PEST AND DISEASE CONTROL IN PLANTS

Ayesha N Nagnoor, Chaitali Rokhade
Shraddha S Vaidya, Spoorti Hiremath, Vishnudath AP
KLE Technological University Hubballi
Vidyanagar, Hubballi, Karnataka
580031,India

Dr. Jyoti Bali
Department of Automation & Robotics
Faculty of Automation & Robotics,
KLE Technological University
Vidyanagar, Hubballi, Karnataka
580031, India

***Abstract*—An image processing and analysis for identification of pest infestations in plants based on the leaf proposed. RGB stands for Red, Green, Blue. This colour model is additive as colours are added together in varying proportions to produce an extensive range of colours. Real-life colours are not actually a mixture of red, green, and blue shades. Nonetheless, the RGB model has been widely successful and it is used in sensor and image-processing. Key understanding of a RGB image is recognizing that the image is a composite of three independent grayscale images. These images correspond to the intensity of red, green, and blue light. Finally, these images are processed separately and combined into a single image that we as humans perceive as having colour. With the help of deep learning, accurate detection of pests and diseases can be done in the farms. Upon using this Machine Learning algorithm KNN Classifier highly accurate predictions can be made. It is one of the simplest ML algorithms which is based on the Supervised Learning Technique. A dataset of 2000 potato plant (Solanum tuberosum) leaf images was collected for the experiment. Results indicate and classify the leaves into healthy and unhealthy leaf and further spray pesticide upon it.z**

Keywords – image processing, RGB image, KNN Classifier

I. INTRODUCTION

Pest and Diseases are a part of the natural environment system. The balance between pest and predator is to be maintained in order to control pests. Therefore, in order to increase the efficiency of agriculture pesticides are sprayed on the crops. The chosen dataset for this project is a set of images of potato leaves as they are grown widely in India. They are mostly grown during the winter season or in cold areas. It also has a high productivity rate and profitability in the market.

Pests and diseases are most commonly seen in potatoes. The most commonly seen pests are aphid, leaf miner, potato tuber moth etc. These cause damage to the plants and the nutrients of the plants. The most widely spread diseases in potatoes are early and late blight. Both are responsible for huge economic losses. This is caused mainly by fungus. Warm temperature and high humidity favour early blight and cool and moist weather favour late blight of potato. They produce brown spots on leaves and stems. The nutrients of the potatoes are affected. This can be reduced by spraying the right amount of pesticides on the plants. Technologies like artificial intelligence, machine learning and image processing are used to identify the unhealthy leaves in the plant and spray the pesticide on to it.Images are trained using a pre-trained network that is KNN classifier model and RGB model of supervised machine learning. There are two classes which are unhealthy and healthy leaves. The camera is used to sense the unhealthy and healthy leaves. When it detects an unhealthy leaf it sends a signal to the pump and the pesticide is sprayed to the plant.

Fig 1 Early blight

Fig 2 Healthy leaf

Fig 3 Late blight

Types of pest infestations	Key symptoms
Early blight	Dark and sunken lesions on the surface
Late blight	Light to dark irregular shaped water-soaked spots

Table.1

II. IMAGE DATASET

Potatoes (Solanum tuberosum) are generous plants that are easy to grow and produce. They are abundantly harvested. Given them full sunlight, loose and fertile soil along with 1 inch of water per week, they give high yield. Potatoes grow in rows. First, a trench of 6-8 feet deep is dug. Seeds are sown and grown for two weeks. Then healthy potato saplings with almost the same height are chosen. A ready dataset for the same was opted for from Kaggle. In total, the dataset consists of 1000 leaf images with a resolution of 256x256 pixels. Each image contains a target leaf. The distribution of leaves is shown in Table II.

