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Analysis and Detection of Weeds in Agricultural Area using various Image Segmentation Algorithms

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Abstract: ***Agriculture is the backbone of human provisions in this world. In the agricultural industry, the weed and crop identification and classification are major technical and economical importance. The segmentation algorithms are focused in this paper. The enhanced segmentation algorithm has been selected to classify weed and crop from the images. There are three main parts the proposed system are segmentation, categorization and error calculation. Several sample images have been tested and the result of some weed coverage rate is illustrated. The misclassification rate is also computed. An algorithm has been done to computerize the tasks of segmentation and classification. Weeds are extracting from images using image processing and describe by shape, color and size features. These features are used to classify different weeds and crop group. We describe different segmentation techniques like Clustering, Thresholding, Watershed, Morphological, color based, Edge-based methods. These are used to differentiate weeds and crops. We analyze all the features of these methods and techniques. The various methods studied and concepts used for crop and weed detection.***

Keywords: Image Enhancement, Pre-processing, Segmentation, K-Means Clustering, Watershed, Thresholding, Weeds Detection.

1. Introduction

Weed control has gained importance in recent years in precision farming. All biotic pressures in agriculture, weeds cause the highest yield loss and the reason for high weed control costs. These are among the most significant and costly environmental threats in the agriculture industry. Weeds inclusive with crop plants for moisture, nutrients, and sunlight. Weeds can have a detrimental impact on crop yields and quality if uncontrolled. Heavy herbicide usage damages the soil, threatens our food safety and also causes negative effects on the farm economy. 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. To detect the weeds they are still using manual power in many parts of the world. Later there came few methods to detect the weeds automatically but due to lack of their accuracy. In this paper, our main aim is to detect the weed in the crop by using image processing. Then we will give the inputs of the weed areas to an automatic spray pesticide only in individual's areas. Designed for this, we need to take a photograph of the field with good clarity to detect the weeds with more accuracy. Taking a photograph can be done by attaching a camera to a tractor or taking them manually. Then we will apply image processing to that image using MATLAB to detect the weed.

This part of the algorithm prepares an image for further advanced processing and is consists of Loading the image from source, color segmentation, and edge detection. Clustering is used to group the pixels of same colors into a group of objects, thereby making it easy to segment. *K*-means clustering algorithm uses iterative refinement to produce a final result. The output image comprises of only two colors. The desired image after color segmentation consists of green color (the crop and the weed) and the remaining part of image black. Making the image feasible to the step in the process, edge detection. K-Means is a least-squares partitioning method that divides a collection of objects into K groups. The algorithm iterates above two steps:

- Compute the mean of each cluster.
- Compute the space of each point from each cluster by computing its distance from the equivalent cluster mean.
- Consign each point to the cluster it is adjacent to.
- Iterate beyond the above two steps till the sum of squared within group errors cannot be lowered any additional.

Watershed segmentation is a predominant segmentation scheme with several advantages. It ensures the closed region boundaries and gives solid results. It is a way of automatically separating or cutting apart particles that touch. The watershed algorithm uses concepts from mathematical morphology to partition images into homogeneous regions.

- Step 1: Read in the Color Image and Convert it to Gray scale.
- Step 2: Use the Gradient Magnitude as the Segmentation Function.
- Step 3: Mark the Foreground Objects.
- Step 4: Compute Background Markers.
- Step 5: Compute the Watershed Transform of the Segmentation Function.
- Step 6: Visualize the Result.

2. Image Processing

Image segmentation is the process of dividing an image into several parts. This is typically used to identify objects or other related information in digital images. Special techniques such as Color based segmentation Edge based segmentation, thresholding based segmentation and watershed segmentation can be use. In this study, Clustering, Watershed, a Morphological segmentation method is used for the segmentation task. The entire segmentation steps are done depending on the binary image. Hence, the grayscale

image is converted into a binary image from the preprocessing stage. Thresholding based on the gray image is used to change the binary image. This means that each pixel in the image is store as a number between 0 to 255. Somewhere 0 represents a black pixel, 255 represent a white pixel and values in-between correspond to shades of gray.

