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# Plant Pest detection and Control using Image Processing for Agriculture application

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**Abstract :** An automatic method for early pest detection is presented in this research. Agriculture is vital to human survival, but it also contributes significantly to the economics of any given nation. Every year, farmers invest millions to ensure the safety of their harvest. The damage done by insects and other pests is significant, and they pose a serious threat to the health of the crop as a whole. Preventing damage from insects and other pests by finding them early is one form of crop protection. Appropriate crop inspection at the right time is the greatest technique to gauge crop health. If pests are found early on, preventative actions can be implemented to save the crop from suffering a significant loss in yield later on. The plantation in India has successfully fought off numerous pest and disease outbreaks thanks in large part to the FOREST method of coffee cultivation. In this research, we present a MATLAB-based automatic pest detection approach to address these issues through the use of image processing methods. Pre-processing, modification, and clustering are applied to these photos. The photographs of leaves can be effectively analysed using computer vision algorithms. On the basis of the properties of the photos, Support Vector Machine (SVM) can determine whether or not an image contains pests through a process of clustering. When compared to other automated methods, this one is far easier to implement while still producing excellent outcomes.

Keywords— image processing, gray level co-occurrence matrix, support vector machine, image filtering, segmentation.

## I. INTRODUCTION

Indian culture centres on farming. It is estimated that 61% of all U.S. citizens make their living in some way related to the agricultural sector. It's more than just a job; it's a way of life. The majority of our food, livestock feed, and energy needs can be met by this. It's the bedrock upon which progress in the economy rests. Its financial benefits to the country are unparalleled. Not only that, but a sizable portion of the population is employed in the agricultural sector. Our country has isotropic weather, but we have not been able to put it to good use in the agricultural sector. Due to drought conditions and water shortages, this has occurred. As another possible cause, unplanned water use may be responsible for a shocking amount of wasted water. Farmers in India at the present time use irrigation methods that involve manual control, watering their fields at predetermined intervals.

The manual nature of the process means that the amount of water entering the soil may not be sufficient, which could have consequences for crop production. With the help of an automatic irrigation system, we can avoid needless water waste and put an end to this issue once and for all. The rate at which crops can be grown is impacted by the existence of pests and diseases. Consequently, poverty, food insecurity, and mortality rates will rise as crop yields fall. Non-chemical pest management solutions are in high demand currently. There is no breathing automatic approach that routinely detects the presence of bugs at this time.

Mathematical operations are performed on an image or images using any signal processing technique if the input also includes a video or video frame. The output can be used for pattern identification, feature extraction, or projection, and it does so by employing an edge detection system and grid formations on the images. Sobel, Prewitt, and the Canny Algorithm are three edge detection methods that follow the initial step of k means clustering in an image detection system. The health of a plant is negatively impacted by shifts in environmental factors including temperature, soil, and humidity, which can range from being mildly irritating to completely devastating.

The sensors record the alterations, which are then processed by MATLAB. Through database connectivity and the transmission of data from sensors measuring soil moisture, air temperature, leaf moisture, and other environmental factors, the infection index may be calculated in python [5]. There are thousands of different kinds of pests and insects that need to be studied, making it difficult to conduct detailed trapping and monitoring of them all. Farmers spend a lot of time and energy every crop rotation trying to rid their fields of pests by surrounding them with nets, barbed wire, poison, etc., but the results are inconsistent.

A bountiful harvest in agricultural production can be achieved by accurate diagnosis and prevention of numerous crop diseases and insect pests, allowing for the satisfaction of people's basic requirements. While MATLAB excels at picture identification, even the most fundamental recognition algorithm requires a sizable sample database and a plethora of parameters. It is crucial to optimise the sample training for deep learning technologies in the case of crop diseases and insect pests. And in general, using biological methods rather than chemicals to control pests and illnesses on protected crops. Recent years have seen a rise in the importance of agricultural research, which aims to boost productivity and food quality at lower costs and higher profits. There is a growing need in many parts of the world for alternatives to chemical pesticides and other medical drugs. There are currently no automated solutions for timely and accurate detection of plant pests. Greenhouse workers do, in fact, conduct routine checks on plants and pests in production environments. This is a very laborious manual process. Improvements in image processing pattern recognition techniques have made the creation of a fully autonomous system for crop disease classification feasible. This publication is dedicated to the study of early pest detection. In the first place, this necessitates keeping a close eye on the vegetation. Cameras and scanners are used to capture photos of diseases. After an image is captured, it must be processed using image processing techniques so that their contents may be understood. Insect detection by picture analysis is the topic of this paper.

