

# **Plant Leaf Disease Detection Using Auto Adaptive Approach**

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**ABSTRACT:** Nowadays crops face many types of infections/diseases. The identification of disease on the plant leaf is a very important to provide large quantity and good qualitative agricultural products. The main objective of this research is to develop a prototype system for detecting the infections like whitefly and black sigatoka. In this paper, we present a strategy based on advances in automatic interpretation of images applied to leaves of the plant. We propose a cognitive vision system that combines image processing, learning and knowledge based techniques. The paper proposes a software prototype system for pest detection on the infected images of different leaves. Images of the infected leaf are captured and processed using image growing, image segmentation techniques to detect infected parts of the plants. Then the detected part is been processed for further feature extraction which gives general idea about pests. This dissertation proposes automatic detection and calculating area of infection of black sigatoka on a banana tree and whitefly on rose and cotton crop by an application of cognitive vision techniques.

**KEYWORDS:** Image acquisition, Segmentation, feature extraction, cognitive vision.

## **I. INTRODUCTION**

Agriculture in India has a significant history. India is a cultivated country and about 70% of the population depends on agriculture. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. The major cash crops are sugarcane, cotton, citrus, groundnut, tobacco, potato, coffee, tea, cashew nut, mango, grapes, oranges, various kinds of vegetables and flowers etc. Besides this major crops are sorghum, wheat, rice, maize, millets and many legumes are also cultivated on large scale as they have increasing market value but the most important natural enemies of agricultural crops are insects, plant diseases, weeds and weather conditions.

The studies of plant disease refer to the studies of visually observable patterns on the plants. Monitoring of health and disease on plant plays an important role in successful cultivation of crops in the farm. In early days, the monitoring and analysis of plant diseases were done manually by the expertise person in that field. This requires tremendous amount of work and also requires excessive processing time. Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit, which has received importance in recent time. Disease on plant leads to the significant reduction in both the quality and quantity of agricultural products. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is considered which shows the disease symptoms. This paper gives the introduction to image processing technique used for plant disease detection by using cognitive vision technique.

## **II. RELATED WORK**

The responsibility of protecting food crops from diseases and pests in the challenging environment is rising with increase in human population and its needs. The crop losses due to pests are assessed to be ranging approximately

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between 10 to 30% of crop productions. Status and importance of various diseases have changed over the years in India. Awareness is needed to know the status of these problems and to develop management modules to protect these in eco-friendly manner. Various techniques of image processing and pattern recognition have been developed for detection of diseases occurring on plant leaves, stems, lesion etc. by the researchers. The sooner disease appears on the leaf it should be detected, identified and corresponding measures should be taken to avoid loss. IDM is a multidisciplinary approach that seems promising to manage diseases effectively by integration of cultural, physical, biological and chemical strategies.

The classical diagnostic method of collecting and sending samples of the infected or damaged crop to extension services, where diagnoses are performed, are time consuming and can lead to delays in implementing control recommendations. In production conditions, staffs periodically observe plants and search for pests. This manual method is to time consuming. Diagnosis is a most difficult task to perform manually as it is a function of a number of parameters such as environment, nutrient, organism etc. There are many researchers who worked in this field. A summary of work of some of the researchers is given below.

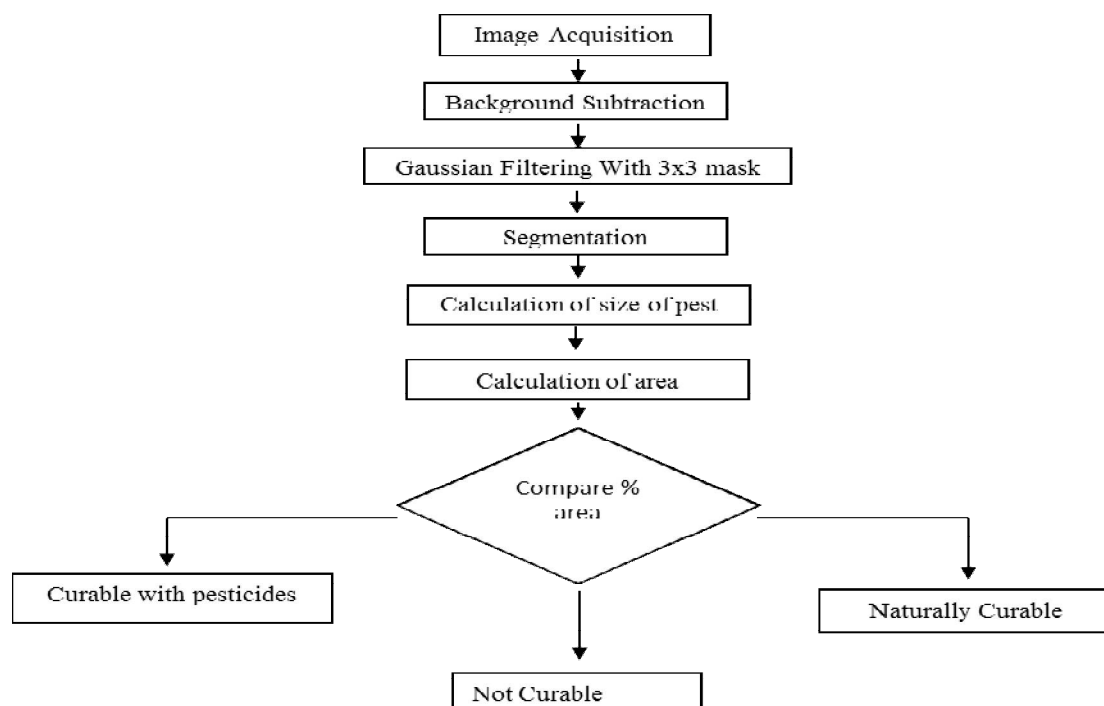
P.Revati has worked on “Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge Detection”. In this work technological strategies using mobile captured symptoms of cotton leaf spot image are discussed. In this work the Image edge detection segmentation technique is used to enrich the captured image. Then color feature image segmentation is carried out to get target portion.

