iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VIII **Month of publication:** August 2020

DOI: https://doi.org/10.22214/ijraset.2020.31187

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VIII Aug 2020- Available at www.ijraset.com

Identification of Occurrence and Infestation of Pests in Crops

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Abstract: Pest detection using image processing methods is very effective to protect the crops against the insect infestation which otherwise would be detrimental to the crops. Pest detection and management is extremely necessary, notably from farmer's purpose of read. Pests like aphids and cutworms can affect the crops overnight, and destroy an enormous area of crops. Pest detection is extremely useful in saving the crops along with its yield. This paper aims at taking the observations before the crop is affected and crop images as soon as the crop is laid low with pests so that the farmers can be alerted. Also, when pests are affected in one space, the farmers of the encircling areas can take precautionary measures, in order to save their crop from pest attack. This research uses the Image cascading algorithm to spot the pest in the affected crops. This paper conjointly emphasizes on Rule based engine algorithm to discover whether there are any chances of the pest attacking the crop, based on symptoms.
Keywords: Pests, Crops, Image Cascading algorithm, Rule Based engine algorithm, Image processing.

I. INTRODUCTION

Detection of pests in the paddy fields is a major challenge in the field of agriculture; therefore effective measures should be developed to fight the infestation while minimizing the use of pesticides. The techniques of image analysis are extensively applied to agricultural science, and it provides maximum protection to crops, which can ultimately lead to better crop management and production. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.

This paper helps in detecting the pests either based on symptoms or image input. The project is very useful to the farmers, as they need not go for the daily visits to their fields for the identification of the disease. It is also useful in the sense that Farmers can take precautionary measures when their surrounding fields are affected. This paper delineates the Image cascading algorithm to find the pests in affected crops and as an advisory step, based on few symptoms, detects whether the crop may be affected with a particular pest.

II. LITERATURE SURVEY

A. *Types of pests and insects*

Following are different types of pests.

1) *Beneficial Insects:* Beneficial insects are useful for the garden as they carry out pollination and pest control . Cultivators acknowledge both the assistance of beneficial insects and the damage caused by the harmful insects which are known as pests. In the words of C.B Huffaker "When we kill off the natural enemies of a pest, we inherit their work." Following are some of the beneficial insects: Beneficial Nematode, Bumblebee, Praying Mantis, Thrips Predator & Whitefly Parasite.
2) *Garden Pests:* Garden pets infest outdoor gardens and are usually found chewing on plant leaves. Few gardens remain healthy and produce a beautiful harvest even though they are infested with insects. The damage caused due to these pests may be insignificant. Gardens should be inspected at the earliest to detect problem. The best way to maintain a healthy garden is to recognize the common bad bugs and control their spread by using earth friendly techniques. Following are some of the Garden Pests: Cabbage Looper, Corn Earworm, Cucumber Beetle, Grasshopper, Leafhopper, Slug & Snail, Potato Beetle, Root Maggot and Tomato Hornworm,
3) *Household Pests:* Household pests are the common insects that infiltrate the house. They may transmit disease causing pathogens, sting, bite, damage furniture and cause inconvenience. These pets may be controlled by using bug sprays, chemical pesticides , limiting the reproductive and survival capacity by minimizing unhygienic conditions .Following are some of the Household Pests: Termites, bed bugs , Box elder Bugs, spiders , ants , cockroaches , Pantry Moths and dust mites