Image enhancement: It is the process of adjusting digital images so that the results are more suitable for display or further analysis. Designed for this purpose author have visited and captured images from some farms.

Image pre-processing: It can significantly increase the reliability of a visual inspection. More than a few filter operations which intensify or reduce certain image details enable an easier or quicker evaluation. Users are able to optimize a camera image with now a few clicks. It involves cropping, turning, normalizing, contrast development, filtering, angle alteration and different graphical operations.

Segmentation: The proposed methodology aims to set a genuine Weeds grading system for agriculture. For experiment purpose, various Weed and crops samples are considered. The following steps are Image Enhancement, Image pre-process, Image segmentation, Transformation to Color process, and Weeds Detection. The flow chart represents the chronological steps by which the whole process is done. This method provides a very clear way of identifying the different weed Images. All these are done through different image processing techniques.

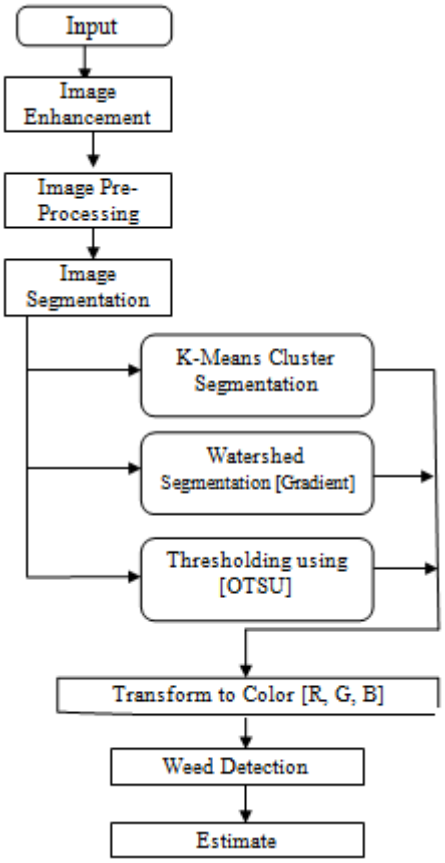
3. Related Works

An existing method for weed detection, independently of the type of crop treated, have in common the first stage: segmentation of vegetation against the background. The procedures for segmentation of the vegetation pixels usually take into account the fact that all pixels belonging to vegetation have a strong green component. This characteristic can be used directly through the RGB color model or creating color indices that represent the 'greenness' of a given pixel. Other approaches propose the use of the HSI color model combined with segmentation methods as Neural networks or clustering. Segmentation can also be performed by texture features selection and its similarities with previous models encountered, stored in a database. Segmentation can be performed by a combination of different cameras, as conventional and NIR cameras. After the vegetation has been separated from the background, it is necessary to detect which of those vegetation pixels belong to weeds. Weed detection by computer vision methods is usually performed combining information about color, position, shape, texture, size or spectrum of weeds. The use of only one or many of these characteristics depends on the way images are taken, crop type, and weed species involved.

4. Proposed Works

The procedures for segmentation of the vegetation pixels usually take into account the fact that all pixels belonging to vegetation have a strong green component. This characteristic can be used directly through the RGB color model or creating color indices that represent the 'greenness' of a given pixel. Segmentation can also be performed by texture features selection and its similarities with previous models are encountered, stored in a database. The objective of the first stage is to convert the input digital red–green–blue (RGB) image into a black and white image. Where the vegetation parts of the input image (weed and crop) will be represented in white and the rest (soil, stones, debris, straws) as black. This is a important stage in the image investigation. The segmentation into black and white of the original input image is incomplete or erroneous; the entire process will suffer from it. The goal of the second stage is to detect and eliminate from vegetation pixels.