## II. EXISTING SYSTEM

Insects and other pests that can be seen with the naked eye and so need constant surveillance. However, when applied to a broad enough area, this method stops being viable. Furthermore, it is a very costly, incorrect, and time-consuming process to use this method. As a result of these drawbacks, a new strategy for pest control has emerged: the integrated pest management (IPM) approach. The three crucial steps of integrated pest management (IPM) are detection, identification, and application. Machine vision is used to assess plants for damage and identify pests. Image processing forms the backbone of many useful agricultural applications, including the identification of afflicted areas, the detection of pests in stem and leaf portions, and the assessment of affected areas' colours. Pest management relies on precise direction and detection methods, including automatic detection through image processing techniques.

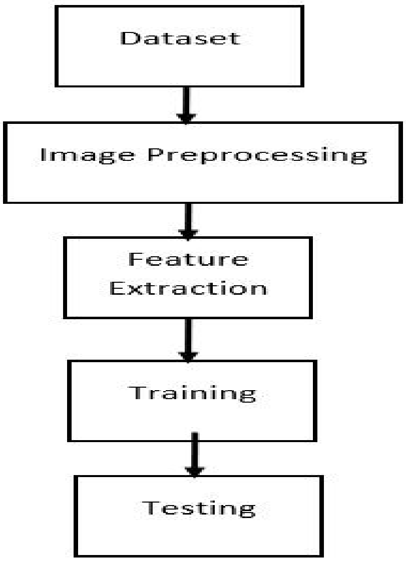


Fig.1 Block diagram of proposed approach

Object detection, feature extraction, and pest identification are all discussed in a variety of published literature, with varying approaches described according to a wide range of variables.ORB is an algorithm that uses visual data to detect and characterize feature points. There are two stages to ORB feature extraction. (1) The Quick corner detector, which is exceptionally fast, is used for feature point detection, and orientation data is also included. (2) The BRIEF feature descriptor, based on a comparison of the pixel binary, is used to describe the feature points, and it is an improvement over the BRIEF descriptor, which is vulnerable to picture noise and lacks rotation invariance.In this context, we employ both image processing and soft computing ideas. Data collection, standardisation, feature extraction, training, testing, and validation are the five cornerstones of a successful research project . The following sections elaborate on each stage.Data collection involves gathering and organizing a variety of images into a single folder. Images in the collection were then sorted by their resolution. We eliminated low-resolution images. The sized photos that had been filtered were changed. The input image is analysed at this stage to extract relevant features that will be used in the training and testing phases to follow.

## III. PROPOSED SYSTEM

Segmenting Images Segmentation, in the field of computer vision, is the process by which a digital image is divided into individual segments (sets of pixels, also known as super pixels). The purpose of segmentation is to transform an image's representation into one that is more digestible and informative. Finding objects and boundaries (lines, curves, etc.) in a picture is a common use of image segmentation. For a more in-depth definition, image segmentation is the act of categorising an image into groups of similar-looking pixels based on their labels. The output of image segmentation is a collection of contours or a group of segments that together cover the full image. When all of the pixels in a certain area share a same attribute or computed property, like hue, opacity, or texture, we say that those pixels are homogeneous. The current algorithm utilised is ORB, however we are replacing it with Clustering techniques based on image segmentation because of the excellent predictability they offer. Due to poor contrast between the pest and the leaf, identification images tend to have a busy background. To use key point detection effectively, it is necessary to first identify a relevant region of interest.

An Approach to Clustering This method use iterative steps to divide a picture into smaller groups. The steps involved in the clustering methodology are described. Manually, randomly, or conditionally selecting clusters is all possible. Pixel to cluster centre distance is expressed as the squared or absolute difference between the two points. Manually, randomly, or conditionally selecting clusters is all possible. Pixel to cluster centre distance is expressed as the squared or absolute difference between the two points. Pixel colour, brightness, texture, and position, or some combination of these, usually carry the heaviest weight in determining the difference. K-means, fuzzy c-means, and the expectation-maximization (EM) algorithm are some of the most popular clustering methods. The quality of the clustering method's output is highly dependent on the quality of the initial clusters. Due to the algorithm's speed, it can be run multiple times and the optimal clustering chosen afterward.

