Removal of Weeds in Agriculture field using Wavelet Transformation in Image Processing

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Abstract: Weeds is a widely procedure to be remove in agriculture field. Weed species decreases the growth of the crop and reduce farm yields. Weeds grow along with main crops and compete with crop for sunlight, space and nutrients. To control weed species, a large number of pesticides and chemicals are used in agricultural fields, which results in drinking water contaminated and environmental pollution. Currently, therefore it is important to successfully identify the weeds from the crop to selectively spray herbicides to reduce wastage use of chemical. Wavelet is very popular tool in image processing algorithm. In this paper a new algorithm is developed for crop detection and management of weed. It is needed to measure the roots and size of the plant in terms of length for detection of crop. For this purpose segmentation and filtering techniques are used in a noise captured image.

Keywords: *Filters, Segmentation, Noise, Weeds, Agriculture*

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I. Introduction

Segmentation of weed plant is one of the essential tool agriculture sectors. It is a process of unwanted plants in and around the agriculture field. The weed will affect the trees and plants growth. The weed also takes in all the nutrients in the soil and water content. To eradicate the weed is the challenging task for farmers. It needs lot of man power to remove the weeds. Today scenario it is difficult to adopt the labour especially of farm lands.Detecting the harmful weeds is the challenging task for the farmers. It is the process of partitioning the unwanted plants otherwise called weeds based on the separation of weed result, surface of plants and roots can be extracted, modeled, manipulated, measured and visualized. Edge detection is an essential task in computer vision. It covers wide range of application from segmentation to pattern matching. The edge measure parameters related to the plant stem and the roots are the first step before registration conventionally edge is detected according to same early brought forward algorithm like sobel and laplacian of Gaussian operator. High pass filtering which are not fit for agriculture image noise edge detection because noise and edge belong to the scope of high frequency. In real world applications agriculture images contain object boundaries, object shadows and noise. Therefore, is difficult to distinguish the extract edge from noise, so morphological filter is applied for noise removal.

Wavelet Transform Wavelet is multi resolution tool. Wavelet transform have advantages over a Fourier transform, sharp spikes and signal contain discontinuity. In proposed system discrete transform is used. Continues transform is hard to implement and difficult to find out the scaling function. Wavelet transform is used for feature extraction of weed and crop images.

2. Pre-processing

Most images have extra parameters such as lighting effects, as well as background information and unnecessary details that may cause misclassification. Therefore, it is important to remove unnecessary parameters for fast and easy processing and to improve the quality of the images. By using the global histogram equalization (GHE) in the pre-processing stage is to improve the quality of the images by lengthening the intensity of the dynamic range and also the histogram of the whole image.

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3. Feature Extraction

At this stage, the RGB images were subjected to a decomposition process using different types of wavelet families. The reason for keeping the images in RGB form was to utilize information in the color space to improve the efficiency of the proposed algorithm. Basically, RGB image decomposition by wavelet transform (i.e., wavelet families) involves decomposition of the signal. If we have a 2D RGB image, namely image I, then the decomposition of the wavelet transform up to one level can be expressed as follows:

$$I = AP1 + DE1 \quad (1)$$

WEED CLASSIFICATION USING WAVELET TRANSFORM where the decomposed image is indicated by I and AP1 and DE1 represent the approximation and detail coefficients, respectively.

If the image is decomposed up to multilevel, then Eq. (2) can then be rewritten as

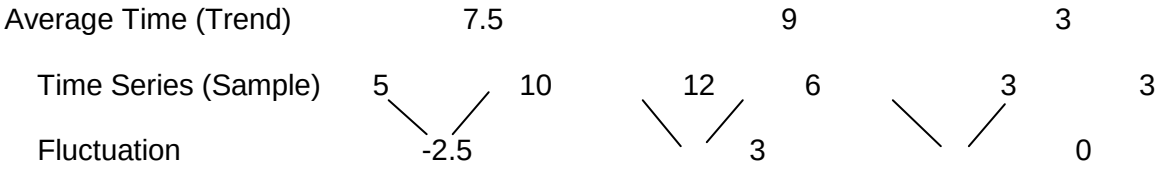
$$I = APj + DEj + DEj\text{-}1 + DEj\text{-}2 + \ldots + DE2 + DE1 \quad (2)$$

where j represents the level of decomposition

Mostly, the detail coefficients consist of noise, so for feature extraction, only approximation coefficients are used. Each image was decomposed up to four levels, i.e., j = 4, because after this value, there is loss of information such that informative coefficients cannot be detected properly, which may result in misclassification. As a result, a one-dimensional matrix is obtained by summing all the approximation coefficients at each level as follows:

$$Mat = AP4 + AP3 + AP2 + AP1 \quad (3)$$

where A indicates the approximation coefficients at each level of decomposition and Mat represents the one-dimensional matrix obtained from summation of all the approximation coefficients. After decomposition, the one-dimensional matrix is subjected to wavelet transform to generate the feature vector. The general form of the wavelet transform can be written as`



Discrete wavelet

[5, 10, 12, 6, 3, 3] ←→ [7.5, 9, 3,] [-2.5, 3, 0]

