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Integrating AI and Image Analysis for Pest Surveillance

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ABSTRACT

Early pest detection is a major challenge in agriculture field. The easiest way, to control the pest infection is the use of pesticides. But the excessive use of pesticides is harmful to plants, animals as well as human beings. Integrated pest management combines biological and physical methods to prevent pest infection. The techniques of machine vision and digital image Processing are extensively applied to agricultural science and it have great perspective especially in the plant protection field, which ultimately leads to crops management.

This paper deals with a new type of early detection of pest's system. Images of the leaves affected by pests are acquired by using a digital camera. The leaves with pest images are processed for getting a gray colored image and then using feature extraction, image classification techniques to detect pests on leaves. The images are acquired by using a digital camera.
The images are then transferred to a PC and represented in python software. The RGB image is then converted into gray scale image and the feature extraction techniques are applied on that image. The Support Vector Machine classifier is used to classify the pest types.

Keywords- Parking Slot, Deep Learning, Automated Parking, CNN, Mask R-CNN, YOLO, Image Processing.

1. INTRODUCTION

India is an agricultural country. 70 percent of the people mainly depends upon agriculture. So, increasing the productivity of crops is an important matter now. Most of the scientists are doing their researches on this field. By using their new techniques and practical implementations this is very easy. But one of the most important problem now exists is, "pest infection" on plants. This paper mainly focuses on greenhouse crops. There are different crops cultivated under greenhouse. for example, vegetables like cucumber, potato, tomato etc. and flower plants like rose, jasmine etc.

The most common pests which will effect on this greenhouse crops are whiteflies a, aphids and trips. One way to control the pest infection is by using the pesticides. Pesticides will suppress particular species of pests. Pesticides are detrimental for the environment and produce considerable damage to eco systems. The excessive use of pesticides will pollute air, water, and soil. Carried by the wind pesticides suspensions contaminate other areas. In this paper, we focus on early pest detection. This implies to regular observation the plants. Images are acquired using cameras. Then the acquired image has to be processed to interpret the

image contents by image processing methods. The focus of this paper is on the interpretation of image for pest detection.

2. EXISTING SYSTEM & ITS DISADVANTAGES

The methods which are used for the early detection of pests in greenhouse crops along with their advantages and disadvantages.

The methods are explained below with their features and drawbacks.

- Detection of Pests Using Video Analysis: This work combines image processing techniques as well as knowledge-based technique. It will detect only whiteflies. The result of this system is more reliable and accurate than that of the manual methods. This is actually a multidisciplinary cognitive vision system that combines different types of techniques like computer vision, artificial intelligence, image processing etc.
- Method which use Sticky Traps: The goal of Detection of insects by a video camera network is to detect the pest infection on leaves by using a video analysis. The traditional methods will take more time to detect and count the pests. Because of this reason they have developed an automatic system based on video analysis. They used 5 wireless cameras in greenhouse.

DISADVANTAGES

- Time Consuming
- Need More Man Power
- Difficult to handle
- Difficult to identify pest disease

3. PROPOSED SYSTEM & ITS ADVANTAGES

For this study, whiteflies and aphids are chosen because this pest requires early detection and treatment to prevent durable infection. Samples are collected by using the pan tilt camera with zoom in greenhouse. The acquired Images are given to the local machine and the image processing techniques will takes place.

ADVANTAGES

- Consume Less Time
- Minimal Man power
- Paper less management
- Hassle free
- Easy to Maintain

4. STUDY OF THE SYSTEM IMAGE CAPTURING

The first step of every image processing application is image acquisition or image capturing. The images of leaves are captured by using the camera and it will store it in some formats like .PNG,
.JPG, .JPEG etc.

