ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Application of Image Processing Techniques in Weed Detection For Crop Production.

Varalakshmi R*, and Vinothkumar R.

*Assistant Professor, Department of Computer Science, Vels University, Tamil Nadu, India.
Research Scholar, Vels University, Tamil Nadu, India.

ABSTRACT

Image processing techniques is effective a tool in Agriculture sector. Dealing with weed is an important concern in agriculture. It is a cost effective and manual labor consuming process. Moreover, over-herbicide may result in surface runoff and pollute surface water. Image processing and communication network can change the situation; this paper intends to focus application of image processing in agriculture field for weed detection. In the proposed mechanism, the various diversified weed plants of the locality is feed to the system which acts as weed sample set. Potentially a 24/7 surveillance system will capture images at different positions. In the proposed method, the video of the farm is captured from different dimensions and angles. The video is segmented into Images. Each frame of the image is applied with a filter for sharpness, image is converted to gray-scale, and the vegetative region is segmented. Thus, obtained gray image is circular convoluted with a unit matrix in the same way the weed sample image also circular convoluted with the unit matrix after converting it to gray. The results are compared and if in any segment more than 85% matches, presence of weed is confirmed. The decision support system will send the short message services (SMS) to the farmer along with the image so the farmer can confirm the weed growth in the region.
Keywords: Circular convolution, Gray Images, Segmentation, unit Matrix, Weed sample.

Corresponding author

INTRODUCTION

In weed management, crop damage from herbicide spray drift and herbicide resistance in weeds are significant concern[1]. Weeds were the plants that are considered as unwanted plants, which race with crop plants for water, light, nutrients, and space, causing decrease in yield and successful use of equipment [2]. In the past, weed detection was done manually with a set of people employed for it. Later on herbicides were used; Manual weed sampling is cost expensive and time-consuming process. Most weed detection techniques uses algorithms that are based on color detection, classification based on wavelets [4], edge detection, etc. Weed recognition system for real time applications uses edge based classifier to identify broad and narrow weeds. Excessive green and thresholding was used for segmenting vegetative and non-vegetative regions. To distinguish vegetation pixels, a linear blend of the RGB planes with coefficients of R=-0.884, G=1.262, and B=-0.311 was performed [5]. In color detection, method images were captured and adjusted color gains and shutter time to gray plates [6]. In HIS (hue, saturation, intensity) color model, along with classification methods such as Bayes networks and clustering [7].

In the proposed approach, the weed is detected by comparing the circular convoluted images of weed and pre loaded weed sample set images. In order to perform circular convolution, a unit matrix equal to the order of the gray-scale weed image and sample set images are used. Circular convolution is performed to normalize the image. This convoluted images compared and 85% of the values matched, presence of weed is confirmed.

PRINCIPLES:

The proposed approach follows the following steps,

Image acquisition and segmentation of the vegetative region :

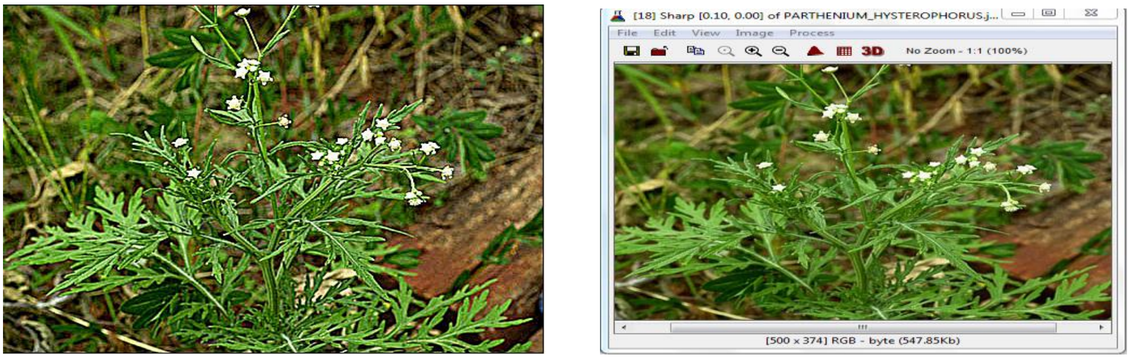
The first step in the proposed approach is to capture the image of the farm. A 24/7 surveillance system is set up which monitor and capture the images across the field. These images are used as the input to the system. Images are often ruined by unsystematic difference in intensity, lighting, or have poor contrast and cannot be used directly. The next step is to segmentation of the vegetation pixels. To distinguish vegetation pixels, a linear blend of the RGB planes with coefficients of R=-0.884, G=1.262, and B=-0.311 was performed [5]. Then the threshold used is set involuntarily for each image. The automatic adjustment of the threshold value is central to achieving segmentation forceful to changes in illumination, which occur frequently due to changing weather. Threshold correcting method will be setting the threshold to the mean pixel intensity following the Eq.1.