The clustering algorithm has the issue of requiring an input parameter for the desired number of clusters, k. Inadequate outcomes may occur if k is selected incorrectly. The algorithm also presupposes that scatter between clusters can be quantified by the variance. The cluster centres can be determined using the following strategy.

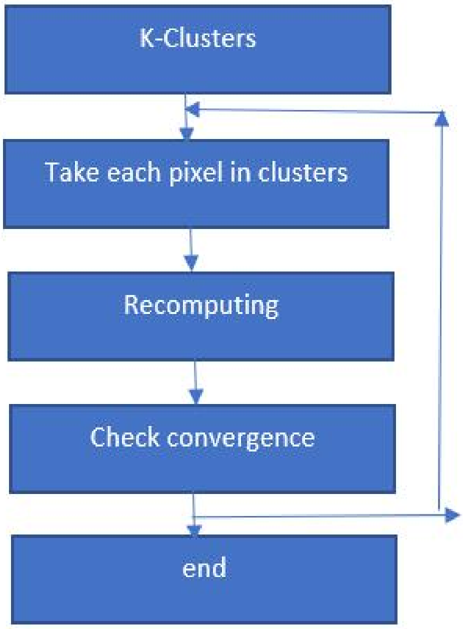


Fig 2. Clustering

Particularly when employing heuristics like Lloyd's algorithm, it's relatively simple to implement and use, even with massive amounts of data. That's why it's been put to good use in fields as diverse as market segmentation, computer vision, geo-statistics, and even agriculture. It's common for other algorithms to use it as a first step in the processing pipeline.

Without a pre-processing step, the segmentation algorithm cannot produce high-quality results. De-noising and image enhancement are just two examples of the pre-processing techniques that can be used. The pest image is ideally suited to the rank filter's de-noising capabilities. It's a non-linear filter, so it keeps your images looking sharp while still preserving details like edges and shapes. Because of their imperfections, pest images require a pre-processing step before the segmentation process can produce reliable results.

The proposed technique incorporates pre-processing prior to segmentation and volume estimation following segmentation. After the algorithm, a subtraction step is added to the images. The proposed method mitigates issues caused by noises and other irregularities in acquired images, and it also gets rid of drawbacks like a lack of intensity homogeneity and artefacts.

When an image is masked, its pixel values are changed to zero or another uniform value. At this stage, we're mostly concerned with locating the green pixels. The following step involves computing a threshold for these pixels according to the given criteria. If the pixel intensity is less than the calculated threshold, the green component is zeroed out. When mapping the pixel's RGB components, the red, green, and blue components all receive the value 0. As the green pixels largely represent the unaffected parts of the leaf, they do not contribute to the diagnosis of diseases.

## IV RESULTS

Results of the suggested method are shown in the form of photographs, demonstrating the detection of pests on various plant leaves and parts.