(Time series) (Trends) (Fluctuation)

Sample Wavelet

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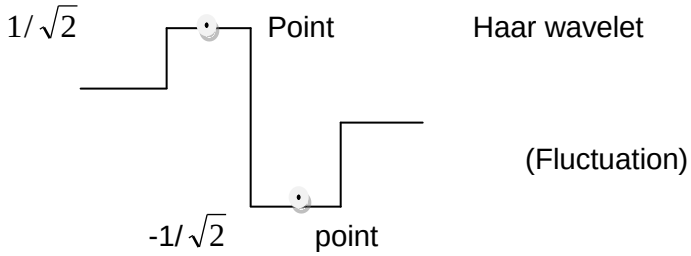

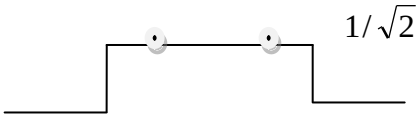

Scaling Signal

$W_1^1 = [1/\sqrt{2}, -1/\sqrt{2}, 0, 0, \ldots\ldots\ldots\ldots]$

Wavelet shift over time

First Level

Support of 2 points $1/\sqrt{2}$, $-1/\sqrt{2}$

Advantages

Function $g = [g_1, g_2, g_3, \ldots\ldots\ldots\ldots, g_n]$ samples

To scaling signal $S_1^1 = [1/\sqrt{2}, -1/\sqrt{2}, 0, 0, \ldots\ldots\ldots]$

Time series trend the source point

$T_1 = g_1+g_2/\sqrt{2}$ apply Haar scaling function $g \cdot s^1_1$

Fluctuation of 2 Points

$F_1 = g_1+g_2/\sqrt{2}$ Linear algebra $g \cdot w_1^1$

$\sqrt{2}$ Is good choice

Square all things

$T_1^2 = (g_1+g_2/\sqrt{2})^2 = g \cdot s^1_1$

$F_1^2 = (g_1-g_2/\sqrt{2})^2 = g \cdot w_1^1$

$T_1^2 + F_1^2 = g_1^2 + g_2^2$

First Level g : $H_1 \rightarrow (a^1/d^1)$

Second level g : $H2 \rightarrow (a^2/d^2/d^1)$

N case g : $H_n \rightarrow (a^n/d^n/d^{n-1}/\ldots\ldots\ldots/d^1)$

4. Morphology Filters

The morphology operators are dilation and erosion.

Let F(u,v) denote grey-scale two dimensional image, E denote structuring element, Dilation of grey scale image F(u,v) by grey-scale structuring element E(x,y) is denoted by

$$(F \oplus E)(u,v) = \max[f(u-x, v-y) + f(x,y)] \text{ ----------4}$$

Erosion of a grey scale image F(u,v) by a grey-scale structuring element E(x,y) is denoted by

$$(F \oplus E)(u,v) = \min[f(u+x, v+y) - E(x,y)] \text{ ----------5}$$

Opening and closing of grey-scale image F(u,v) by grey-scale structuring element E(x,y) are denoted by

F O E= (F-E) +E

F C E= (F+E)-E

O denote opening and C denote closing operators

Erosion is a transformation of shrinking, which decreases the grey-scale value of the image, which dilation is a transformation of expanding, which increases the grey-scale value of the image. But both of than are sensitive to the image edge whose grey-scale value changes. Opening is erosion followed by dilation and closing is dilation and closing is dilation followed by erosion. As a result the morphological is used to detect image edge and at the same time it denoised the image.

Opening-Closing operation is firstly used to preprocess and to filter the noise. Smoothing the image by applying the dilation property by closing. The perfect image will be the result by performing the difference between the processed image by above process and the image before dilation.

5.Proposed algorithm

Step:1 Prepare the display device for load grayscale and color table.
Step:2 Select and open the image file which was captured.
Step:3 Get the image dimensions, prepare a window and display the image.
Step:4 Define the radius of the structuring element and create the disk.
Step:5 Apply the opening operator to the image.
Step:6 Create a window and display an intensity histogram to help determine the threshold intensity value.
Step:7 Threshold the image and remove background noise.
Step:8 Display the threshold image.
Step:9 Apply the opening operator to the threshold image.

Step:10 Display the image and structuring element.
Step:11 END

6. LITERATURE SURVEY

There are basically 2 technique used to detect the crop and weed in the agriculture field.

A. Biological Morphology Based Technique

In biological morphological shape and size features are extracted. Shape features like, major axis, areas, minor axis, aspect ratio, width are used for detection of plant. Hidden features are also found with the help of biological morphological technique.[4] is used the excessive green color algorithm for segmentation of soil and vegetation, after that median filtering for removing the noise, morphological features and calculation of statistical threshold value. Using this, they got 72.6% of precision. Seven shape features for detection of crop and weed is used by [5] but this is limited to only for paddy and they got the accuracy 98.9%.

