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Controlling of Pest using Image Processing and Machine Learning Methods

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Abstract - In addition to giving humans food, agriculture is a major source of resources for every nation's economy. Pests and insects cause damage to crops, making them extremely risky for the crop's overall growth. In the world of agriculture, early tormentor identification may provide significant challenges. Using insecticides is the greatest way to control the tormentor infection. On the other hand, overuse of pesticides is detrimental to animals, plants, and even the general population's automatic method of early insect detection. Digital image processing techniques are widely used in agricultural research and offer great perspectives, especially in the field of plant protection, which leads to crop management. This study discusses a novel approach to pest monitoring through early detection. Using a photography camera, one may create nonheritable images of pest-ridden leaves. An automated system that can identify the type of pests on crops in addition to examining the crops to detect infestations of tormentors is required. Support Vector Machine (SVM) is utilized for the categorization of images with and without pests, while the YOLO algorithmic method is used for tormentor detection.

Key Words: Image Processing, Pesticides, Machine Learning, Agriculture, Plants, YOLO.

1. INTRODUCTION

India is a nation that relies heavily on agriculture. An important part of the global economy is agriculture. The agricultural system may be under more strain as long as the human population is growing.

The majority of the population—70%—is dependent on agriculture. Consequently, raising crop yield is a crucial issue at the moment. The majority of scientists do study in this area. Agrotechnology and exactitude farming, often known as digital agriculture, are emerging fields of study that leverage information-intensive methods to maximize agricultural output while reducing environmental effect. This may be quite easy if their innovative methods and sensible applications are misused. However, "pest infection" on plants is now one of the most important drawbacks. Pesticide overuse can contaminate the land, water, and air. Pesticide suspensions carried by the wind pollute other places. We focus primarily on early tormenter identification in this study. this entails routinely observing the plants. Images are not inherited when they are captured by cameras. The nonheritable picture should next be analyzed using image processing techniques to comprehend the contents of the image. This paper's primary focus is on picture interpretation for tormenter identification. Exotic pest species can be suppressed by pesticides. Pesticides are bad for the environment and seriously disrupt ecological processes.

2. Body of Paper

Pest Detection Using Image Processing Techniques:

Agriculture may face significant difficulties in detecting pests in rice fields, thus efficient ways to combat the infestation while reducing the use of pesticides must be devised. Image analysis techniques are widely used in agricultural research and offer the highest level of crop protection, which may eventually result in improved crop management and productivity. Men are responsible for keeping an eye out for pest infestations, but automated monitoring has been developing to reduce human mistake and effort. In order to detect and remove insect pests, this work expands on the use of various image processing techniques by developing an automated system for detecting and extracting blighter concentrations from paddy fields.

Automated Crop Inspection and Pest Control Using Image Processing:

Numerous machine-controlled methods that are available in literature have been created for field environmental observation and irrigation management. Nonetheless, it's crucial to track the progress of the plant at each stage and make decisions accordingly. It is inevitable to notice the beginning of plant illnesses in addition to monitoring environmental indicators such as temperature, moisture content, and hydrogen ion concentration. It is essential to preventing losses in agricultural product quantity and production. Farmers find that diagnosing diseases by constant eye observation is a very difficult process that is also less accurate and may wear out restricted regions. Therefore, the goal of this project is to create an algorithmic rule for an image process that will identify rice plant illnesses. Magnaporthe grisea is the cause of the rice blast disease, which also affects wheat, rye, barley, pearl millet, and rice plants. Eighty-five nations throughout the world have sixty million afflicted people due to rice blast disease. The image processing technology is widely used due to its accuracy. Early illness detection will boost agricultural yield by encouraging the proper use of chemicals.

3. PROPOSED METHOD

In this paper, detection was conducted on the paddy fields since rice is the most important and main source of food in India. But, once rice is attacked by several insect pests, it may lose its quantity and quality. Consequently, it is imperative to look for practical ways to reduce the amount of their infestation in the paddy fields. By abusing the pan tilt camera with rivet paddy fields, samples are gathered. The native computer receives the nonheritable images so that image processing techniques can be used.

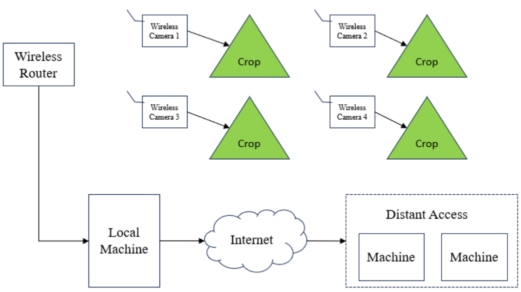

Fig -1: Proposed System Architecture

4. METHODOLOGY

Image Acquisition:

picture capture, often known as picture acquisition, is the initial stage of any image processing program. The photos of leaves are taken by adjusting the camera incorrectly, and the files are saved in various formats, such as PNG, JPG, and JPEG. the installation of sticky traps and a network of wireless cameras to catch insect pests. The cameras were square-shaped CISCO Linksys Wireless-G net home observation cameras, capable of capturing eight megapixels of imagery at ten frames per second. A native computer with a processor was used to process the photos that were taken.

Image pre-processing:

Through image pre-processing, an improved picture is produced that is more suited for processing still images. The method uses the following picture preparation steps: 1) Convert RGB image to grayscale image 2) Resizing the picture 3) Applying an image filter.