Types of leaves	Number of images
Early blight	392
Late blight	392
Healthy leaves	216

Table.2

III. PROPOSED SYSTEM

The Proposed pesticide spraying robot is used for cultivation purposes. The Technologies which are AI-based help to improve efficiency in the fields of the agricultural sector. In this build a real time AI based pest controller, which is portable and easy to mount and maximize crop production with minimal input costs and avoid manual spraying of pesticides and it should be safe and simple to control. An input from the leaf is first divided into blocks of size 64X64 resolution, now the controller unit mainly focuses on the affected area and we have used KNN classifier because it makes highly accurate predictions. A supervised Learning Method, In this we have used RGB model for processing the image captured. The training database data are plotted and colored according to their morphological class in RGB Space. Once the image is captured, now the controller unit mainly focuses on the affected area and it decides how much amount of leaf is infected, based on that the control goes to the pesticide tank. The Microcontroller unit that is Raspberry pi controls the spraying mechanism which consists of a hydraulic motor and a sprayer. Arduino UNO is used for Navigation of the robot, it consists of a motor driver (L298D) and DC motors. The DC motor is fixed on the wheels of the robot. The robot is controlled manually through a Smartphone. In order to test the level of the pesticides quantity available in the tank, we have added an extra feature for detecting the level of the pesticides. We have assigned different colored LED lights to indicate the level of the pesticides, GREEN is to indicate tank is full whereas YELLOW is to indicate tank is moderate level of pesticide and RED is to indicate tank is empty and it will notify the user through the buzzer.

IV. EXPERIMENTAL RESULTS

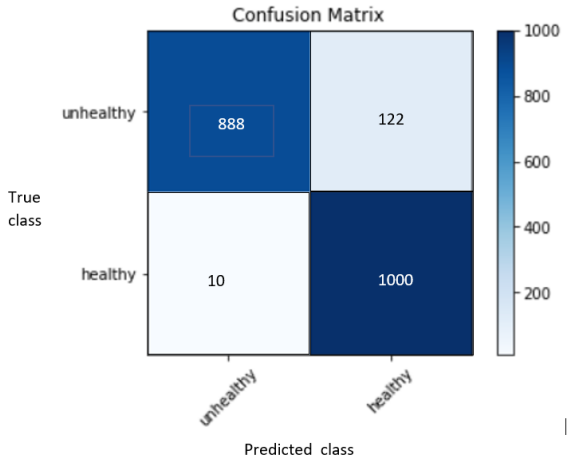
To access the pests on the leaf, the confusion matrix is obtained where true positive *tp*, true negative *tn,* false positive *fp* and false negative *fn.*

Precision = tp/ (tp + fp)
= 0.98

Recall = tp/ (tp +fn)
= 0.98

F- measure = 2 x (precision x recall)/ (precision + recall)
= 0.98

The precision, recall and F-measure is calculated using the results of the confusion matrix. Although the proposed method could not achieve the accurate results, it is notably more successful than humans overall. The result is obtained by identification of pests using the AI based RGB model. It detects the pest infestation in potato plants and then sprays pesticide in the required quantity based upon the pest infestation levels. It is able to navigate in the directions as desired by the user.Only when the detected leaf is unhealthy, pesticide is sprayed on the plant.



V. CONCLUSION AND FUTURE WORKS

Experimental results present the feasibility of using the RGB model and KNN classifier of supervised machine learning to identify and kill the pests in potato plants based on their leaves. Automatic spraying of pesticide on the leaves upon detection of the pest makes it much easier. Manual human labour is reduced. Development in robots results in maximum efficiency in the pesticide usage and reduces health issues related to excess usage of pesticides. Vegetation is also protected and taken care of from the pests by using the right pesticide in the right quantity. On the other hand, there is always scope for further improvement.

The world of technology is not constant. What seems outstanding today, will eventually be outdated tomorrow. Our next steps include implementing the system in a complete artificial intelligence environment, using automating systems to show results in web applications, and the system can also be made water resistant. To keep abstract of technical improvements, the prototype can be refined.

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