Nat. Volatiles & Essent. Oils, 2021; 8(6): 1273-1280

NVEO
Natural Volatiles & Essential Oils

An Advanced Weed Detection Using Deep Learning Techniques

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Abstract

Weed identification across the vegetable plantation is most challenging in the crop prediction based techniques and many researchers are understanding the study of identification of leaf and weed across the agriculture fields using many techniques through which the identifications of weeds in the vegetable plantation due to random plant spacing across the agriculture fields. Many traditional methods are implemented in order identify the week which are focused identifying weed directly in which for these manual techniques identifying weed across the vegetable leaves become more challenging aspects. This research paper provides a solution for the existing problem in integrating deep learning techniques in order to identify the weed plants across the vegetable plantation using CNN and advanced deep learning techniques like feature selection algorithms such as GABOR filter. Initially a trained Model was used over the data sets in order to draw the overlay by boundary boxes across the vegetable and weed leaves. The remaining space which was falling out of the overlay boundary boxes will be considered as weed through advanced detection techniques. In this way, the model focuses on identifying only the vegetables and thus avoid handling various weed species. Furthermore, this strategy can largely reduce the size of training image dataset as well as the complexity of weed detection, thereby enhancing the weed identification performance and accuracy. To extract weeds from the background, a colour index-based segmentation was performed utilizing image processing. The automation used for implementing identification of weeds is Deep learning (DL) and image processing (IP). Firstly, the Convolutional Neural Network (CNN) algorithm is used to recognize the weeds by drawing the bounding boxes around the green plants and the left-over parts are identified as crops. Later on, GABOR filter is used on same dataset, confusion matrix and accuracy are generated. Agri_data is the dataset used for training and testing data. By using the

algorithms, we can identify whether they are weeds or crops. Accuracy of CNN and GABOR filter are compared for weed Identification and prediction.

Introduction

CNN or Convolution Neural network is a subset of deep learning. Deep learning is a broader set of machine learning and Artificial Intelligence. Deep learning is a sophisticated learning approach from the dataset and creates a model according to the data set (Patel et al. 2018). Deep learning can be a supervised way of learning and it can be an unsupervised way of learning. Generally, it has a solution of real-life problems, learning outcome can be supervised, semi-supervised or unsupervised, at first there is a dataset given then first to operate on data one must clean the data because in real-life data models there is a lot of data are missing model cannot be created with a missing data for that one must prepare the data for the algorithm to run on, before applying the algorithm one must carefully clean the data and understand the real-life after that one can apply the suitable algorithm, After applying the algorithm one will get desired data representation which is based on Artificial neural network(Mongaet al. 2020). The name Artificial Neural Network (ANN) might sound similar to biological neurons because the structure is quite the same as the neuron resides inside a brain but it has some key difference with its biological counterparts such as Artificial Neural Network is Static where the other one is living organism so it is dynamic in nature and the other one is Artificial Neural Network is a symbolic and biological one is an analogue. Deep Learning has various architecture and this various architecture has several applications across many fields such as "Natural Language Processing (NLP), Medical Image Analysis, Drug design, Bioinformatics, Speech Recognition, Deep Neural Networks, Convolution Neural Network, Medical Vision, Computer Vision. " convert or Convolution Neural Network deals with image restoration. Convolution Neural Network has a wide range of applications in fields of “Image segmentation, Crop Image Analysis, Brain-Computer interface, Image Classification." Motivated by the recent success of deep learning techniques in image processing, a feed-forward, deep Convolutional Neural Network (CNN) in combination with Inception- ResnetV2 is being trained by sets of sample images using back-propagation to recognize the pattern in RGB and grayscale values. The trained neural network is then used to predict two a* and b* chroma channels given grayscale, L channel of test images. CNN vividly colorizes images with the help of the fusion layer accounting for local features as well as global features. Two objective functions, namely, Mean Squared Error (MSE) and Peak Signal-to-Noise Ratio (PSNR), are employed for objective quality assessment between the estimated colour image and its ground truth. The model is trained on the dataset created by ourselves with 1.2 K historical images comprised of old and ancient photographs of Nepal, each having 256 × 256 resolution. The loss i.e., MSE, PSNR, and accuracy of the model are found to be 6.08%, 34.65 dB, and 75.23%, respectively. Other than presenting the training results, the public acceptance or subjective validation of the generated images is assessed by means of a user study where the model shows 41.71% of naturalness while evaluating colorization results.