4. 1 Proposed Work Methodology



5. Result

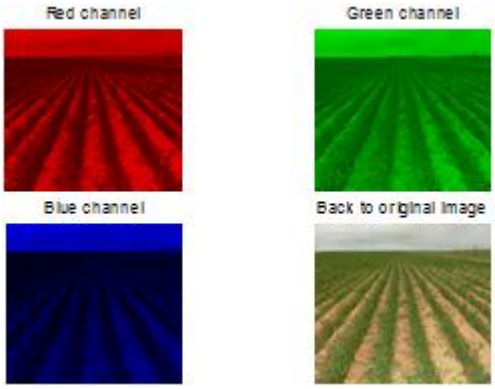
The proposed method needs the adjustment of a series of parameters. Which determine how the method works for each particular image. The best set of parameter values will be different. To fully develop the potential of the proposed system and check its correct operation, an adjustment of parameter values needs to be made. How to each parameter value change affects the overall processing. The Global search can only among the various global search algorithms are existent. These algorithms are developed was used to find the best possible combination of parameter values for a fixed method combination (which method is used at each stage) for a set of images.

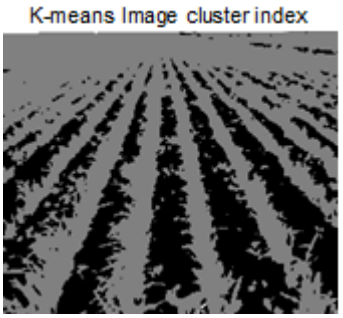
5.1 Performance measures for segmentation algorithms.

Table 1

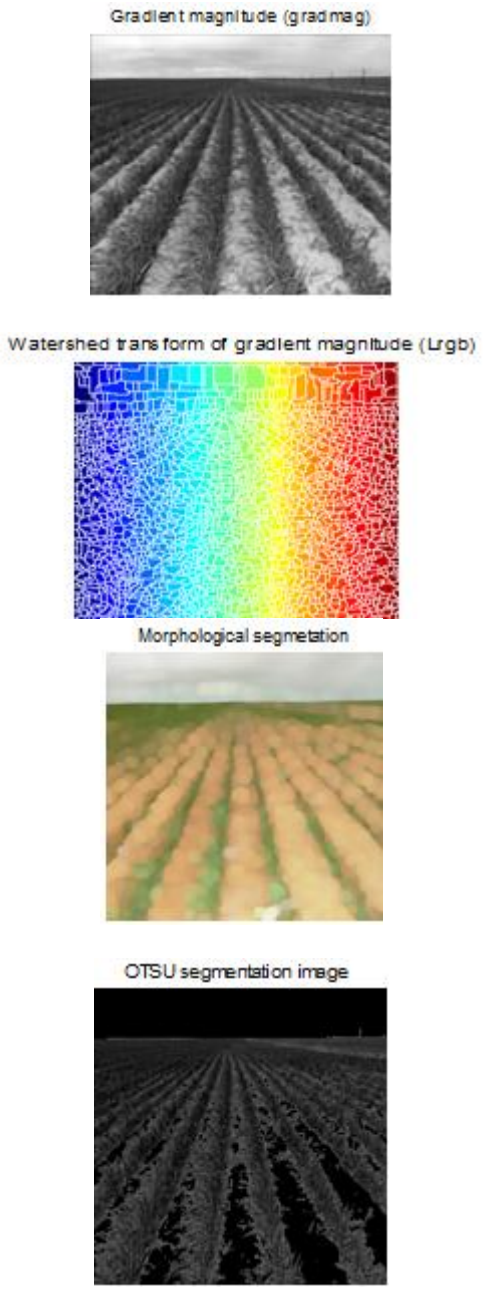
NO.of Datasets	Methods [S1,S2,S3]	Accuracy	Sensitifity	Specificity	Precision	F-Measure
200	1. K-Means Clustering	90	100	100	100	0
200	2. Watershed using	89.9985	100	98.8506	97.7273	0
200	3. Thresholding using	-10	0	NaN	0	58.84100

