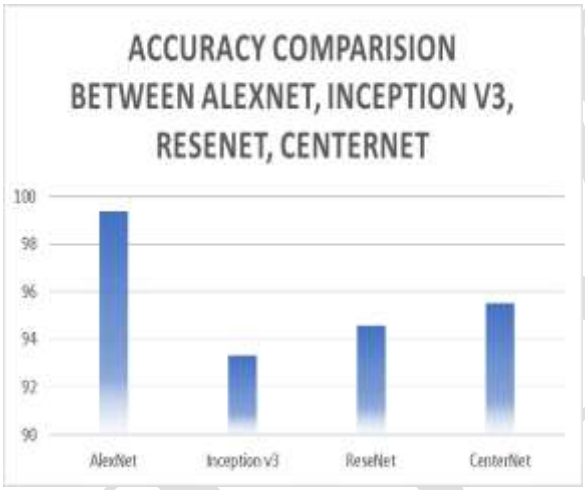

Fig: 2 Comparison of accuracy

IV. EXPERIMENT AND RESULTS

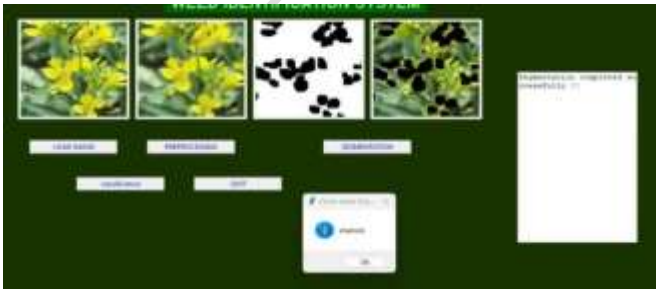

Fig: 3 Output

The Images used as input were reduced to 512 × 512 pixelsthe input required by the Hourglass architecture may be accommodated. Other factors (momentum, learning rate at first, regularisation of weight decay, etc.)used to describe the AlexNet model's default settings. After establishing the training parameters, the model was trained in accordance with the training procedure described in the original work on AlexNet.Utilising training data to iteratively update network weights, Adam's optimisation approach was utilised to reduce training loss and increase identification accuracy.

IV. CONCLUSION

A technique that combines deep learning with image processing for classifying various types of plants. Since AlexNet has greater accuracy than all four of the other algorithms we have presented here, we have utilised it in this project to identify the various varieties of crops.Two steps were used to illustrate the algorithm. We trained an AlexNet model to recognise plants.A 99.4% accuracy, 99.0% recall, and an F1 score of 0.953 were attained by the trained AlexNet.

A colour index was established to separate weeds from the background.We may conclude that weed identification in a mass of plants is significantly simpler than it was using earlier techniques because-the methodology avoids dealing with several weed species in favour of focusing on recognising just the plant.

VI. ACKNOWLEDGMENT

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[4] M.J. Aitkenhead, I.A. Dalgetty, C.E. Mullins, A.J.S. McDonald, N.J.C. Strachan, Weed and crop discrimination using image analysis and artificial intelligence methods, Comput. Electron. Agric., 39 (2003) 157-171.

[5] H. Mennan, K. Jabran, B. H. Zandstra, and F. Pala, ‘‘Non-chemical weed management in vegetables by using cover crops: A review,’’ Agronomy, vol. 10, no. 2, p. 257, Feb. 2020.