Fig 3. Pest Image

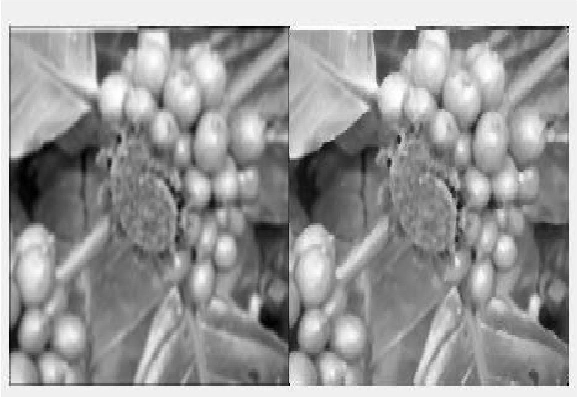

Fig 4. Gray Image and Filtered Image

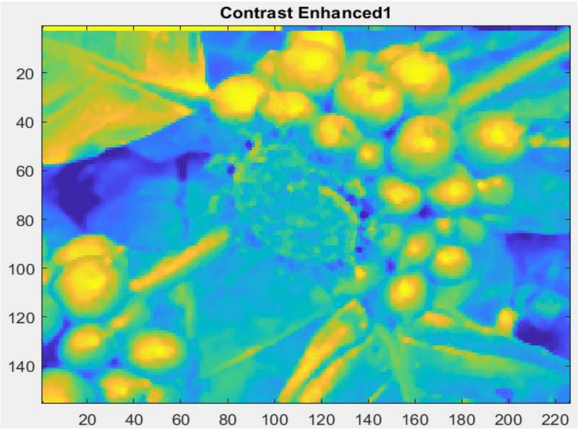


Fig 5. Masked Image

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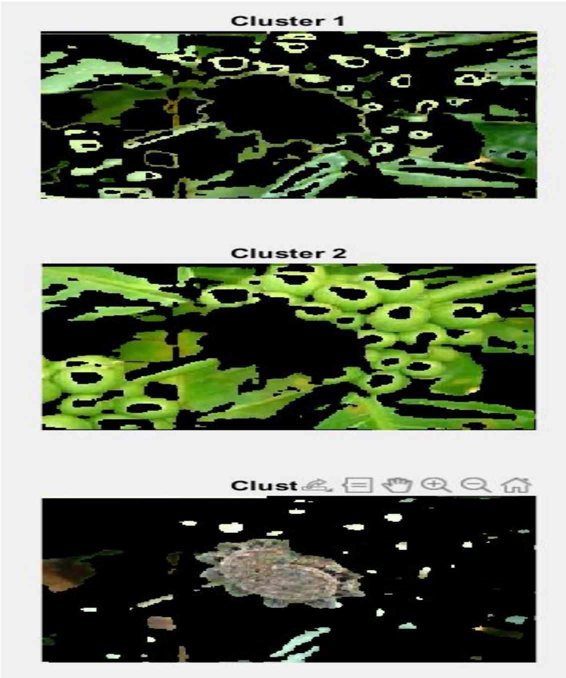


Fig 6. Pest Detection Image

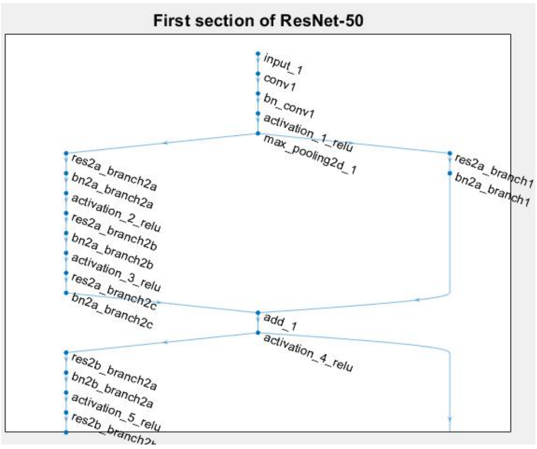


Fig 7. Resnet 50 layered Image

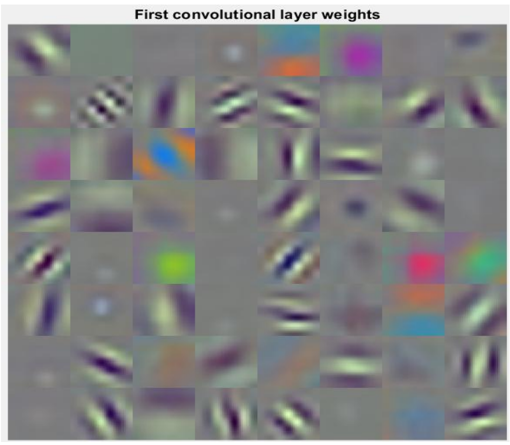


Fig 8. layered Image

## V CONCLUSION

The quality of plantation crops has been declining for a long time due to the widespread use of artificial pesticides and nematicides. In this paper, we introduce a new method that efficiently maps out where these pests have infested crops. Using more advanced software and higher quality picture collecting devices, the algorithm can be tweaked to better locate crop infected spots. Experts in agriculture from around the world are striving to eradicate bio aggressors, and diseased coffee plantations are one of the difficulties that has arisen as a result. Image processing is a key part of this process. First and foremost, we want to identify bio aggressors (aphids) and plant diseases like coffee berry on plantations. The cognitive method adds new data to be extracted from images, such as new types of items to search for or new types of image processing software. We provide a method for early detection of the crop-damaging insect. Quick detection of pests was achieved with high reliability using the prototype system. Very little effort is required to get good performance.

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