$$\text{Threshold}=\frac{\sum_{x=1}^{l}\sum_{y=1}^{h}(r*R(x,y)+g*G(x,y)+b*B(x,y))}{l*h} \quad \text{(Eq. 1)}$$

where, r =−0.884, g = 1.262, b =−0.311, *l*=length of the image, *h*= height of the image, *R(x,y), G(x,y), B(x,y)* are the pixel values of the image respectively red, green and blue.

Filtration & Segmentation :

Filtration is a process by which image is sharpened. Sharpening enhance line structures and other details in an image. A high-pass filter is used to make an image appear sharper. The fig1. below shows the image that is being sharpened. A high pass filter is applied to the original image in the fig1. (a) and sharpened as shown in the fig1. (b)



(a) (b)

Fig1. (a) Original Weed Image (b) After Applying Filtration for sharpening

Converting image to gray-scale :

The true color images (RGB) image is converted to gray-scale image. In order to make the computation easier and effective, gray-scale images are used, which will also compute the intensity of the light at each pixel. Fig2 shows the gray-scale image of sharpened image.

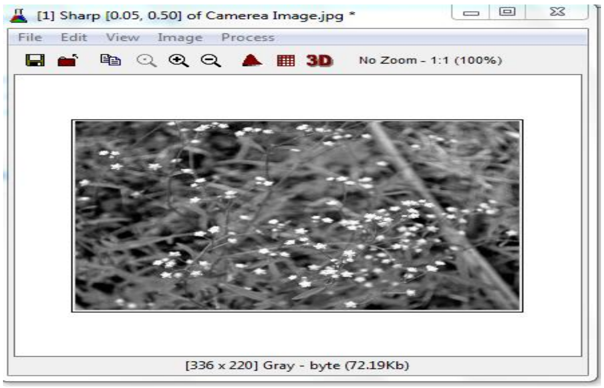


Fig 2 Gray-scale Image.

Circular Convolution and comparison :

In order to compare the image with weed sample set, circular convolution is performed. The following Eq.2 & 3 will be used to compare the results.

$$y_1(n) = h_1(n) \odot x(n) \quad \text{(Eq.2)}$$
$$y_2(n) = h_2(n) \odot x(n) \quad \text{(Eq.3)}$$

In the equation 2 & 3 the values of $y_1(n)$ and $y_2(n)$ represent the circular convolution value of the weed image and weed sample set image respectively. The values are computed and compared. In the equations 2 &3 $h_1(n)$ and $h_2(n)$ are matrix extracted from the pixels using gray-scale.

$$h_1(n) = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix} \qquad h_2(n) = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix}$$

Here a_{11}, a_{1n}….a_{nn} represents the pixel values the gray-scale image of weed image in case of $h_1(n)$ and sample set image in case of $h_2(n)$.

$x(n) = \begin{pmatrix} 1 & \cdots & 1 \\ \vdots & \ddots & \vdots \\ 1 & \cdots & 1 \end{pmatrix}$ is an unit matrix of order equal to the order of $h_1(n)$ and $h_2(n)$.