Sameer Pokharkar introduces computer vision which has a wider field of application such as disease and pest control[7]. It has been applied in quantify symptoms of powdery mildew, weed control and spider mite attacks, or in develop an automated plant monitoring system.

Computer vision methods are easier to apply in our system we simply use a consumer electronics scanner to get high-resolution images of leaves. It has been applied in respectively, to quantify symptoms various pests attacks, or in to develop an automated plant monitoring system.

Santanu and Jaya described a software prototype system in paper [3] for disease detection based on the infected images of various rice plants. They used image growing, image segmentation techniques to detect infected parts of the plants. Zooming algorithm is used to extract features of the images. Self Organize Map (SOM) neural network is used for classifying diseased rise images.

### III. METHODOLOGY



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### **IMAGE PROCESSING OPERATION:**

Image Processing is a technique to enhance raw images received from cameras/sensors or pictures taken in normal day-to-day life for various applications. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software. The output of image processing may be either an image or, a set of characteristics of the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

### **IMAGE ACQUISITION:**

Images of the infected leaf are captured by digital camera, we simply use a consumer electronics scanner to get high-resolution images of leaves. This image is in RGB (Red, Green And Blue) form.

### **BACKGROUND SUBSTRACTION:**

Background subtraction is a commonly used technique for extracting and focusing out objects of interest in an image. The name subtraction comes from the simple technique of subtracting the observed image from the estimated image and thresholding the result to generate the objects of interest. In this background subtraction process an image's foreground is extracted for further processing (object recognition etc.). Generally an image's regions of interest are objects in its foreground.

### **IMAGE FILTERING:**

Filtering is a technique for modifying or enhancing an image. Filtering process is carried an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing, sharpening, and edge enhancement.

### **SEGMENTATION:**

Segmentation procedures partition an image into its constituent parts. Segmentation means partitioning of image into various parts of same features or having some similarity. Segmentation accuracy determines the eventual success or failure of computerized analysis procedures.

## **IV. RESULTS AND OBSERVATIONS**

This project is implemented using MATLAB image processing toolbox.

The proposed work has mainly follows the steps:

Image acquisition.

Background subtraction.

Filtering.

Segmentation/ Edge Detection.

Feature extraction.

The images can be captured using a regular digital camera with minimum 6 megapixels of resolution for better quality; maintaining an equal distance, equal angle and equal illumination to the object with uniform background. All the images should be saved in the same format such as JPEG, TIF, BMP, PNG etc. Here we have taken infected leave images of cotton, banana and rose plant.

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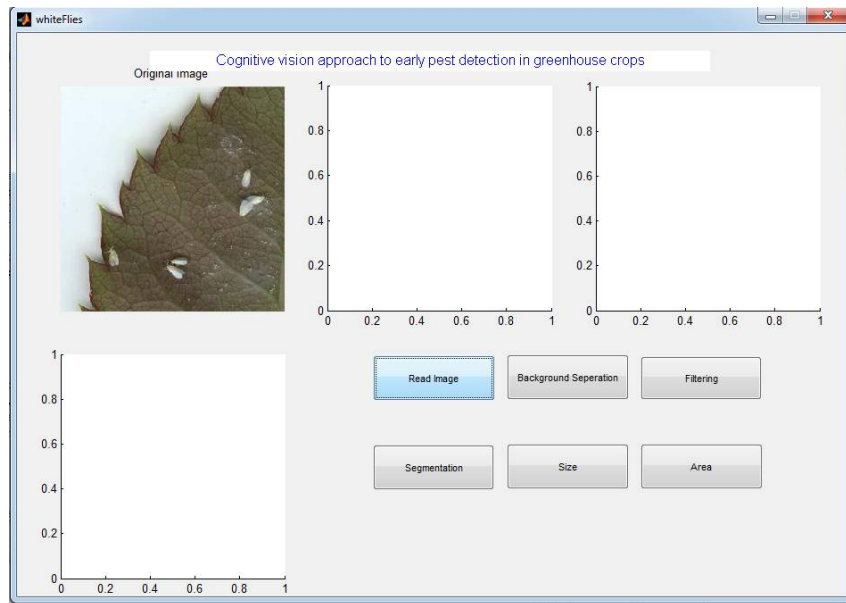


Figure: Image Acquisition of Rose Leaf with Whiteflies on GUI Window

## Background Subtraction

Background Subtraction is a type of image segmentation which goal is to separate the parts of the image that are invariant over time (background) from the objects that are moving or changing (foreground).