1. ***Convert RGB image to grayscale image:*** RGB to Gray Conversion Picture Each colour occurs in its three basic spectral components (red, green, and blue) in the RGB colour model. Red, green, and blue (RGB) make up the three colours that make up a pixel. The drawbacks of RGB models are that they take longer to process and need a lot of storage space. Thus, it is necessary to transform the RGB model to the gray model. RGB images are transformed to grayscale images for this study since the procedure only requires grayscale images.
2. ***Resizing the picture:*** Resizing the Picture A crucial stage in the preparation of images is resizing. Resizing modifies an image's dimensions. The acquired image is downsized in accordance with the system's specifications. Resizing photos may be done in a variety of ways. The most popular resizing techniques are bilinear, bicubic, and nearest neighbor interpolation techniques.
3. ***Applying an image filter:*** All that filtering entails is removing the undesirable area from the picture. We use a smoothing filter in our system. The goal of smoothing is to lower noise and enhance the image's visual quality. While temporal images are exclusively applied to dynamic pictures, spatial filters are applied to both static and dynamic images. The average filter is the most basic smoothing filter. It is split by 9 and is composed of a 3X3 matrix of 1.

Feature Extraction:

In this project, feature extraction is the most important component. Several characteristics of the images are taken into consideration here. Region attributes, gray variance matrix properties, and other types of characteristics are among the several kinds. The characteristics like distinctiveness, entropy, and variance. area unit that was taken out of the picture and area unit that was used to train the SVM classification dataset. For binary classification, Support Vector Machines (SVMs) are a relatively recent learning method. Finding a hyper plane that completely divides the d-dimensional data into its two categories is the key strategy. The table below lists the many types of attributes that an image may have.

Mean	Returns the mean value of the elements along different parameters of an array.
Standard Deviation	Computes the standard deviation of the values in matrix.
Contrast	Returns a measure of intensity contrast between pixels.
Energy	Returns the sum of squired elements in the glem.
Filled Area	Scalar specifying the number of pixels in filled area.

Table -1: Properties of an image

Detection and Classification:

This module compares the damaged and unaffected photos using the SVM's provided dataset. The second dataset offered by the SVM is used to compare the picture in case it becomes impacted again. It is possible to identify the type of pest from this comparison.

Determining the amount of pesticides to be used:

The quantity and kind of pesticides are chosen based on the number of pests found and categorized. Sprinklers are used to spray the desired amount of insecticides.

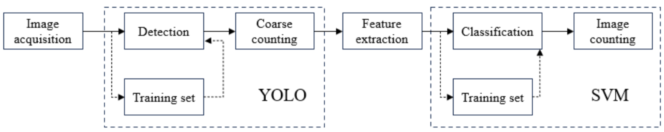

Fig -2: Flow chart

5. DETECTION:

This module's objective is to find insects. Given that many elements such as lighting, out-of-focus cameras, and contaminants can significantly impact the picture acquisition process, a robust and dependable identification method is important. While deep learning techniques like YOLO often yield acceptable results, obtaining sufficient samples of some insects might be challenging. As a result, we suggest that all insect species be seen as belonging to a single class, that insects be detected and roughly counted using a deep learning technique, and that SVM be given the detection data to enable finer categorization. The issue of inadequate samples is therefore resolved. Furthermore, adding or modifying recognized types of flying insects without having to retrain the entire system is a simple process.

Training set:

The insects in this study are manually tagged using the rectangle dataset for YOLO. Moreover, pictures are gathered to serve as the SVM training set. In the dataset, there are both positive and negative samples. Additionally, other specialists validate the samples.

Coarse counting:

It is possible to determine the quantity of flying insects using this method, however the precise type of bug is not given.

Feature extraction:

The field of feature extraction focuses on using mathematical techniques to describe an item quantitatively. In this study, many features are selected to build the feature space in order to collect overall feature information.

Classification:

We employ support vector machines (SVM) to categorize the detection results of YOLO into seven classes, comprising bees, flies, mosquitoes, moths, chafers, and other insects, based on the extracted attributes.

Fine counting:

Accurately tracking the population dynamics of several flying insect species and providing a quantitative description of their intensity require knowing the total number of each species.

7. CONCLUSIONS

All machine learning has to do is take in infinite quantities of data, analyze and evaluate it in real time. It usually operates at a faster pace. The software for image recognition uses photos that were taken with the camera to identify fixable flaws. After that, users are given advice, strategies, and other workable alternatives for restoring soil. YOLO is a unified object detection model. Our model can be trained directly on full-length images and is simple to build. YOLO is trained using a loss function that directly relates to detection performance, unlike classifier-based techniques, meaning that the entire model is trained at once. swiftly the fastest generic object detector in the literature is YOLO, which also advances the progressive in-period object detection. Yolo also works well in new domains, making it perfect for applications that need fast, accurate object identification. The imaging process's greatest advantages include Digital computers are frequently used to process digital images. Important details like edges are frequently taken out of photos that may be used in trade. Images are frequently given more clarity and a more refined appearance. Small mistakes are frequently fixed. Image sizes are frequently reduced or doubled. In order to facilitate faster image transport over the network, images are often compressed and decompressed. Photographs are frequently arranged automatically based on the materials that are required. In essence, SVM rule offers advantages in terms of quality. In most circumstances, it is discovered that SVM performs better.

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