4) *Houseplant Pests:* Houseplant pests attack the indoor plants. These insects multiply rapidly as they have the advantage of developing and reproducing in optimum conditions. They are uncontrollable and may cause serious damage to the plants causing them to look ill. Therefore it is important to identify and control the indoor plant pests as soon as possible. Following are some of the Houseplant Pests: Fungus Gnat, Leaf miner, Mealy bug, Springtail, Thrips & Whitefly
5) *Landscape/ Lawn Pests:* Insect life can be found in healthy lawns and landscapes. Nevertheless very few organisms seen in the backyard damage the plantation. It is estimated that less than 1% of all insect species are pests. The most effective measure for pest control is the implementation of the least toxic methods such as barriers & repellents, beneficial insects, biological pesticides, soaps and oils. It is not advised to spray harmful chemicals when the lawn pests are detected as the broad spectrum insecticides kill both the beneficial insects and harmful pests. Following are some of the Landscape/ Lawn Pests: Beetle, Box elder Bug, Carpenter Ant, Aphid, Springtail, Tent Caterpillar, Thrips, Tick.
6) *Orchard & Tree Pests:* Tree pests can be found seasonally during growing seasons or annually but cause minimal damage. Orchards and ornamental shrubs encounter diverse species. Productive trees can be maintained by regular backyard surveys and pest detection at an early stage. Following are some of the Orchard & Tree Pests: Apple Maggot, Codling Moth, Gypsy Moth, Peachtree Borer, Pecan Weevil, Psyllidae, Sawfly, Scale Insect, Spruce Budworm & Tent Caterpillar

III. EXISTING SYSTEM

The existing system for the pest detection using image classification is identification of pest using various detection methods. It mainly focuses on pest identification based on pest acoustic signal, pest detection and classification using crop images. The acoustic signal of pest and images are pre-processed to remove the noise content and the enhancement techniques are applied. The application of water to the soil for growing crops is termed as irrigation. Water management to crops is the act of temporal order and regulation of irrigation water applications to meet the water demand of the crop. It is based on the IOT technology.