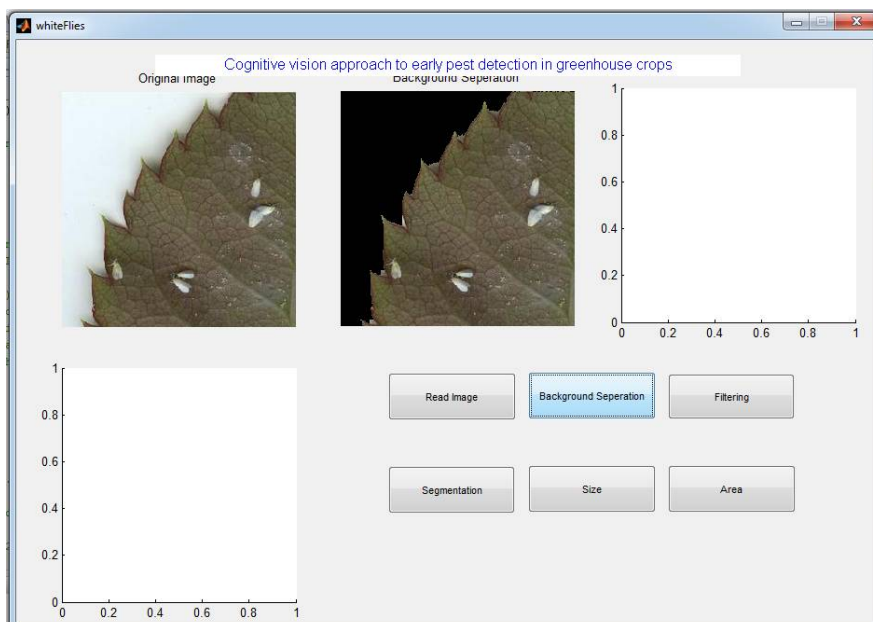


Figure: Background Subtraction of Rose Leaf with Whiteflies on GUI Window

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### Filtering

Filtering means to filter an image. An image has to be filtered for smoothing, sharpening, removing noise, edge detection. The filtering process of digital image is carried out in spatial domain. Here we used best suitable filter of Gaussian with its default mask [3 3] and sigma 0.5.

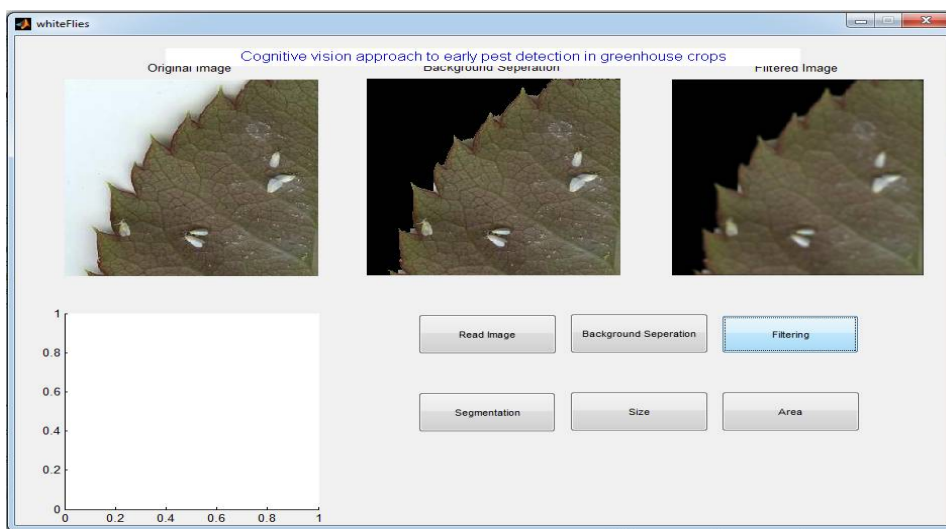


Figure: Filtering of Rose Leaf with Whiteflies on GUI Window

### Image Segmentation:

Image segmentation refers to the process of partitioning the digital image into multiple segments to change the representation of an image into something that is more meaningful and easier to analyze. There are various techniques for image segmentation such as edge detection, clustering methods, compression-based methods, histogram-based methods, region growing methods etc. Here we used edge detection method.

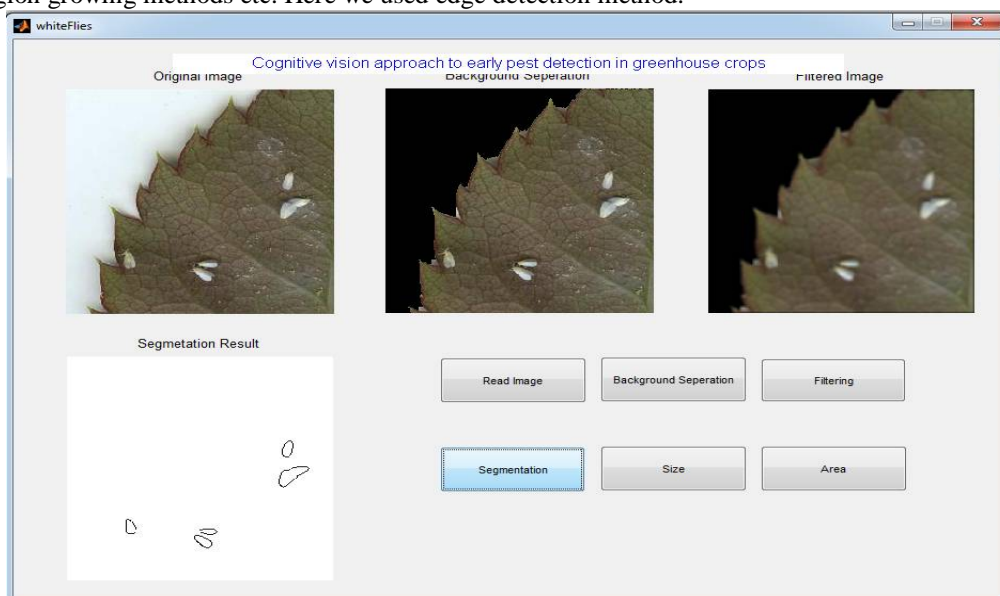


Figure: Segmentation of Rose Leaf with Whiteflies on GUI Window

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### Feature Extraction:

Features play a fundamental role in classification. In image processing, image features usually include color, shape and texture features.

**Grading:** Once the features are extracted, next step is to find to which disease class the query image belongs to and in which stage the disease is.

**High-level processing:** At this step the input is typically a small set of data, for example a set of points or an image region which is assumed to contain a specific object.