B. Plant Reflectance Based Technique Spectral reflectance technique

It is used for plant species identification. Spectrometer is necessary to record spectral reflectance parameter but cost is higher than the common former can offered. Various types of spectral reflectance parameter are used like for vegetation indices, to measure crop properties in the visible spectrum typically ratios of broadband reflectance values are used. The features like, variance of the near infrared spectrum, skewness, average gives the high level of success in color segmentation[7] got 72% of accuracy in their proposed system for detection of weed in Mango trees.

III. FIELD SURVEY Field survey of Mango tree and coconut tree is carried out in Karuvelanpatti, Tamilnadu, India. In Karuvelanpatti Mango tree is the main crop chosen by farmer.

Total Income

Crop	Time period	Total Yield	Market Rate	Total Income
Mango	6 Month	Kg.300	Kg.60	18,000
Coconut	6 Month	No.3000	Rs.8	24,000

Total Expense

Crop	Labour charges	Fertilizer + Transport	Pesticides	Total

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Mango	3000	2000+1000	650	6650
Coconut	2000	2000	600	4600

Cost of De-Weeding

Crop	After 1 Month	After 2 Month	After 3 Month	Total
Mango	1000	1000	1000	3000
Coconut	1000	NA	NA	1000

Table 1 shows the total expenses required for the de-weeding of coconut and mango in 1 Acre.

De-weeding is the costliest input in the agriculture field. Farmer uses more herbicides for the de-weeding. De-weeding can be done manually with the help of labour.

Fig : 1 Input image

Fig : 2 Threshold image

Fig : 3 Morphological image closing

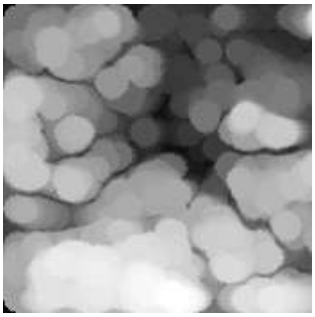

Fig : 4 Morphological image opening

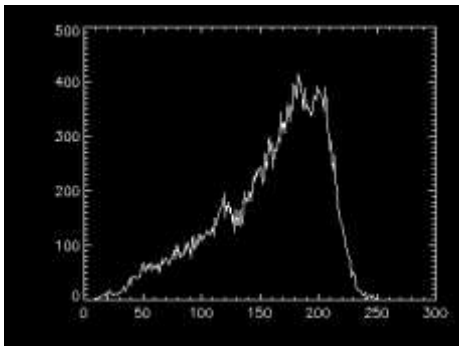

Fig : 5 Threshold intensity value

0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1	1	1	1	0	0	0	0
0	0	0	1	1	1	1	1	1	1	1	1	0	0	0
0	0	1	1	1	1	1	1	1	1	1	1	1	0	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	0	1	1	1	1	1	1	1	1	1	1	1	0	0
0	0	0	1	1	1	1	1	1	1	1	1	0	0	0
0	0	0	0	1	1	1	1	1	1	1	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Fig : 6 Structuring element

7. Conclusion

After apply of wavelet transformation, the weed in the agriculture field is dramatically reduced and the total yield of the plant is increased its productivity of mango and coconut is increased by 600Kg and 4500No. In future the same can also be implemented in any mobile applications so to easily monitor the activity in agriculture field.

8. Reference

[1] A.Senthilrajan, Dr.E.Ramaraj, “Parallel Sorting Algorithm”, 12thInternational workshop on Future Trends of Distributed Computing Systems, Kunming, China. PP.115-119, October 2008.

[2] A.Senthilrajan, Dr.E.Ramaraj, “Multi Core processor to support network parallel Image processing applications”, International conference on signal processing system 15-17 May,2009,Singapore, Organized by International association of computer science and IT. IEEE computer society, ISBN: 978-0-7695-3654-5, pp.42-45.

[3] A.Senthilrajan, Dr.E.Ramaraj, International multi conference of engineers and computer scientists, 17-19, March,2010, “High Density Impulse Noise removal using Median Filter”, Hongkong, International Association of Engineers. ISBN: 978- 988-18210-4-1,ISSN: 2078-0958. pp1481-1485.

[4] A.Senthilrajan, Dr.E.Ramaraj, “Median Filter Using Multiprocessing in Agriculture”, in 10th International Conference on Signal Processing (ICSP’10), Oct.24-28, 2010, Beijing, China, Organized by IEEE Signal Processing Society. pp. 232-235.

[5] Dr.A.Senthilrajan, ”Paddy Grade and Dirt classification using Image Processing Techniques”, in C2SPCA2013Oct 10,11,2013,IEEE conference in Bangalore, India.

[6] A.Senthilrajan, Dr.E.Ramaraj, "Median Filter in Agriculture", In World Congress on Engineering and Computer Science 2010 SanFrancisco, USA, , pp. 604-607, Organized by the International Association of Engineers (IAENG). ISBN: 978-988- 17012-0-6.

[7] Dr.A.Senthilrajan , Engineering Sciences International Research Journal : Volume 3 Issue 2 (2015) ISSN 2320-4338 IMRF Journals ¸´ PEST CONTROL IN PADDY USING SEGMENTATION IN IMAGE PROCESSING ".