Image pre-processing

Image preprocessing is used to create an enhanced and please full version of the captured image. The image preprocessing steps used in the system are:

1) Conversion of RGB image to gray image
2) Resizing of the image
3) Filtering of the image.

a) Conversion of RGB to Gray Image

In RGB color model, each color appears in its primary spectral components of red, green, and blue. The color of a pixel is made up of three components; red, green, and blue (RGB). The disadvantages of RGB models are, it requires large space to store and it will take more time to process. So, there is a need for converting the RGB model to Gray model.

b) Resizing of the Image

Resizing is an important step in image preprocessing. The acquired image is resized according to the requirement of the system. Resizing of the image: Resizing is nothing
but, changing the dimensions of an image. The captured image is resized using some resizing methods according to the requirement of the system. There are different methods for the resizing of images. B-linear, Bicubic and Nearest neighborhood interpolation are the common resizing methods. Here in our system, we are using bicubic method

c). Filtering of the image

Filtering is nothing but, eliminating the unwanted portion of the image. Different types of filters are available. Low pass filters are smoothening filters, it will pass only low frequency
signals and eliminate all the high frequency signals. High pass filters are sharpening filters, and it will eliminate all the low frequency signals and pass only high frequency signals. Band pass filters will pass the signals which is having a specific range of frequencies. In our system we are using smoothening filter. The purpose of smoothing is to reduce noise and improve the visual quality of the image. Spatial filters are applied to both static and dynamic images, whereas temporal images are

applied only to dynamic images. The simplest smoothening filter is average filter. It consists of a 3X3 matrix of 1 and it is divided by 9.

Feature Extraction

Feature extraction is the most important part of this project. Some properties of the images are considered here. The different types of properties includes region properties, gray covariance matrix properties etc. The properties standard deviation, entropy, contrast etc are extracted from the image and are used to train the dataset for the SVM classification. Support Vector Machines (SVM's) are a relatively new learning method used for binary classification. The basic idea is to find a hyper plane which separates the d-dimensional data perfectly into its two classes. The different types of properties of an image, listed in the table below.

Detection and Classification

In this module the affected and unaffected images are compared by using the dataset provide in the SVM. If it is an affected image again it is compared by using the second dataset provided.

HARDWARE & SOFTWARE REQUIREMENTS:
HARDWARE REQUIRMENTS:

- Processor : i3 and any latest versions
- Hard Disk : minimum 40GB
- RAM : minimum 4GB

SOFTWARE REQUIRMENTS:

- Operating system : Windows 8 & Above
- Coding Language : python 3.7
- Frontend frame work : Tensor flow

SYSTEM ARCHITECTURE:

The complete working procedure of the project.

SYSTEM DESIGN:

System design shows the overall design of system. In this section we discuss in detail the design aspects of the system.

METHODOLOGY INVOLVED IN THIS PROJECT

Tensorflow: TensorFlow is a free and open-source software library for dataflow and differentiable programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks. It is used for both research and production at Google. TensorFlow was developed by the Google brain team for internal Google use. It was released under the Apache 2.0 open-source licence on November 9, 2015.

Numpy:

Numpy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays.

It is the fundamental package for scientific computing with Python. It contains various features including these important ones:

- A powerful N-dimensional array object
- Sophisticated (broadcasting) functions
- Tools for integrating C/C++ and Fortran code
- Useful linear algebra, Fourier transform, and random number capabilities

Besides its obvious scientific uses, Numpy can also be used as an efficient multi-dimensional container of generic data. Arbitrary data-types can be defined using Numpy whichallows Numpy to seamlessly and speedily integrate with a wide variety of databases.

Pandas:

Pandas is an open-source Python Library providing high- performance data manipulation and analysis tool using its powerful data structures. Python was majorly used for data munging and preparation. It had very little contribution towards data analysis. Pandas solved this problem. Using Pandas, we can accomplish five typical steps in the processing and analysis of data, regardless of the origin of data load, prepare, manipulate, model, and analyze. Python with Pandas is used in a wide range of fields including academic and commercial domains including finance, economics, Statistics, analytics, etc.