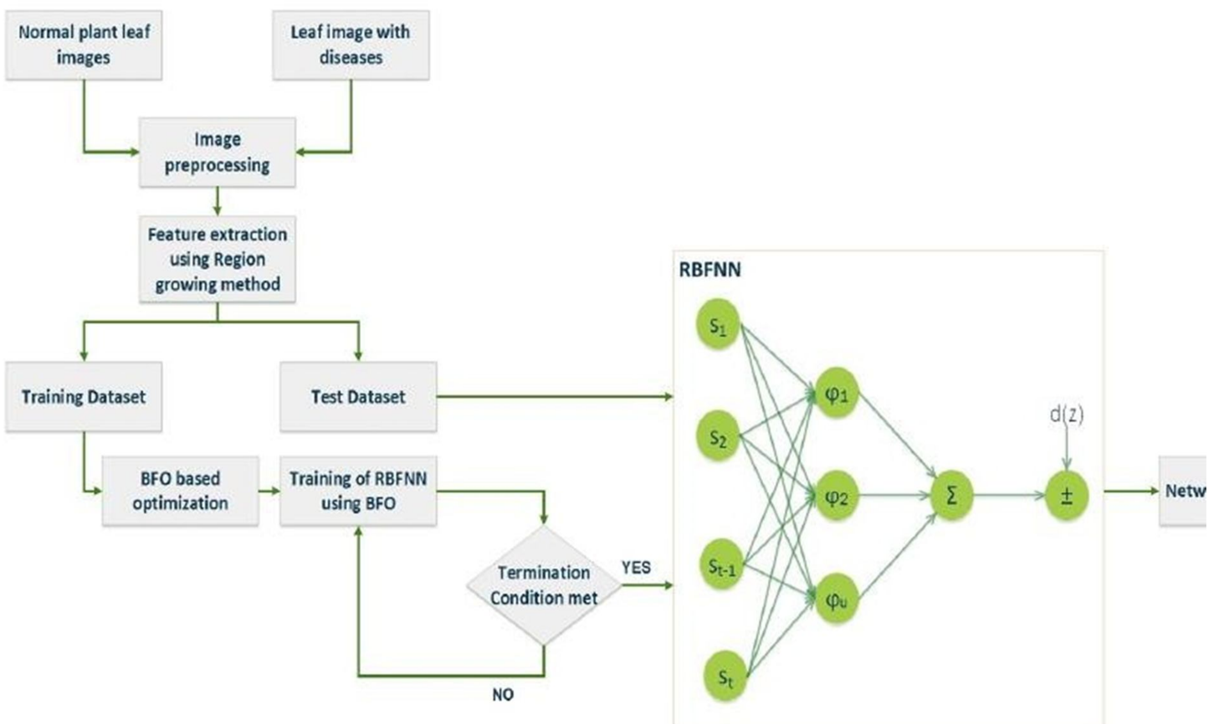

Fig.1 Leaf disease identification and classification using RBFNN

Radial Basis Function Neural Network (BRBFNN). The feature extraction method is done out by seeding associated grouping the points having similarity in some manner utilization region growing approach the training of the RBFNN is performed by bacterial foraging optimization that proves to be an economical and powerful tool for initializing the weight of RBFNN and training the network which will properly determine completely 5 different affected regions on plant leaf image. With the assistance of BFO, the proposed system achieves higher convergence ratio and accuracy.

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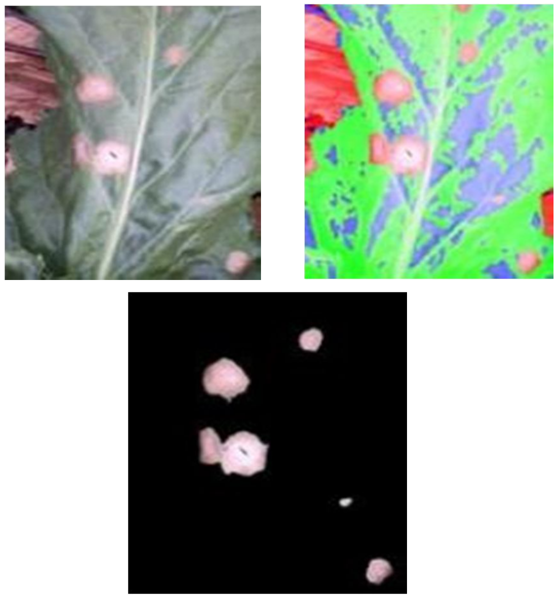

Fig.2 Pest affected leaves

It takes the input as the images and produces the filtering of noise and improvement of quality of the signal and image are mandatory in segmentation process. The segmentation task is used to detect the pest on the plant. The feature extraction is used to calculate the features to apply the neural network. The neural network is applied to classify the pest based on the signal and image

IV. PROPOSED SYSTEM

Pest detection and identification of occurrence of pest beforehand helps to protect the crop and improve its yield. Here a different approach is articulated i.e. Rule Based engine algorithm for finding if pest may affect the field and Image cascading algorithm to detect the pest in the plantations.