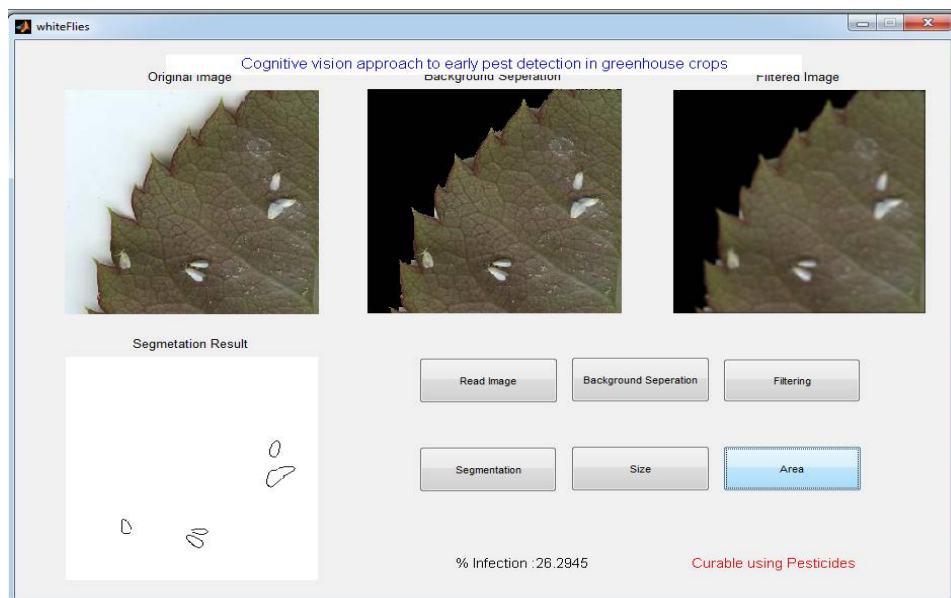


Figure: Grading of Rose Leaf with Whiteflies on GUI Window

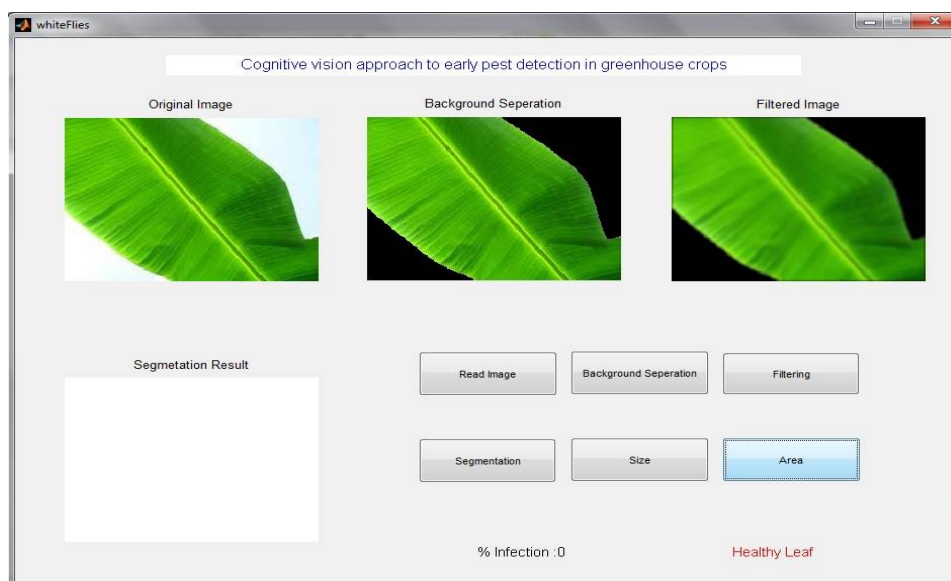


Figure: Grading of Healthy Banana Leaf on GUI Window

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The results of image processing on cotton rose and banana leaf with pest like whiteflies and black sigatoka.

