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RESEARCH ARTICLE

AGRICULTURE PEST CONTROL USING COMPUTER VISION TECHNIQUE

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Abstract

All over the world, the population depends on agriculture. Research in agriculture aims to increase the quality and quantity but pests decrease the quality. To stop the effect of these pests, Pesticides are used. But the excessive use of pesticides is very harmful to the environment. So the early pest detection is necessary. Pest detection is to get the information and location of the pest and this can be done only temperature controlled room like in the greenhouse. The project proposes pest detection by using the image processing system at early stage to optimize the use of pesticides. To detect these pests, images are captured by camera in real time. An algorithm is developed for detection and classification of pest. Proposed system provides a simple, efficient and fast solution in detecting pests.

INTRODUCTION

India is an agricultural country where in most of the population depends on agriculture. Agriculture is one of the major domains which decide economy of the nation. Environmental parameters such as rain, temperature & other weather conditions which are beyond control of human beings affect the cultivation[8]. Pest is another major biological parameter which affects productivity of the crop. Pests cause diseases to crops which degrade its quality. Since pests can be controlled, research provides solution for pest control. Greenhouse research provides insight to this issue. Greenhouse ventilation, heating, carbondioxide enrichment, irrigation are most important factors available in greenhouse. Tomato, Capsicum, Gerbera, Leafy greens, Spinach, Cucumber, Grapes, Strawberries, Coriander, Rose, Chillies, Raspberries, Lemon and orange are grown in the greenhouse[1]. Pests enter in the greenhouse through soil, water and air. To reduce effect of this pest on the plant, pesticides are used. Pesticides are substances used for attracting, seducing, and destroying pest. The term pesticide is often treated as plant protection product. There are organic and in-organic pesticides. Organophosphate pesticides, Carbamsate pesticides, Pyrethroid pesticides, Sulfonylurea herbicide are the chemical pesticides. These pesticides have many side-effects and they are harmful. They degrade the quality of soil and crops and reduce biodiversity. In this research paper we have considered two types of pests-Aphid and Whitefly. Aphids are small 2-3mm in size. It is soft bodied insects, pear shaped, ranging in colour from a light green, pinkish dark green and black[1]. Aphids have unusual lifecycles. There are usually 4 nymphal stages. A female will give birth to more than 100 live young over her life span of 1 to 4 weeks. Another one is Whitefly, the adult whitefly is 1.5mm long. Eggs are pale yellow in colour, before turning grey prior to hatching. Newly hatched larvae known as crawlers, are in the immature life-stage[7]. During the first and second larval instars, the appearance is that of a pale yellow. During the fourth and final immature life-stage known as the "pupa".

This paper describes a simple and efficient method based on image processing using neural network for classification of pest.

The paper is divided into 4 sections. Section 2 describe the literature review. Section 3 describe proposed method in detail. Result discussion and conclusion described in section 4.

2. LITERATURE REVIEW

OLD METHODS

There are two methods to detect pest in earlier stage on the greenhouse crops .The methods are explained below with their features and drawbacks.

2.1. Method with Static Images

- In this method the image acquisition is done with the scanner.
- The second stage involves Image Processing to detect the pests.
- The method has good accuracy and results, but the drawback of this method is the use of scanner for image acquisition. Also it is much slower. When we scan the image there may be a chance that the pests may fly away or there may be a chance of the image getting blurred. Improper scanning may lead to false information.

2.2. Method which use Sticky Traps

- In this method the sticky traps are used to detect the pests.
- Sticky material which is on the sticky traps attracts the pests due to their properties. But to reach the sticky traps, the development of the pest must be completed i.e. the pest must fly but at this stage the damage is already done to the crops.
- The drawback of both these methods can be overcome by using pan tilt camera with zoom. The camera is continuously moving and used to capture the image so there is no problem flying away of pests and there is no false information. Also there is no need to reach the sticky trap[5].