Development of methods of artificial vision to detect weeds from images is an open field of work of great importance in PA[Precision Agriculture]. They can be used as starting point to the development of a real-time vision system. Finally, we classify the results of segmentation (**k-means Clustering**) for better performance. Weeds destroy crops by competing for water, light, nutrients, and space. To reduce the quantifier of weeds in a field and to improve the effectiveness of machinery. A real time weed classification system is important. To increase accuracy and efficiency, we developed new pre-processing and post-processing methods. The K-Means Clustering algorithm creates the initial population by completes a number generation for all values except those of S1. Which some relationships were respected to assure correct vegetation against non-vegetation segmentation. The first step of S1 only assures that a monochrome gray level image will be created by a linear combination of the Red–Green–Blue planes of the input image. Except do not declare in any case a correct segmentation of vegetation against non-vegetation. To declare that the linear combination will correctly result in high intensities for vegetation and low intensities for non-vegetation. R, G, B must fulfill a series of requisites. Those requisites are resumed in Table 1. The green is the primary vegetation color. The requisite limits the range of possible values to simplify the computation of the segmentation step. To check the correctness of the R, G, B indices created by these relationships and compare its results with the widely used indices to proposed system. A second version of the Watershed algorithm has been running was these indices were fixed. Table 1 shows the results of the segmentation algorithm over the more sets of images. Seven Columns represents the combination of methods used at each stage, copying all possible combinations, in order to test the entire system. The above segmentation algorithms [S1, S2] will produce the five performance result. That will be presented in the Table1. The accuracy can be defined as the percentage of correctly classified instances (TP + TN)/(TP + TN + FP + FN).





5.1.1 The successful application of the proposed method of Figures:



5.1.2 Performance graph for Proposed Works

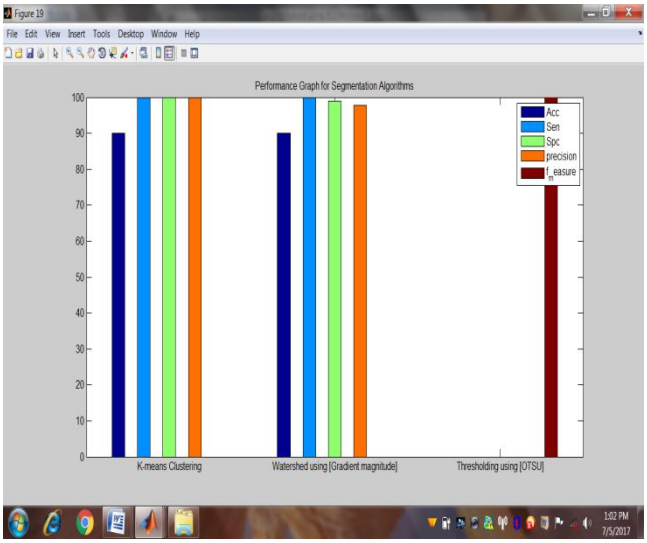


Figure 1

6. Conclusion

This paper proposes a strategy for Identifying between the Crops and Weeds. The image segmentation algorithm is a very useful method in the image processing and it is very useful for the successive processing. When the plants are separated from each other in the images. The segmentation task was tested on various images and the experimental results obtained by the segmentation process are more efficient and reliable when compared to the current techniques. The present model assumes Gaussian noise in the weed and crops images. Different noises have varying effects on the weed images. In future, several other noises are planned to be considered. The computation efficiency of the algorithms is also being compared with one another. The K-Means Cluster computation result will produce a better performance of crop and weed detection. The method, which has proven effective and simple, is based on color segmentation operations and well-known shape descriptors and classifiers, are common operations in image processing. Each and every technique has several advantages and disadvantages for it. After study all characteristics of Segmentation techniques we have decided to go with K-Means Clustering because it is suited for the complex as well as complete data. Which can be applied in the domain of agriculture with great accuracy for analyzing agronomic parameters? If the crop is additional developed, the weeds will most possible present the segmentation process will develop into complicated. Generally suitable to occlusions important to incorrect differentiation of the weed shapes. As future work, it is proposed to improve the processing time of the system. Taking advantage of the images it would be possible to get improved results during the segmentation stage. The result of the preliminary test shows the better result of weed extraction. Other types of Agriculture Land Images will also be tested in future. The results can be considered acceptable, better results can be obtained by improving the segmentation stage.

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