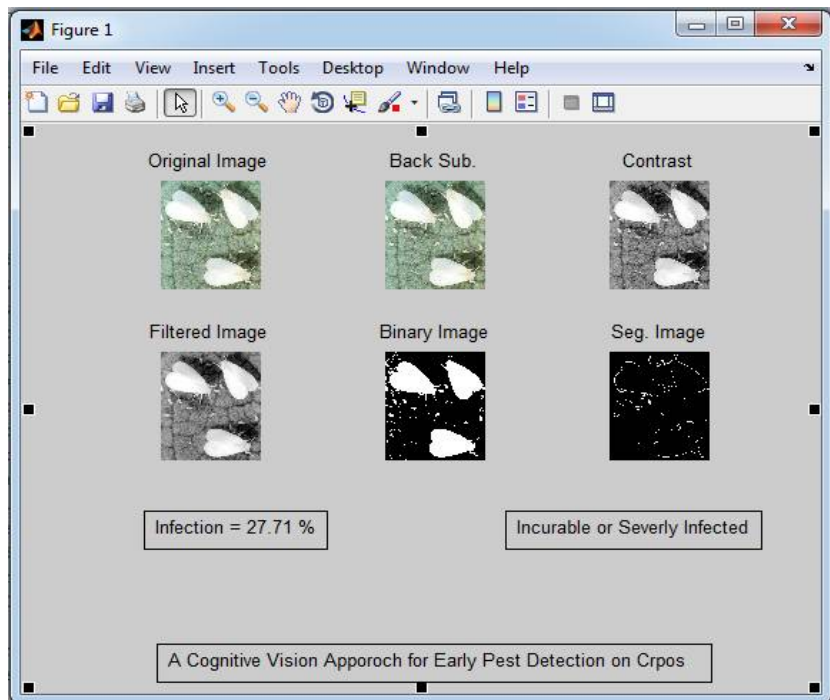


Fig.: Image Processing on Severely Infected Cotton Leaf

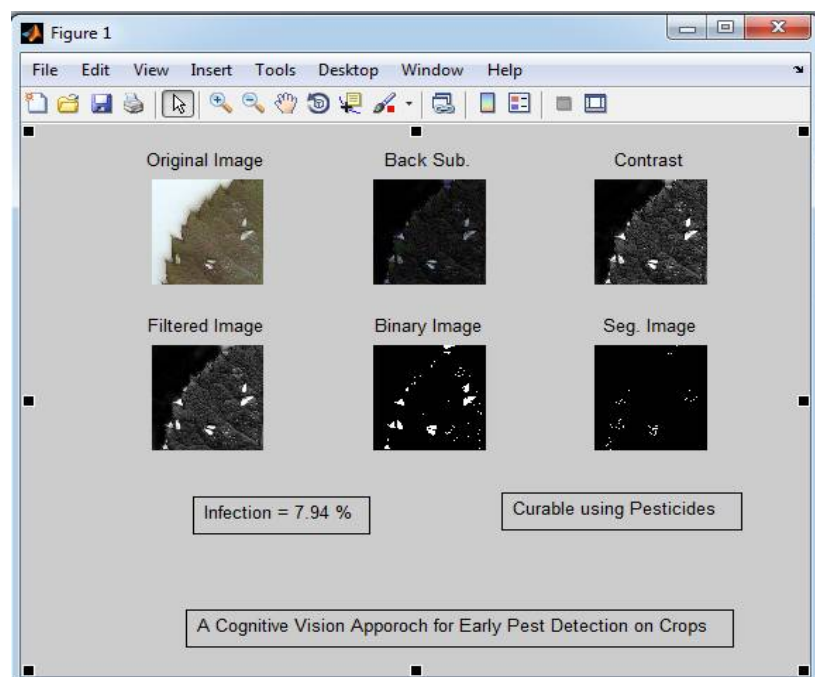


Fig.: Image Processing on Infected Rose Leaf Curable using Pesticides

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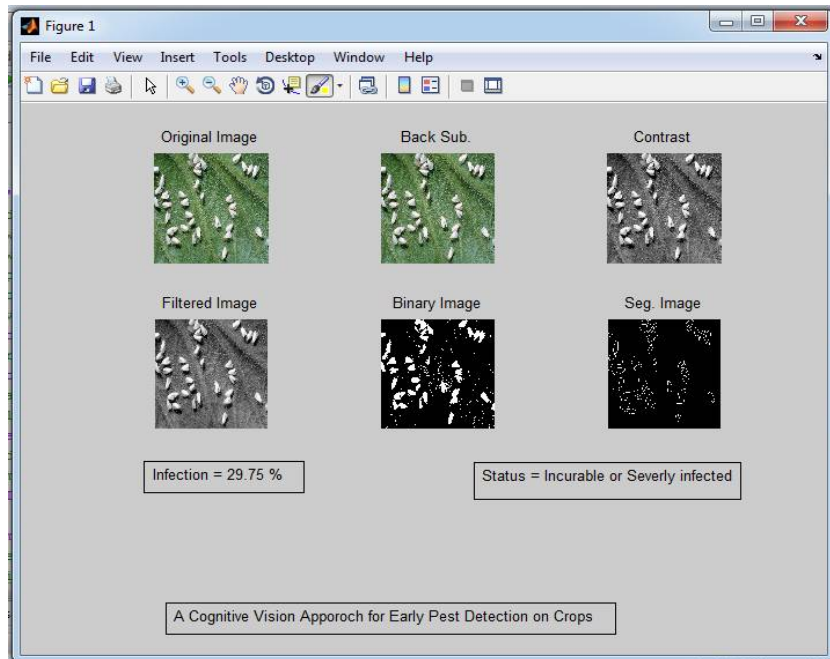


Fig.: Image Processing on Severely Infected Cotton Leaf which is Incurable.