3. PROPOSED METHOD

3.1 Camera Calibration

Camera calibration is the first step of proposed system; first we capture the images from wireless camera. Generally Five wireless cameras are used in a greenhouse to take the images. The position, number, and nature of cameras are critical to obtain an optimized image sampling in terms of accuracy. The cameras capture images with 20X zoom of leaves in order to detect flying insects, when it firstly enters into the greenhouse. The camera is interfaced with the system which will take the image captured by the camera as an input.

3.2 Image Pre-Processing

Image pre-processing creates an enhanced image that is more useful or pleasing to a human observer.
The image pre-processing steps used to detect

3.2.1 The Whitefly

a) Resize the image
b) Conversion of RGB image to gray image
c) Compare the image.

3.2.2 The Aphid

a) Resize the image
b) Conversion of RGB to HSV image
c) Conversion of RGB to YCBCR

3.3 Feature Extraction

Feature extraction is the process where the large set of data is transformed into reduced set of features so we get image with reduce set of features without loss of information. In feature extraction we are considering some properties of the image. There are different properties like region properties, grey covariance matrix properties. Amongst those; properties like entropy, mean, standard deviation, contrast are extracted from the image.These features are given as input to the neural network. Artificial neural network acts as classifier and feed forward network is used for classification purpose and trained by using back propagation algorithm with gradient

decent. This algorithm is based on the adjustment of the weights of the connections of the network to minimize error. The error is calculated by comparing obtaining outputs with expected outputs of known inputs.

3.4 Disease Classification

Disease classification is done on feed forward network. It can be divided into two categories affected images and unaffected images. This data is provided to train the network. From the below table it can be observed that there is variation in standard deviation, contrast, variance, entropy etc.

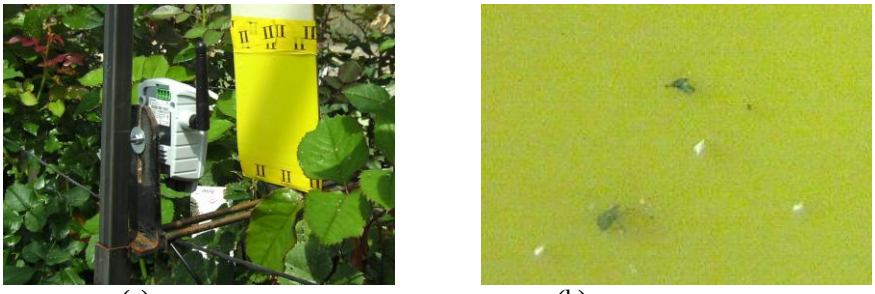
3.5 Detection

As neural network is trained with the data collected from data base. The features of the input image are extracted and given as an input to the network; based on the comparison with the parameters of database network generates the output.

3.6 Identification of Pests (Bug)

If leaf was found affected by bug the next step is to find out the type of bug i.e. whiteflies or aphid. For deciding the category again we use neural network classifier as shown in the figure 3.

4. RESULT

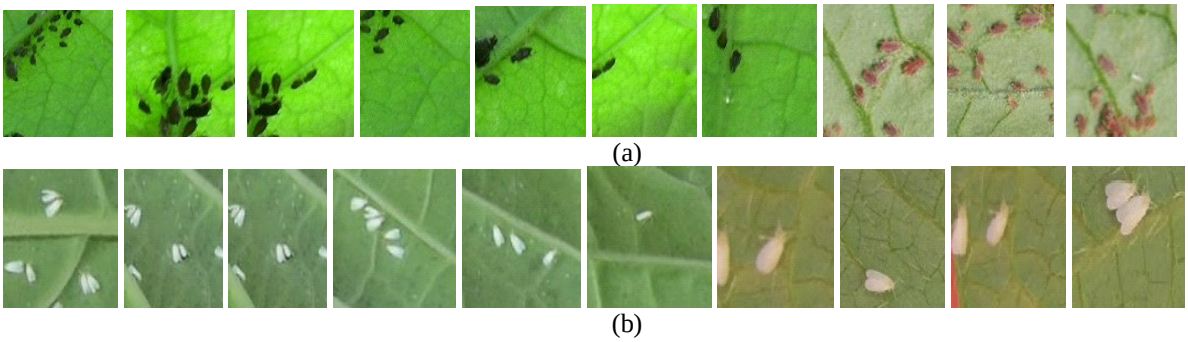


(a) (b)