A. Architecture

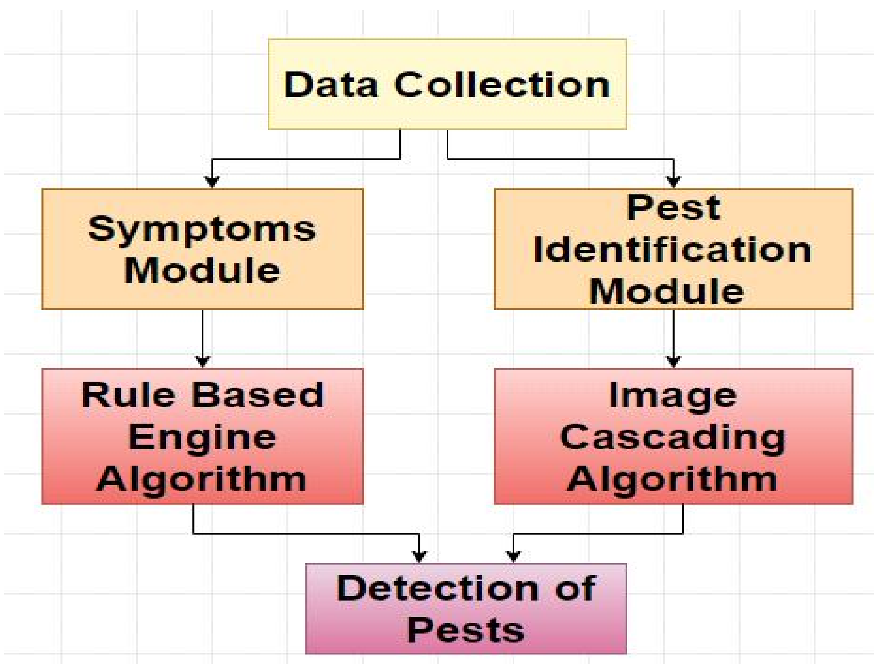

Fig.3 Architecture of proposed model

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B. Symptoms Module

1) *Data Collection:* In the symptoms module, we take into consideration some symptoms which are observed in the field such as:
   a) Rapid weather changes occurring frequently
   b) Temperature much below the avg. season temperature
   c) Humidity much below the avg. season humidity
   d) No free flowing of fresh air in the weather
   e) Oxygen levels in weather are much lower
   f) Fishes in the ponds are coming to the top of ponds
   g) Continuous clouds in the sky without any rain
   h) Continuous clouds in the sky with little drizzle
   i) Continuous fog without sunshine
   j) Pests already affected surrounding areas

2) *Symptoms Module*: For these symptoms we run the Rule Based Engine algorithm to find out whether a pest may attack the crop.
3) *Algorithm:* Rule-Based Prediction Algorithm: In a rule-based system, the inference engine usually goes through a simple recognize-assert cycle. The control scheme is called forward chaining for data-driven reasoning, and backward chaining for goal-driven reasoning. The basic idea of forward chaining is when the premises of a rule (the if portion) are satisfied by the data, the expert system asserts the conclusions of the rule (the then portion) as true. A forward-chaining reasoning system starts by placing initial data in its working memory. Then the system goes through a cycle of matching the premises of rules with the facts in the working memory, selecting one rule, and placing its conclusion in the working memory. This inference process is useful in searching for a goal or an interpretation, given a set of data. In a backward-chaining reasoning system the goal is initially placed in the working memory. The system matches rule conclusions with the goal, selects one rule, and places its premises in the working memory. The process iterates, with these premises becoming new goals to match against rule conclusions.

C. Pest Identification Module

1) *Data collection:* This module is used for taking the image from field and uploads the crop image to the system.
2) *Pest Identification Module*
   a) After accepting the image, the algorithm runs and shows the result to the user.
   b) It opens the image which shows where the pest is affected in the image
   c) The types of pests that affects are white pests and black pests
   d) This module will result in the pest identification.
   e) The entire crop is taken as the picture so that farmer can know where the crop is affected by pests.
   f) It will identify what type of pest has been affected.
   g) It opens the image and shows the pest effected area with marking a red box.

3) *Algorithm:* Image Cascading Algorithm: Image cascading is a technique for finding areas of an image that are similar to a patch (template). A patch is a small image with certain features. The goal of template matching is to find patch or template in an image. To find it, the user has to give two input images: Source Image (S) – The image to find the template in and Template Image (T) – The image that is to be found in the source image.
   a) It is basically a method for searching and finding the location of a template image in a larger image.
   b) The idea here is to find identical regions of an image that match a template we provide, giving a threshold.
   c) The threshold depends on the accuracy with which the designer wants to detect the template in the source image.
   d) For instance, after applying face recognition and if user wants to detect the eyes of a person, he/she can provide a random image of an eye as the template and search the source (the face of a person).
   e) In this case, since "eyes" show a large amount of variations from person to person, even if the threshold is set as 50%(0.5), the eye will be detected.
   f) In cases where almost identical templates are to be searched, the threshold should be set high.(t>=0.8)

4) *How Template Matching Works?*
   a) The template image simply slides over the input image (as in 2D convolution)

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b) The template and patch of input image under the template image are compared.
c) The result obtained is compared with the threshold.
d) If the result is greater than threshold, the portion will be marked as detected.