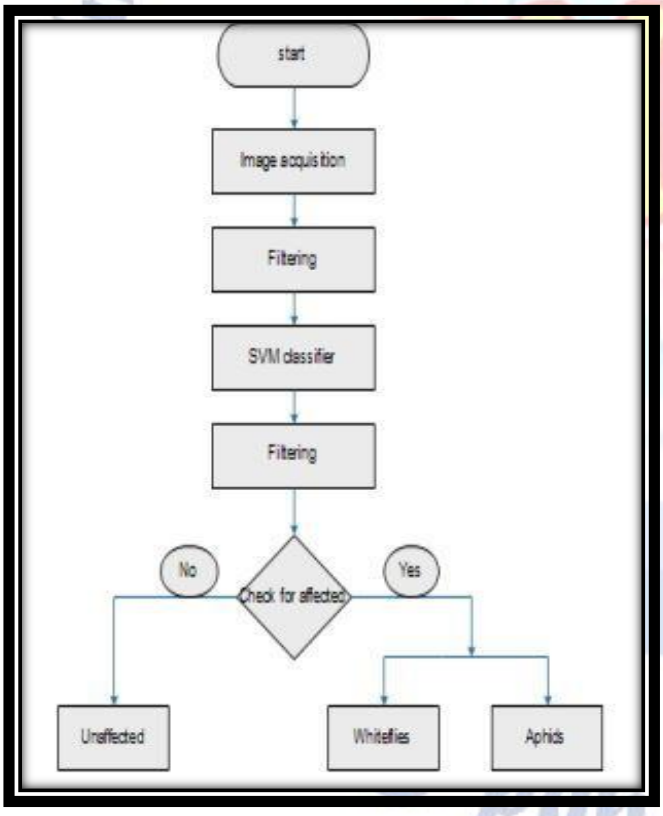
Matplotlib:

Matplotlib can be used in Python scripts, the Python and I Python shells, the Jupiter notebook, web application servers, and four graphical user interface toolkits. Matplotlib tries to make easy things easy and hard things possible. Matplotlib is a Python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive

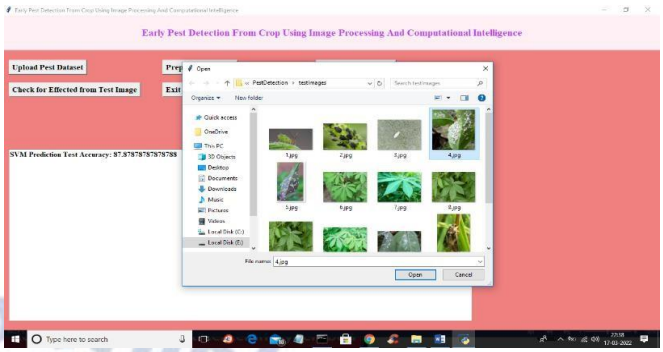
environments across platforms. We can able to generate plots, histograms, power spectra, bar charts, error charts, scatter plots, etc., with just a few lines of code. For examples, see the sample plots and thumbnail gallery. For simple plotting the pilot module provides a MATLAB-like interface, particularly when combined with I Python. For the power user, you have full control of line styles, font properties, axes properties, etc, via an object-oriented interface or via a set of functions familiar to MATLAB users.