Figure1 :(a)camera filming a sticky trap, (b) close view of sticky trap

(a) (b)

Figure 2: Dataset for feature extraction shows (a) unaffected and affected images by aphid,(b)unaffected and affected images by whitefly



(a)

(b)

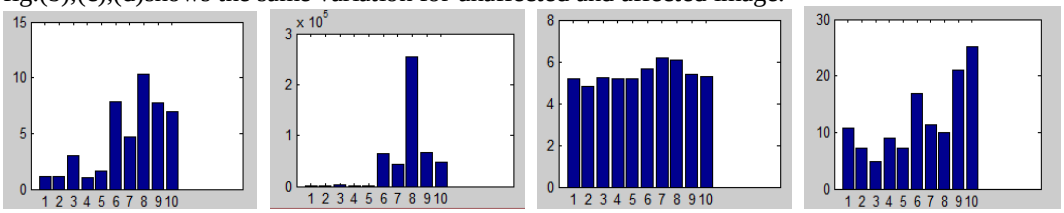
Figure 3: Database for classification,(a) images of aphid,(b)images of whitefly

Table 1 and 2 shows feature extracted parameters for aphid and whitefly. The obtained features were given as inputs to a Feed Forward Neural Network, which gives an output of 0 or 1. Zero represents Non-Affected and one represents Affected image.

Table 1: Feature extracted parameters of aphid

Parameters	Sr. No.	Mean	Variance	Standard deviation	Entropy	Kurtosis
Unaffected Images	1	127.1935	421.2018	1.1727	5.1608	10.7853
	2	126.0104	192.8039	1.0939	4.8416	7.2856
	3	137.7277	3.5359e+03	3.0019	5.2430	4.9097
	4	125.2794	387.7588	1.0762	5.1874	8.9158
	5	122.6004	924.0161	1.6340	5.1805	7.1374
Affected Images	6	157.1613	6.5171e+04	7.8517	5.6727	16.9736
	7	126.4316	4.3584e+04	4.6743	6.1997	11.2755
	8	122.9989	2.5387e+05	10.3195	6.0986	10.0657
	9	123.1124	6.6193e+04	7.7311	5.3833	21.0410
	10	137.8819	4.7025e+04	6.9542	5.2818	25.1600

The fig. 4 shows bar graph of feature extracted parameters. This bar graph shows the variation in unaffected and affected image. The bar graph of standard deviation indicates that first five images have less than 5 pixel which means it is unaffected .the next five images displays value higher than 5 pixel which means it is affected by aphid. fig.(b),(c),(d)shows the same variation for unaffected and affected image.

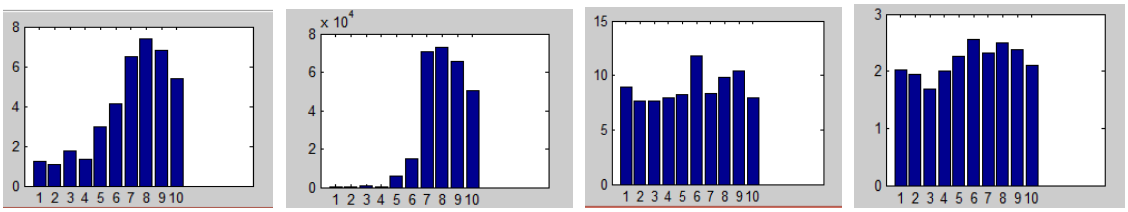


(a) (b) (c) (d)