With the recent tremendous advances of computer graphics rendering and image editing technologies, computer generated fake images, which in general do not reflect what happens in the reality, can now easily deceive the inspection of human visual system. In this work, we propose a convolutional neural network (CNN)-based model to distinguish computer generated (CG) images from natural images (NIs) with channel and pixel correlation. The key component of the proposed CNN architecture is a self-coding module that takes the colour images as input to extract the

correlation between colour channels explicitly. Unlike previous approaches that directly apply CNN to solve this problem, we consider the generality of the network (or subnetwork), i.e., the newly introduced hybrid correlation module can be directly combined with existing CNN models for enhancing the discrimination capacity of original networks. Experimental results demonstrate that the proposed network outperforms state-of-the-art methods in terms of classification performance. We also show that the newly introduced hybrid correlation module can improve the classification accuracy of different CNN architectures.

Proposed Methodology:

Noise- removal - To remove the video noise the noise removal is used it can be done by using the "Convolutional -Neural- Network".

Removal of Motion blur - This is used to remove the blur area which occurs due to the motion. So, to remove the motion-blur and to get a clean clear image software is needed. It can be done by using any of the software networks available above.

Removal of hazard - To reduce the disturbance and RGB classification the picture and to make it seem clear it is needed (Bertalmío et al. 2018).

Removal of Rain-drop - If there is a raindrop effect in the images then in the images there will be large quality problems for rain-drops. The raindrop effect makes the image very much blunt.

Removal of Rain streak - As the removal of the rain streak is done the picture will also be very clear and the quality of the picture will also increase to a high quality and all the curves of the images will also be cleared (Ma et al. 2017). The colour variations will be very much attractive if it is done.

Analysis of Crop image -In the medical field also this Critical evaluation of the effectiveness of de-hazing images are used in a random way to get a clear image of different reports like - "x-ray copy, eco photocopy" etc(Cheng et al. 2020). Generally, in this field many times the machine has problems and the picture is not cleared in that case by using any kind of software network we can access the image.

Analysis of crime image - In the case of crime, the software helps us to clear out the criminal image, crime place image and many other images as well.