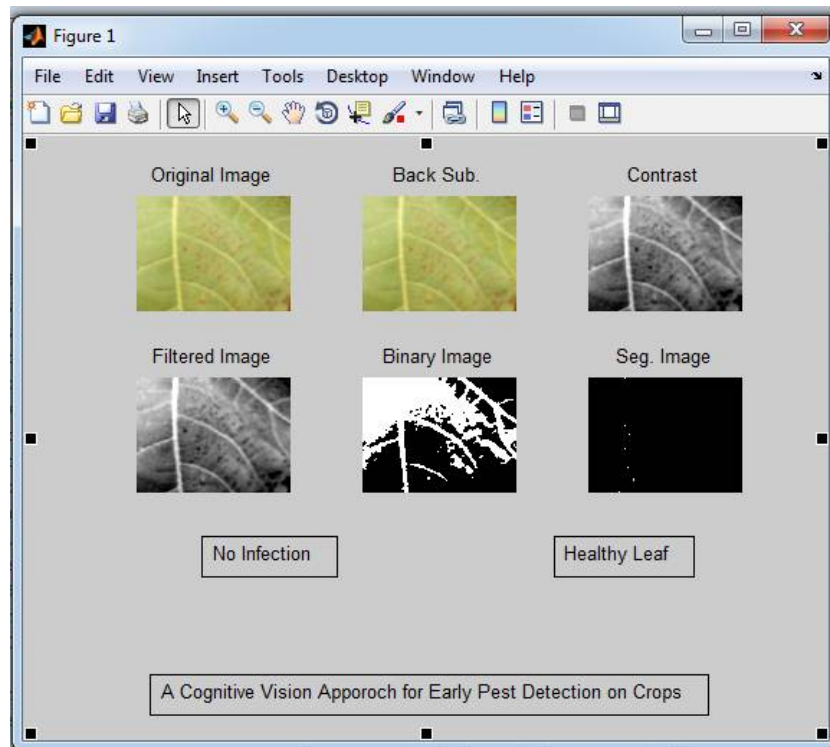


Fig.: Image Processing on Healthy Cotton Leaf



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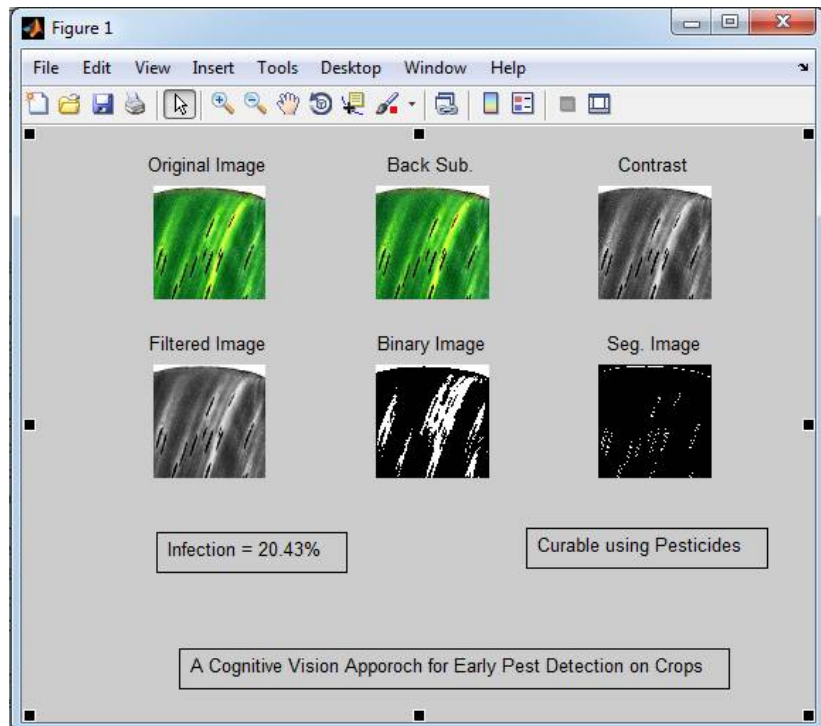


Fig.: Image Processing on Infected Banana Leaf Curable using Pesticides

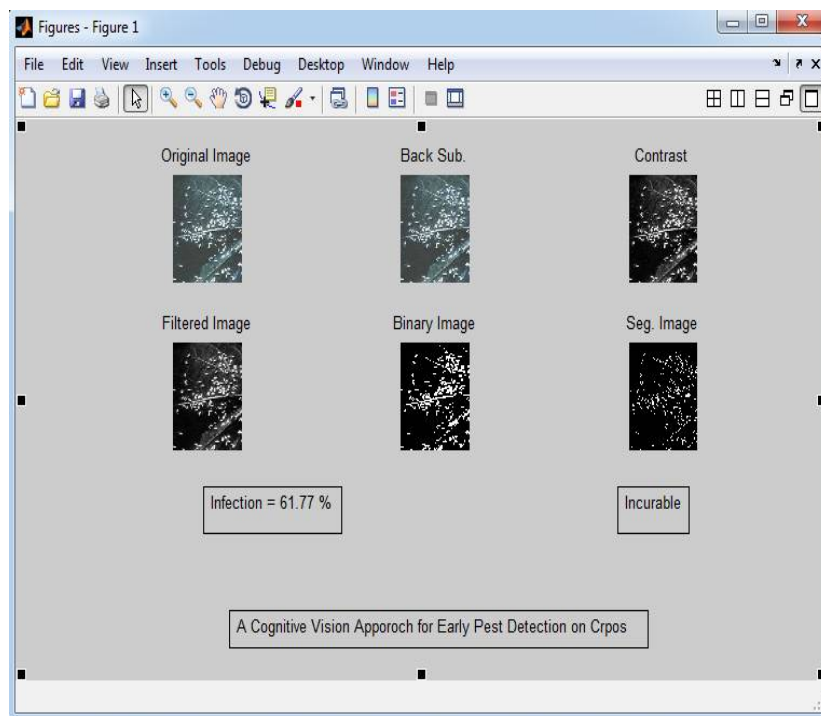


Fig.: Image Processing on Infected Incurable Leaf

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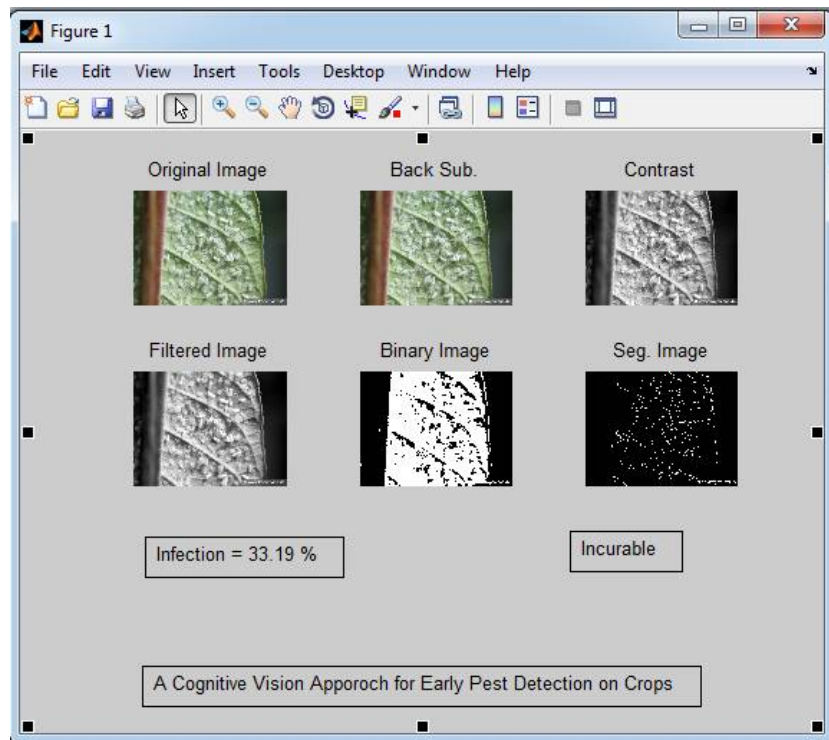