Figure 4: Bar graph of aphid showing: (a) standard deviation, (b) variance, (c) entropy,(d) kurtosis

Table 2**:** Feature extracted parameters of whitefly

Parameters	Sr. No	Mean	Variance	Standard deviation	Entropy	Kurtosis
Unaffected Images	1	120.4096	272.5093	1.2555	4.7111	8.9570
	2	128.7637	262.1276	1.0560	5.0342	7.6809
	3	128.0525	952.1855	1.7562	5.0407	7.6370
	4	126.9532	369.4741	1.3435	5.1561	7.9325
	5	112.6086	5.7207e+03	2.9520	5.3482	8.2852
Affected Images	6	119.3933	1.4763e+04	4.1337	5.7033	11.7520
	7	124.5196	7.0508e+04	6.4754	5.7381	8.3715
	8	134.7732	7.2863e+04	7.3848	5.7149	9.8547
	9	126.7562	6.5356e+04	6.8301	5.8048	10.4322
	10	130.7909	5.0378e+04	5.3741	6.0250	7.9751



(a) (b) (c) (d)

Figure 5: Bar graph of whitefly showing: (a) standard deviation, (b) variance, (c) entropy,(d) kurtosis

2.1 Confusion matrix

The above feature extracted parameters of aphid and whitefly are given input to the feed forward network for classification. The following confusion matrix shows how it is correctly classified.

- Matrix (a) for aphid shows that images are70 percent correctly classified and 30 percent incorrectly classified.
- Matrix (b)for whitefly shows that images are 80 percent correctly classified and 20 percent incorrectly classified.

(a) (b)

Figure 6 : (a) confusion matrix of aphid,(b) confusion matrix of whitefly

5. CONCLUSION

- Observation and research shows that the detection of pests should be done at earlier stages.
- This method is reliable and efficient for rapid detection of pests.
- This method is also cost effective and simple.
- Also it can be concluded that when pests are detected at the early stages, it reduces the usage of pesticides up to 80 percent.

6. REFERENCE

[1] Rupesh G. Mundada andDr. V. V. Gohokar. "Detection and Classification of Pests in Greenhouse Using Image Processing" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p-ISSN: 2278-8735. Volume 5, Issue 6 (Mar. - Apr. 2013), PP 57-63

[2] R. Huddar, S. Gowri and S R Rupanagudi "Novel Algorithm for Segmentation and Automatic Identification of Pests on Plants using Image Processing" Third International Conference Computing Communication & Networking Technologies (ICCCNT), 26-28 July 2012

[3]V. Martin and S. Moisan "Early Pest Detection in Greenhouses" International Conference on Pattern Recognition, December 2008.

[4] J.K.Patil. and R. Kumar "Feature Extraction Of Diseased Leaf Images" Journal of Signal and *Image* Processing ISSN: 0976-8882 & E-ISSN: 0976-8890, Volume 3, Issue 1, 2012, pp.-60-63.

[5]Boissard, P., Martin, V., Moisan, S. "A cognitive vision approach to early pest detection in greenhouse crops." Computer and Electronics in Agriculture (2007)

[6]Noldus, L., Spink, A., Tegelenbosch, R. "Computerised video tracking, movement analysis and behaviour recognition in insects." Computers and Electronics in Agriculture (2002) 201–227.

[7] RaziehPourdarbani, Behnam Rezaei" Automatic Detection Of Greenhouse Plants Pests By Image Analysis."TarimMakainalariBilimiDergisi(Journal of Agricultural Machinery Science) 2011,7(2),171-174.

[8]Gaurav Y. Kandalkar, A.V.Deorankar "Overview Of Image Processing Approach For Identification Of Agricultural Pests" International Journal Of Advanced Electronics & Communication Systems Approved By Csir-NiscairIssn No: 2277-7318 Proceedings Of International Conference On Modeling And Simulation In Engineering & Technology (Icmset-2014) 15th - 16th February, 2014.