Algorithms

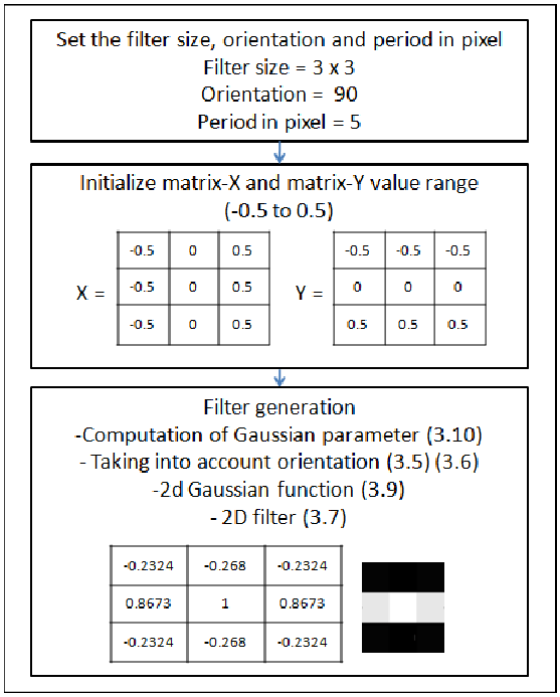

Figure.1 Gabor Filter Feature Extraction

In this paper author is using CNN algorithm to identify Weed plants in Vegetable Plantation as this weed plant are unwanted plants which grows in between of vegetable plants and consume all nutrients and water from soil and damage to vegetable crop and to avoid this damage author is training vegetable plants with CNN and then detecting this vegetable plants with CNN from new images. In this paper author evaluating performance of CNN with SVM in terms of accuracy and confusion matrix. The extension of the project includes Gabor Filter algorithm is used in order to undertake pre-processing and feature extraction and texture based analysis across the implementation of the project.

Let $x=[x_1\ x_2]^T$ be the image coordinates. The impulse response of a Gabor filter $g(x)$ is then given by:

$$g_{mn}(x) = \frac{1}{2\pi a_n b_n} e^{-\frac{1}{2}x^T A_{mn} x} e^{jk_{0mn}^T x}$$

Here, the matix A determines the bandwidth and the orientation selectivity of the filter.

$$A_{mn} = \begin{bmatrix} \cos\phi_m & -\sin\phi_m \\ \sin\phi_m & \cos\phi_m \end{bmatrix} \begin{bmatrix} a_n^{-2} & 0 \\ 0 & b_n^{-2} \end{bmatrix} \begin{bmatrix} \cos\phi_m & \sin\phi_m \\ -\sin\phi_m & \cos\phi_m \end{bmatrix}$$

If the modulation frequency vektor k_0 is in the same direction as one of the envelopes axes, with

$$k_{0mn} = k_{0n} \begin{bmatrix} \cos\phi_m \\ \sin\phi_m \end{bmatrix}$$

Figure.2 Gabor Filter Modulation Frequency

Convolution operations implemented for extracting the features which are high level such as pixel width, light and dark, edges based on the input images. In the layered architecture each layer is responsible for the specific feature extraction and provides the best approach in extracting the

required all possible features from one layer to another provides the intensity of the results and accuracy graph will be appropriate based on the trained methods.

Similarly, like convolution layer extracts the best features of the images, pooling layers in meant for minimizing the size of the data and convolved features based on the spatial ranges. In order to reduce the computational power and boost the performance of the algorithm and reduce the dimensionality of the datasets only pooling helps in extracting the main features and most of the dominant features of the dataset are captured and this will automatically enhances the speed of the execution and provides best and fastest results even the size of the data set is large.

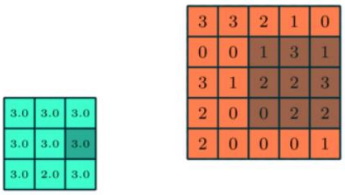

Figure.3 Pooling the Convolved Features of the input

It is a linear function applied in order to provide the results if the result is positive based on the given data elements, if the result is not positive it generates 1, it will generate the output as 0. It is also called as default activation function across different type of neural network algorithms the results generated will be accurate and perfect results are generated based on the model trained by us. Performance calculation is applicable based on the accuracy and error rate of the values generated.

Sequential Model using CNN:

CNN will learns the filters automatically without mentioning anything and extracts the features with high accuracy. Sequential model is proposed in order to obtain the results of the dataset, the model is trained in such a way it will classify the images into 4 categories and each category is provided with multiple images. These categories are classified and undergoes several layered approach of the proposed sequential CNN model. Based on the training dataset this model is predefined in using python keras.

The first 2 layers are based on Conv2D layers mainly involves in dealing with datasets which are having collection of images and they seem to be 2D matrixes which are collection of rows and columns to estimate the dark and lighter pixels of the images and identifying the key most pixels after that feature extraction takes places to capture the properties of the images and provided an index as categorical data, and provided proper results during the comparison of the testing images with original images provided. It is provided with a predefined activation function to define the values and undergoes summation and results are generated.

