Analysis of Various Weed Detection Algorithms

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Abstract - **The image processing is the technology which process information stored in the form of pixels. The weed detection is the major issue of the image processing. The weed detection process has the three major steps which are segmentation, feature extraction and classification. The classification techniques can classify the weed and non weed detection portion from the image. In this paper, various weed detection algorithms are reviewed in terms of certain parameters.**

keywords - **Weed Detection, Segmentation, Feature extraction, classification**

I. INTRODUCTION

A technique that uses several algorithms for performing a quantitative analysis of any digital image data is called image processing. This technique helps in calculating the replicable and rater-based values within the 3D parametric maps. Several enhancements have been made within image processing technique over the years and providing automation services within the applications is the major objective of this technique.

A weed is a plant growing along with the useful agriculture products .A weed may be defined as any plant or vegetation that interferes with the objectives of farming or forestry, such as growing crops, grazing animals or cultivating forest plantations. This weed decreases the growth of the crop and reduces the farm yield; hence these weeds should be identified and classified. In olden days weed detection was done by employing some men especially for that purpose. They will detect the weed by checking each and every place of the field. Then they will pluck them out manually using their hands. Later with the advancement in the technology they started using the herbicides to remove the weeds. But to detect the weeds they are still using manual power in many parts of the world [1]. If the Weed is not removed they spread seeds which act as seed bank for many years. Based on the shape and edge frequencies the weeds are classified into various types.

1.1.1 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

II. LITERATURE SURVEY

Ambika N.K, et.al (2018)designed an image processing algorithm for processing the original image and computing geometrical parameters (length, width, area, diameter, and perimeter) in OpenCV Java and Support Vector Machine was the classifier used. It was perceived that the accuracy in identification increases when four features were considered instead of two. The two features considered are perimeter ratio of length and width and form-factor [8]. But the number of features must not be very high as it will lead to computational complexity and processing delay. The work identifies plants of the same genus but belonging to different species which is a rarely explored area. When the plants of the same variety were considered, the similarity between them was more. This work can further be extended to other members of the orchid family. An improved version of the algorithm can be developed which can work with images taken from the plant directly. It can also be improved by making use of deep learning techniques.

Oscar Barrero, et.al(2016) investigated the use of neural networks (NN) to detect weed plants in rice fields based on aerial images. For this purpose, images are taken at 50 meters high with 16.1 megapixels CMOS digital camera mount- ted on an autonomous electrical fixed wind plane. Then, an orthomosaic map of the field is created by stitching 250 pictures, as the image is ortho-corrected, the pixel in- formation on the final map is more reliable for the analysis [9]. For the NN training, Gray-Level Co-Occurrence Matrix (GCLM) with Haralicks descriptor are used for texture classification as well as Normalized Difference Index (NDI) for color. As result we have 99% precision for detection of weed on the test data, this indicates that neural networks can have a good performance on the weed detection on rice fields. For weed plants similar in form to rice plants, the level of detection was low, due to images resolution when this are taken at 50 meter high over the ground.

Adnan Farooq, et.al(2018) investigated patch-based weed identification using hyperspectral images. Convolutional Neural Network (CNN) is evaluated and compared with the Histogram of Oriented Gradients (HoG) for this purpose. Suitable patch sizes are investigated. The limitation of RGB imagery is demonstrated [10]. The experimental results indicate that the overall accuracy of the weed classification using CNN increases with the increasing number of bands used. With more bands, CNN extracts more powerful and discriminative features and leads to improved classification as compared to the traditional HoG feature extraction method. The computational load of CNN, however, is slightly increased with the increasing number of bands.

Shubham Lavania, et.al(2015) proposed two methods; oriented to crop row detection in images from agriculture fields with high weed pressure and to further distinguish between weed and crop [11]. Firstly, for crop row detection the image processing consists of three main processes: image segmentation, double thresholding based on the 3D-Otsu's method, and crop row detection.Secondly, further classification between weed and crop, is carried out by compressing the three dimension vectors of an image to one dimension using the principal component analysis (PCA) method. Finally the combination of Otsu method and the PCA enable us to not only detect weed in crop rows but also classify this weed from crop. Hence it is better suited for the real time applications pertaining to weed detection.

Sarmad Hameed, et.al(2018) presented that with the increase in the world population the demand of the wheat is also increases. In order to increase the growth wheat in the wheat crop it is necessary to detect the weed in the wheat crop and the barren land to minimize the growth of weed so that the growth of the wheat can be increased [12]. Weed detection is the important factor to be analyzed. Unmanned Air Vehicle (UAV) is used for data acquisition of wheat crop in different phases so that high quality of RGB images can be captured. The proposed method facilitates the extraction of weed, wheat, and barren land in the wheat crop field using background subtraction. The result shows that background subtraction method is good for detecting the weed, barren land and wheat.

Table 1: Table of Comparison

Algorithms	Outcome
Support vector machine An image processing algorithm for processing the original image and computing geometrical parameters in OpenCV Java and Support Vector Machine.	This work can further be extended to other members of the orchid family. An improved version of the algorithm can be developed which can work with images taken from the plant directly.
Orthomosaic Map Weed plants in rice fields based on aerial images. For this purpose, images are taken at 50 meters high with 16.1 megapixels CMOS digital camera mount- ted on an autonomous electrical fixed wind plane. Then, an orthomosaic map of the field is created by stitching 250 pictures, as the image is ortho-corrected, the pixel in-formation on the final map is more reliable for the analysis.	For weed plants similar in form to rice plants, the level of detection was low, due to images resolution when this are taken at 50 meter high over the ground.
Convolution Neural Network Convolutional Neural Network (CNN) is evaluated and compared with the Histogram of Oriented Gradients (HoG) for this purpose. Suitable patch sizes are investigated. The limitation of RGB imagery is demonstrated. The experimental results indicate that the overall accuracy of the weed classification using CNN increases with the increasing number of bands used.	The computational load of CNN, however, is slightly increased with the increasing number of bands.
• **Otsu's** • **Classification**	Hence it is better suited for the real time applications pertaining to weed detection.

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• **GLCM** • **Support vector machine** The increase in the world population the demand of the wheat is also increases. In order to increase the growth wheat in the wheat crop it is necessary to detect the weed in the wheat crop and the barren land to minimize the growth of weed so that the growth of the wheat can be increased.	The proposed method facilitates the extraction of weed, wheat, and barren land in the wheat crop field using background subtraction. The result shows that background subtraction method is good for detection the weed, barren land, and wheat.

Conclusion

In this paper, it is concluded that weed detection is the major issue of the image processing. The weed detection process depends upon the segmentation and feature extraction. The various techniques are designed for the weed detection. The region based segmentation and textural feature analysis techniques are the most efficient technique for the weed detection. In future, classification approach will be proposed for the weed detection in the crops.

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