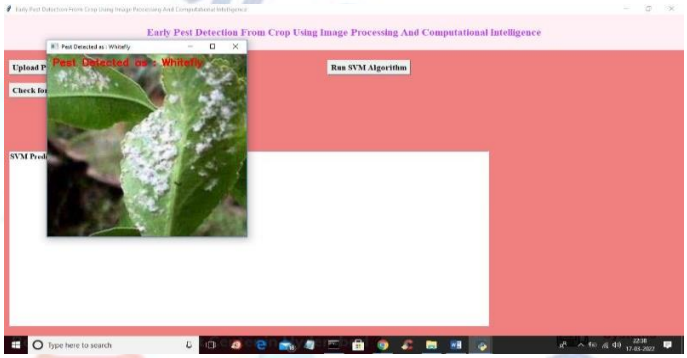
Flowchart

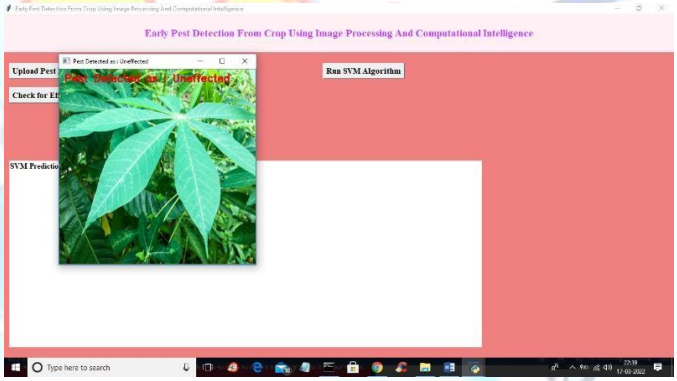
Flowchart for the proposed system is given in figure 3. The images are acquired by using camera and it is filtered by using bicubic filters to avoid unwanted noise portions. This is actually the image preprocessing step. The next step is SVM classification to detect the pest infection. If the image is affected, then again it is applied to the SVM to detect the type of pest

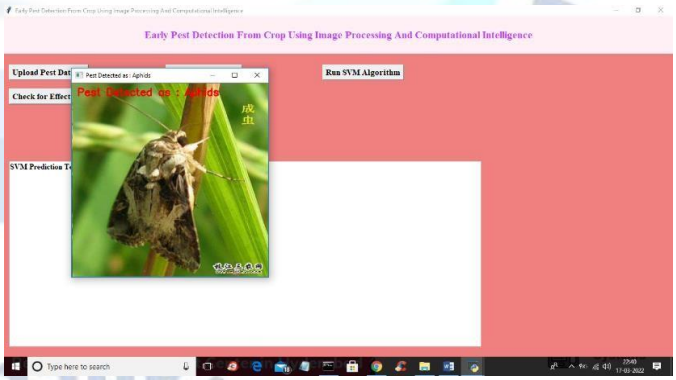


FINAL OUTPUT









CONCLUSION

Image processing technique plays an important role in the detection of the pests. Our first objective is to detect whiteflies, aphids and thrips on greenhouse crops. We propose a novel approach for early detection of pests.

To detect objects we use pan tilt camera with zoom. So without disturbing the pests we are able to take the image. It illustrates the collaboration of complementary disciplines and techniques, which led to an automated, robust and versatile system.

The prototype system proved reliable for rapid detection of pests. It is rather simple to use and exhibits the same performance level as a classical manual approach. Our goal is to detect the pests as early as possible and reduce the use of pesticides.

FUTURE ENHANCEMENT

Disease detection, quantification, classification and prediction are such challenging domains as they contain many varying parameters. Due to its vast, unpredictable nature inclusion of the latest machine learning and big data techniques will be a major improvement and an obvious evolution. discussed the implementation of big data in farming practices which further improves the predictiveness of external environmental factors in farming and many others. There are many challenges still in the field of plant disease diagnosis using image processing and computer vision. In the recent review papers, we found out there are many potentials areas such as work on 3D images are still not so prevalent.

Talking about deep learning, the predictive and probabilistic model generation from the already existing data is one of the significant advantages of it, and hence it is quite efficient regarding plant growth and disease prediction, identification, classification and quantification. Furthermore, multiple kernel support vector regression and fusion of various techniques, such as super pixel along with PHOG, can be explored. Better optimization and segmentation techniques with newer evolutionary methods can be examined.

Use of portable development boards such as Raspberry Pi, Beagle Bone, Intel Galileo are still not so prevalent which can help in portability, cost-effectiveness and robustness of the system. The inclusion of IoT related framework will also boast the work and enhance the performance results.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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