To avoid the issue caused by the different sizes of the template and original image the multi-scaling technique is used. In case where, just because the dimensions of the given template do not match the dimensions of the region in the image the user want to match, does not mean that you cannot apply template matching.

5) Multi-scaling mechanism in Template Matching

The process of Multi scaling is as follows:

a) Loop over the input image at multiple scales (i.e. make the input image progressively smaller and smaller).
b) Apply template matching and keep track of the match with the largest correlation coefficient (along with the x, y-coordinates of the region with the largest correlation coefficient).
c) After looping over all scales, take the region with the largest correlation coefficient and use that as the "matched" region.

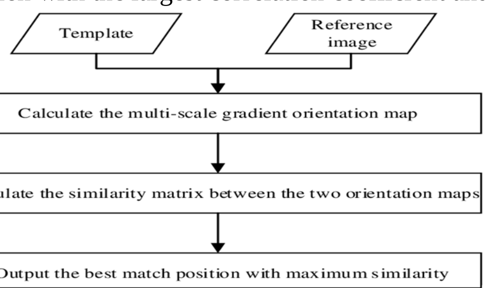

Fig.4 Template matching algorithm flowchart

6) Step by Step Explanation

a) After storing the width and height of template in w and r, initialize a variable found to keep track of the region and scale of the image with the best match. From there start looping over the multiple scales of the image. This function accepts three arguments, the starting value, the ending value, and the number of equal chunk slices in between. In this example, the user start from 100% of the original size of the image and work the way down to 20% of the original size in 20 equally sized percent chunks.
b) Then resize the image according to the current scale and compute the ratio of the old width to the new width, it's important that one should keep track of this ratio. Then make a check to ensure that the input image is larger than the template matching.
c) At this point one can apply template matching to the resized image: The template matching function takes correlation result and returns a 4-tuple which includes the minimum correlation value, the maximum correlation value, the (x, y)-coordinate of the minimum value, and the (x, y)-coordinate of the maximum value, respectively. The designers are only interested in the maximum value and (x, y)-coordinate so they keep the maximums and discard the minimums.
d) After that, inspect the regions of the image that are getting matched at each iteration of the scale. From there, update the found variable found to keep track of the maximum correlation value found thus far, the (x, y)-coordinate of the maximum value, along with the ratio of the original image width to the current, resized image width.
e) After that loop over all scales of the image, and unpack the found variable and then compute the starting and ending (x, y)-coordinates of the bounding box. Special care is taken to multiply the coordinates of the bounding box by the ratio to ensure that the coordinates match the original dimensions of the input image.
f) Finally, draw the bounding box and display it.

Parameters:

- image – Image where the search is running. It must be 8-bit or 32-bit floating-point.
- templ – Searched template. It must be not greater than the source image and have the same data type.
- result – Map of comparison results. It must be single-channel 32-bit floating-point. If image is $W \times H$ and templ is $w \times h$, then result is $(W - w + 1) \times (H - h + 1)$.

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The function slides through image, compares the overlapped patches of size $w \times h$ against templ using the specified method and stores the comparison results in result . Here are the formulae for the available comparison methods (I denotes image, T template, R result). The summation is done over template and/or the image patch:
$x' = 0...w-1, y' = 0...h-1$

1.

$$R(x,y) = \sum_{x',y'} (T(x',y') - I(x+x',y+y'))^2$$

2.

$$R(x,y) = \frac{\sum_{x',y'} (T(x',y') - I(x+x',y+y'))^2}{\sqrt{\sum_{x',y'} T(x',y')^2 \cdot \sum_{x',y'} I(x+x',y+y')^2}}$$

3.

$$R(x,y) = \sum_{x',y'} (T(x',y') \cdot I(x+x',y+y'))$$

4.

$$R(x,y) = \frac{\sum_{x',y'} (T(x',y') \cdot I(x+x',y+y'))}{\sqrt{\sum_{x',y'} T(x',y')^2 \cdot \sum_{x',y'} I(x+x',y+y')^2}}$$