Fig.3 shows the algorithm of the proposed approach.

1) Extract value of $h_1(n)$ and $h_2(n)$ using Gray-scale
2) Assign the value of x (n) as unit matrix.
3) Compute $y_1(n)$ and $y_2(n)$;
4) Compare $y_1(n)$ and $y_2(n)$;
5) If $y_1(n)$ $=y_2(n)$; then weed sample match with vegetative images of the farm.

Else weed sample do not match with vegetative image.

Fig.3 Algorithm for image comparison

Experimental Results:

The $y_1(n)$ and $y_2(n)$ values from the equation Eq.2 & 3 are compared. If the two convoluted values matched, more than 85% the presence of weed in the region is evaluated as true. For the evaluation that are true, the farmers will be receive an SMS with the respective image and geo location information. Fig 4. Extraction of Vegetative regions of the Weed Sample Set and Image captured from the Farm.

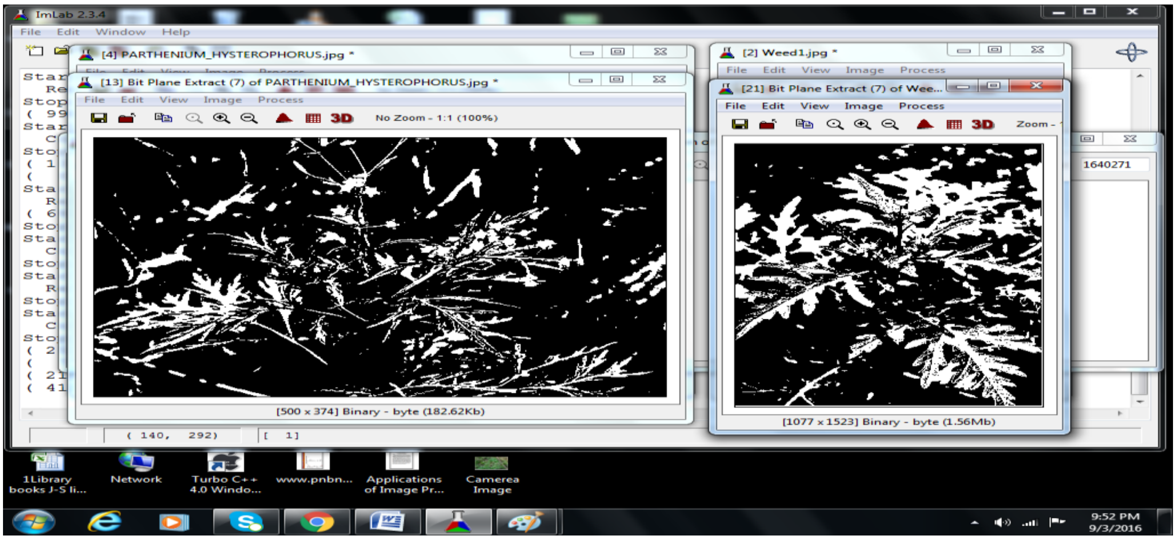


Fig 4. Extraction of Vegetative regions of the Weed Sample Set and Image from the Farm.

Fig 5. Shows the histogram of Gray Image of the Original Weed Image and Image obtained from the farm similarity of the vegetative regions of the original weed image and the image obtained from the farm.