Fig.6.14: Image Processing on Whiteflies Infected Incurable Leaf

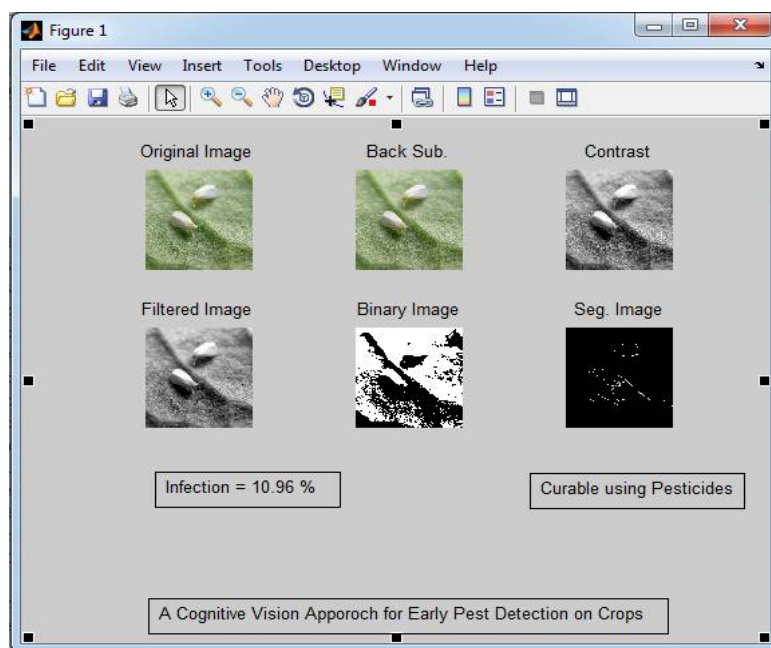


Fig.: Image Processing on Infected Cotton Leaf Curable using Pesticides

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### CALCULATION OF INFECTED AREA AND AREA OF EACH PEST

By using image analysis we can calculate the percentage of infected area. The given output is in form of pixels. So the infected area in percentage can be calculated by simple formula as follows:

$$\text{Percent infection} = (\text{Infected area} \div \text{total area}) \times 100$$

### RESULT OF WHITEFLY ON ROSE LEAF



Figure: Whitefly Infected Rose Leaf

The whitefly infected rose leaf shown in above figure and the result of it such as infected area, percentage infection, status of leaf and flies height width shown in table shown below:

Total Area of a captured rose leaf image = 73440

Infected Area of whiteflies = 7230

Percent infection= (Infected area ÷ total area) × 100

% Infection on Leaf = (7230/73440) × 100 = 9.84 %

Status of Leaf: **Curable with Pesticides**

Table: Results of whitefly on Rose Leaf

No. of pests		1	2	3	4	5	6	7	8	9	10	11
Size	Width	31	27	12	15	27	20	19	24	29	24	10
	Height	26	43	25	42	41	15	6	45	23	11	21
Area of infection of each pest		79	70	57	48	56	50	41	46	45	85	46

### RESULT OF BLACK SIGATOKA ON BANANA LEAF



Figure: Black Sigatoka Infected Banana Leaf

The black sigatoka infected banana leaf shown in above figure and the result of it such as infected area, percentage infection, status of leaf and flies height width shown in table given below:

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Total Area of a captured BANANA image = 73439  
 Infected Area of black-sigatoka = 15010  
 Percent infection= (Infected area ÷ total area) × 100  
 % Infection on Leaf = (15010/73439) × 100= 20.44 %  
 Status of Leaf: **Curable with Pestsides**

Table: Results for Banana Leaf (Black Sigatoka)

No. of pests		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Size	Width	267	17	16	16	14	19	19	12	21	15	22	17	15	7	6	18	5
	Height	25	52	52	55	35	59	52	32	58	34	50	53	44	24	19	34	5
Area of each pest		268	54	53	108	73	119	105	65	114	70	101	54	45	25	20	68	12

### RESULT OF WHITEFLY ON COTTON LEAF



Figure: Whitefly Infected Cotton Leaf

The whitefly infected cotton leaf shown in above figure and the result of it such as infected area, percentage infection, status of leaf and flies height width shown in table below:

Total Area of a captured cotton image = 73440  
 Infected Area of whiteflies = 21850  
 Percent infection= (Infected area ÷ total area) × 100  
 % Infection on Leaf = (21850/73440) × 100 = 29.75 %  
 Status of Leaf: **Incurable/ Severly Infected**

Table: Results of whitefly on Cotton Leaf

No. of Pest		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Size	Width	9	22	10	15	26	27	22	4	29	23	18	19	21	20	48	16	23	25
	Height	12	49	25	18	21	34	16	26	50	30	19	18	23	16	34	27	23	27
Area of each Pest		23	112	26	23	62	80	52	27	115	89	56	53	69	49	109	22	64	56

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<b>No. of Pest</b>	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
<b>Size</b>	<b>Width</b>	8	20	13	16	8	13	14	24	18	19	16	19	27	1	10	29	17	1
	<b>Height</b>	28	32	32	39	34	30	33	36	18	17	22	29	29	7	9	37	25	5
<b>Area of each Pest</b>	58	80	59	88	55	72	74	94	59	57	56	74	94	8	12	97	55	6	

## IV. CONCLUSIONS

Moreover, cognitive vision detects whiteflies three times faster and it covers three times more leaf surface. The context of this work is to automate operations in greenhouses and agriculture field as well. Our goal is rather to better spot the starting points of bio-aggressors attacks and to count these latter so that necessary action can be taken. In this dissertation range of infection has been decided by considering cotton crop into a mind. From these observations finally we can say that this proposed technique is very good for infection or pest detection on agricultural crops as well as for green house crops.