5.

$$R(x,y) = \sum_{x',y'} (T'(x',y') \cdot I'(x+x',y+y'))$$

Where,

$$T'(x',y') = T(x',y') - 1/(w \cdot h) \cdot \sum_{x'',y''} T(x'',y'')$$
$$I'(x+x',y+y') = I(x+x',y+y') - 1/(w \cdot h) \cdot \sum_{x'',y''} I(x+x'',y+y'')$$

6.

$$R(x,y) = \frac{\sum_{x',y'} (T'(x',y') \cdot I'(x+x',y+y'))}{\sqrt{\sum_{x',y'} T'(x',y')^2 \cdot \sum_{x',y'} I'(x+x',y+y')^2}}$$

After the function finishes the comparison, the best matches can be found as global minimums or maximums was used using a function. In case of a color image, template summation in the numerator and each sum in the denominator is done over all of the channels and separate mean values are used for each channel. That is, the function can take a color template and a color image. The result will still be a single-channel image, which is easier to analyze.

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V. RESULTS

A. Symptoms Module

The following symptoms are considered and the Rule Based Engine algorithm is run which gives the following result:

	Y/N
Rapid weather changes occuring Frequently?	Y
Temparature much below than avg.season temp?	N
Hunidity much below than avg.season humidity?	N
No Free Flowing of fresh air in the weather?	Y
Oxygen levels in weather are much lower?	N
Fishes in the ponds are coming to the top of ponds?	Y
Continuous clouds in sky without any rain?	Y
Continuos clouds with little drizzles?	N
Continuous fog without sun shine?	N
Pests already affected surrouding areas?	Y

Fig.5 Symptoms for finding if a crop may be affected by pests or not

1) If less than 20% of the conditions are true, then no chance of pest attack
2) If more than 20% and less than 60% of the conditions are true, then low chance of pest attack
3) If more than 60% of the conditions are true, it shows that the crop is very likely to be affected by pests

B. Pest Identification Module

The image below shows the pest in a crop marked in a red box. Here, white pest and black pest have been detected in the field. This image is just a representation of the result. Even a small patch of the pest affected area can be detected from the image using image cascading algorithm.

Fig.6 White pest and Black pest affected crop

VI. CONCLUSION

This paper entitled **"**Identification of Occurrence and infestation of Pests in crops**"** has presented an approach to identify the pest affected areas. The primary focus of the paper is to recognize the pests in the fields with the help of image processing methods and regular monitoring strategies. This method is extremely beneficial to the farmers as it assists them in identifying the disease by checking the entire field. It alerts them as soon as the fields are attacked by pests and thereby prevents further damage to the crops. Healthy fields can be maintained by early identification and control of the infestation as the pests can rapidly affect the fields overnight and lead to the destruction of a large area of crop. Frequent examination of the field is the best way to know about the health of the crop. After the detection of pests, farmers can implement pest control measures to safeguard their fields. Farmers can cut down on the use of chemical pesticides and insecticides using the help of this project. This project ultimately, helps increase both the quality and the quantity of the crop yield and thereby the income of the cultivators. This system is highly efficient and user-friendly. Furthermore, it is boosts the economic development of the country as agriculture is the backbone of the economy.

A. Future Scope

The main objective of the pest detection project is to regularly monitor the crops using satellite images and notify the farmers promptly when the field is infiltrated by dangerous pests. This project can be augmented further by effectuating a farmer alerting system through sending notifications to the mobile phones of the farmers using area codes of the neighbouring fields. It can provide the advance alert report before the infestation as well as after the infestation in the field. The results of the detection will be displayed in the text form in real time. The farmers need not survey the field themselves and can rely on this project for a more accurate surveillance. This project will prove to be convenient for such farmers who can't visit their fields everyday due to their engagement in other activities. Additionally, the image processing techniques can be implemented in the identification of other diseases as well.