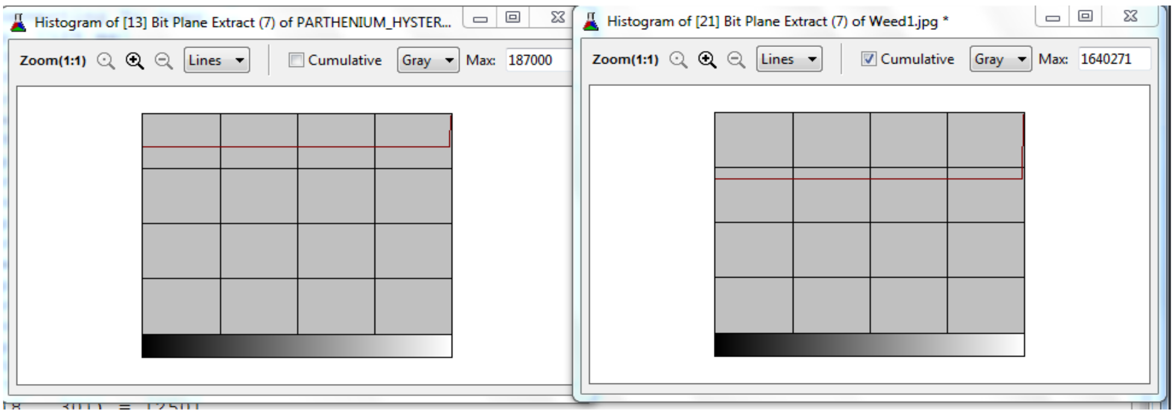


Fig 5. Histogram of Gray Image of the Original Weed Image and Image obtained from the farm

In the fig.6, the two graphs show the how close both the weed sample image and the vegetative image lies after the circular convolution using the equation Eq 2 & 3. If more than 85 % similarity exists then the presence of weed is confirmed and the SMS is sent to the farmer along with the weed image and geo-location is sent as an acknowledgement.

CONCLUSION

To achieve geo location specific weeds management, the important pace is the location and density estimation of weeds. In this approach, the system provides weed detection methods, which can be of great help in constructing fully automatic and cheapest weed sampling systems. The problem is that due to changing conditions of lighting, dampness, flora growth, different weed species encountered, and due to the similarities presented with crop plants and weeds, in many cases, making decision a complex task and an open field of research. In this paper, an image technique based weed detection system is presented. The system is making use of comparison of images, which is circular convoluted with unit matrix after the filtration and segmentation. RGB calculation is done based on the timely basis based on different environmental condition. In the same time, gray-scale image comparison is performed.

REFERENCES

[1] [Yanbo Huang, Matthew A. Lee, Steven J. Thomson, Krishna N. Reddy, 2016, Ground-based hyperspectral remote sensing for weed management in crop production, International journal of Agricultural and Biological Engineering Vol. 9No.2, March 2016.

[2] Ajinkya Paikekari, Vrushali Ghule, Rani Meshram, V.B. Raskar, 2016, WEED DETECTION USING IMAGE PROCESSING, International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 03 | March-2016

[3] Amit Verma and Gayatri Khanna, A Survey on Digital Image Processing Techniques for Tumor Detection, 2016, Indian Journal of Science and Technology, Vol 9(14), DOI: 10.17485/ijst/2016/v9i14/84976, April 2016.

[4] Roushdi Mohamed FAROUK and Rajesh KUMAR3, “Iris Matching Based on a Stack like Structure Graph Approach”, Walailak J Sci & Tech 2012; 9(4): 461-474.

[5] Xavier P. Burgos-Artizzu, Angela Ribeiro, Maria Guijarro, Gonzalo Pajares; “Real- time image processing for crop/weed discrimination in maize fields”; Elsevier; 2010.

[6] Imran Ahmed, Awais Adnan, Salim Gul, Md Islam, 2008, “ Edge based real time weed recognition system for selective herbicides”, Proceedings of IMECS, Vol-1.

[7] Zheng, L., Zhang, J., Wang, Q., 2009. Mean-shift-based color segmentation of images containing green vegetation. Comput. Electron. Agr. 65, 93–98.

[8] Imran Ahmed, Syed shah, Md Islam, Awais Adnan, 2007, “ A Real time specific weed recognition system using statistical methods” , World academy of science, engineering and technology, pp 143-145.

[9] Kamarul Ghazali, Mohd Mustafa, Aini Hussain, 2007, “Color image processing of weed classification: A comparison of Two feature extraction technique”, proceedings of ICEEI Institute technology Bangdung, Indonesia, pp 607-61.