Results

```
[[0. 1.]
 [1. 0.]
 [0. 1.]
 [0. 1.]
 [1. 0.]
 [0. 1.]
 [0. 1.]
 [1. 0.]
 [1. 0.]
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 [1. 0.]]
[0 1]
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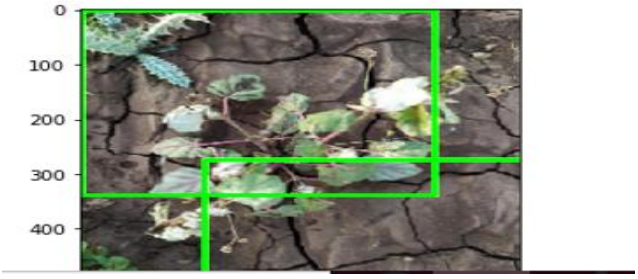

Figure.4 Boundary Box across the Vegetable Plants.

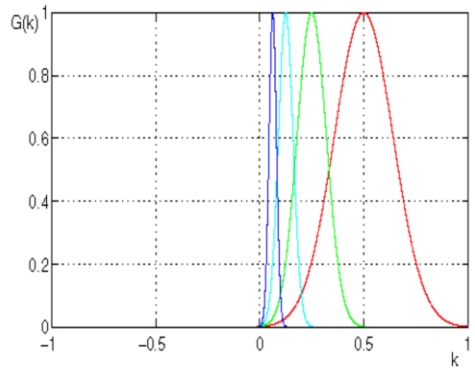

Figure.5 Gabor Filter and its modulation frequency

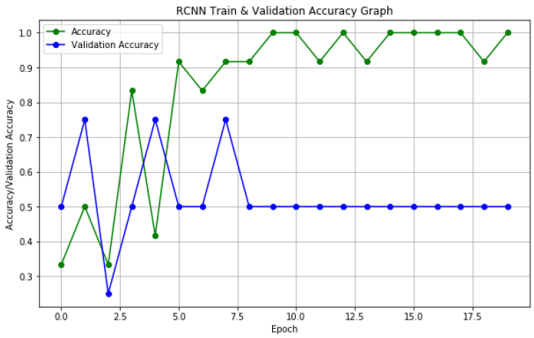

Figure.6 Accuracy Graph

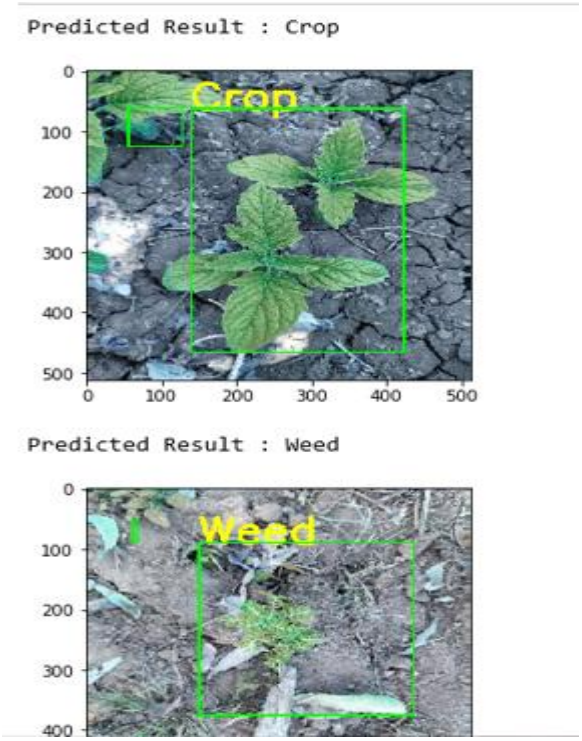

Figure.7 Weed Detection.

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: RF, SVM, and KNN. The experimental results demonstrate that RF performed better than the other classifiers in terms of accuracy andother performance metrics. RF and 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.

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