VII. ACKNOWLEDGMENT

I would like to express my sincere thanks to my college GNITS, for providing the working facilities in the college. I am extremely thankful and indebted to HOD, faculty, Dept. of CSE, GNITS for all the timely support, valuable suggestions and encouragement throughout the research. Constant guidance and continuous advice has given me a lot of motivation in completing the work. Finally, I would also like to thank all individuals who helped me directly or indirectly, parents and friends for their cooperation in completing the research work.

REFERENCES

[1] Poornima and Dr. G. Arulselvi , Identification of Pest Using Various Detection and Classification Methods for Smart Agriculture, International Conference INTELINC 18, 12th & 13th October 2018,pp.380-386, http://www.ijrat.org/downloads/Conference_Proceedings/INTELINC- 18/AUECE_434.pdf

[2] Faith praise Fina1,Philip Birch2,Rupert Young3, J. Obu4,Bassey Faith praise5 and Chris Chatwin6, Automatic plant pest detection and recognition using k-means clustering algorithm and correspondence filters, International Journal of Advanced Biotechnology and Research, Vol 4, Issue 2, 2013 https://www.researchgate.net/publication/255483247_Automatic_plant_pest_detectio n_recognition_using_k-means_clustering_algorithm_correspondence_filters

[3] Johnny L. Miranda, Bobby D. Gerardo and Bartolome T. Tanguilig III, Pest Identification using Image Processing Techniques in Detecting Image Pattern through Neural Network, International Journal of Advances in Image Processing Techniques– IJIPT,Vol 1,Issue 4, 27 December, 2014, https://pdfs.semanticscholar.org/0f4b/3dfaf27788c06c3c6297a5c6c293799fb081.pdf

[4] Monika Wadhai ,Dr. V.V. Gohokar and Dr.ArtiKhaparde, Agriculture Pest Detection Using Video Processing Technique International Conference on Information Processing (ICIP) , pp.544-547,Issue 16-17,dec,2015 https://ieeexplore.ieee.org/document/7489444/references#references

[5] Muhammad Danish Gondal and Yasir Niaz Khan, Early Pest Detection from Crop using Image Processing and Computational Intelligence, FAST-NU Research Journal (FRJ), Volume 1, Issue 1, January 2015, pp.59-68 https://www.researchgate.net/publication/282119578_Early_Pest_Detection_from_Crop_using_Image_Processing_and_Computational_Intelligence

[6] Preetha Rajan, Radhakrishnan. B and Dr.L.Padma Suresh, Detection And Classification Of Pests From Crop Images Using Support Vector Machine, International Conference on Emerging Technological Trends [ICETT], Issue2016, https://ieeexplore.ieee.org/document/7873750