## V. FUTURE SCOPE OF PRESENT WORK

The results presented in this thesis are promising but several improvements in both material and methods can be carried out to reach the requirements of an Integrated Pest Management system. In future the feature extraction of image will be carried out. From this results type, shape, color, texture of pest will be detected. From all this measures what preventive action against pest should be taken will be decided through which the production of crops can be increased.

## REFERENCES

- 1] P. Sanyal, U. Bhattacharya and S.K. Bandyopadhyay, "Color Texture Analysis of Rice Leaves Diagnosing Deficiency in the Balance of Mineral Levels Towards Improvement of Crop Productivity," 2007 *IEEE 10th International Conference on Information Technology*, pp. 85-90, 2007 Z. Qin.
- 2] B.Cunha. "Application of Image Processing in Characterisation of Plants". *IEEE Conference on Industrial Electronics*.2003.
- 3] Santanu Phadikar, Jaya Sil., "Rice Disease Identification Using Pattern Recognition Techniques." *IEEE 10th International Conference On I.T.E.2007*.
- 4] Rafael C. Gonzalez, Richard E. Woods. "Digital Image Processing", 2<sup>nd</sup> edition, Pearson education (Singapore) pte.ltd.2003.
- 5] T.F.Burks, S.A.Shearer and F.A. Payne, "Classification of weed species using color texture features and discriminant analysis," *Trans. ASAE*, vol.43, , pp.441-448, 2000.
- 6] R.Pydidpati, T.F. Burks and W.S. Lee, "Identification of citrus disease using color texture features and discriminant analysis," *Comput. Electron. Agric.*, vol.52, no.1, pp.49-59, June 2006.
- 7] S. R. Pokharkar, Dr. Mrs. V. R. Thool, "Early Pest Identification in Greenhouse Crops using Image Processing Techniques", *International Journal of Computer Science and Network (IJCSN)*, Volume 1, Issue 3, June 2012, ISSN 2277-5420.
- 8] T. Kobayashi, E. kanda, K. Kitada, K. Ishigurd and Y. "Detection Of Rice Panicle Blast with Multispectral Radiometer and The Potential Use of Multispectral Scanner.' *Torigoe-2000*
- 9] Laaksonen, J.Koskela, M.Oja, E., "Self-organizing maps for content-based image retrieval," *International Joint Conference on Neural Networks*, vol.4, pp.2470-2473, 1999.
- 10] R.M. Haralick, K. Shanmugam and I. Dinstein, "Textual features for image classification," *IEEE Trans. Syst. Man Cybern.*, vol.3, no.6, pp. 610-621, Nov. 1973
- 11] Paul Boissard, Vincent Martin, Sabine Moisan, "A cognitive vision approach to early pest detection in greenhouse crops" *ELSEVIER Computers and Electronics in Agriculture* 62 (2008) 81-93.
- 12] H.Ritter and T. Kohonen. "Self-organizing semantic maps", *Biological Cybernetics*, vol.61, pp.241-254, 1989.
- 13] Martin V., Thonnat M., "A Learning Approach for Adaptive Image Segmentation." in *Proceedings of the Fourth IEEE International Conference on Computer Vision Systems (ICVS 2006)*.
- 14] Vincent Martin, Sabine Moisan, Bruno Paris, Olivier Nicolas," Towards a Video Camera Network for Early Pest Detection in Greenhouses" in *Proceedings of the IEEE International Conference on Computer and Agriculture, 2008*.

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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- 15] V. Martin and M. Thonnat. Learning contextual variations for video segmentation. In *Proc. of the IEEE ICVS'08*, volume 5008, pages 464–473. Springer, May 2008.
- 16] Meenakshi M. Pawar, Sanman Bhusari, Akshay Gundewar, “Identification of Infected Pomegranates using Color Texture Feature Analysis” *International Journal of Computer Applications (0975 – 8887) Volume 43– No.22, April 2012.*
- 17] Tushar H Jaware, Ravindra D Badgujar and Prashant G Patil,” Crop disease detection using image segmentation”. *World Journal of Science and Technology 2012*, 2(4):190-194
- 18] Sabah Bashir, Navdeep Sharma, “Remote Area Plant Disease Detection Using Image Processing”. *IOSR Journal of Electronics and Communication Engineering (IOSRJECE) ISSN : 2278-2834 Volume 2, Issue 6 (Sep-Oct 2012), PP 31-34.*
- 19] Ikhlef Bechar and Sabine Moisan, “On-line counting of pests in a greenhouse using computer vision”. *Author manuscript, published in "VAIB 2010 - Visual Observation and Analysis of Animal and Insect Behavior (2010)"*
- 20] Anand.H.Kulkarni, Ashwin Patil R. K, “Applying image processing technique to detect plant diseases”. *International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.5, Sep-Oct. 2012 pp-3661-3664*
- 21] S. R. Nandurkar, V. R. Thool, “Design of a Soil Moisture Sensing Unit for Smart Irrigation Application”.
- 22] Jayamala K. Patil , Raj Kumar, “Advances In Image Processing For Detection of Plant Diseases”. *Journal of Advanced Bioinformatics Applications and Research ISSN 0976-2604 Vol 2, Issue 2, June-2011, pp 135-141.*