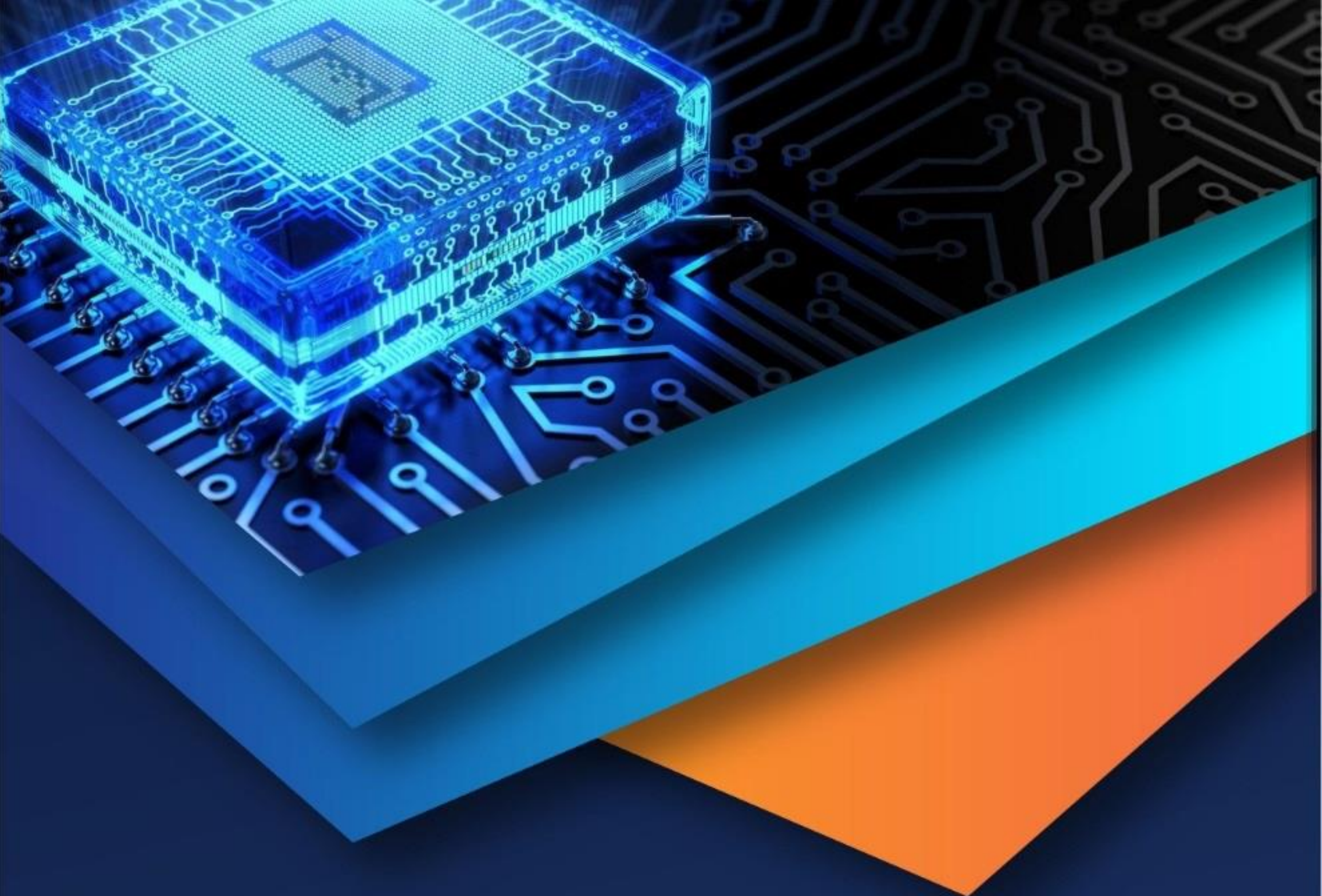
[7] Rupesh G. Mundada and Dr. V. V. Gohokar, "Detection and Classification of Pestsin Greenhouse Using Image Processing", IOSR Journal of Electronics and Communication Engineering, Vol 5, Issue 6 (Mar- Apr) 2013, pp 57-63, https://pdfs.semanticscholar.org/909d/14a22ff1e470afad891f69e0bc310b0513b0.pdf

[8] Sabah Bashir and Navdeep Sharma, "Remote Area Plant Disease Detection Using Image Processing", IOSR Journal of Electronics and Communication Engineering ,Vol 2, Issue 6 (Sep - Oct) 2013, pp. 31-34 https://pdfs.semanticscholar.org/704a/00ab9941390b24f1af4951b89495dc9c0078.pdf

[9] Sanjay B. Dhaygude, Mr.Nitin P.Kumbhar, Agricultural plant Leaf DiseaseDetection Using Image Processing, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013, http://www.ijareeie.com/upload/january/5_Agricultural%20plant.pdf

[10] T.Tanguilig and L. Miranda, Bobby D. Gerardo , Pest Detection and Extraction Using Image Processing Techniques, International Journal of Computer and Communication Engineering, Vol. 3, No. 3, May 2014,pp.189-192, https://www.researchgate.net/publication/271305520_Pest_Detection_and_Extraction_Using_Image_Processing_Techniques

[11] https://www.planetnatural.com/pest-problem-solver/plant-disease/



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