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PLANT DISEASE DETECTION USING DRONES IN PRECISION AGRICULTURE

Harshad Rakshe
Department of Computer Engineering
harshadrakshe28@gmail.com

Shivam Kakade.
Department of Computer Engineering
shivamkakade95@gmail.com

Onkar Hinge.
Department of Computer Engineering
onkarhinge25@gmail.com

Sanket Shingote .
Department of Computer Engineering
sanketshingote25102@gmail.com

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Abstract:

The paper discusses the use of drone technology in precision agriculture, specifically in early detection and classification of plant diseases. It proposes a novel approach that integrates computer vision techniques and machine learning algorithms with aerial drone imagery. The study demonstrates the feasibility and effectiveness of this approach in real-world scenarios, paving the way for sustainable and data-driven agricultural practices. The integration of high-resolution drone imagery, deep learning, and image processing techniques offers a cost-effective and efficient solution for disease diagnosis in large agricultural fields.

Keywords **—Deep-Learning, You Only Look Once Version Five(YOLOv5), Disease Detection, Single Shot Detection (SSD), Real-time detection.**

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I. INTRODUCTION

Agriculture is crucial for India's economy, but disease causes a 40% decrease in yield each year. Traditional plant disease detection technology and chemical-based disease removal technology have been used, but these methods have negative impacts on the environment and labor. Chemical-based disease removal technology uses a single pesticide to cover the entire field, causing soil and water pollution. To address this, a robust, cost-effective, and environmentally friendly disease management system is being developed. Deep learning is used to detect and classify diseases within and between crop rows, extracting features for automatic classification and object detection. The system uses YOLO5, a one-stage object detection system, and SSD-RESNET, a single-shot multi-box detector residual network. Image segmentation is challenging due to the nature of objects, such as pure lightning, poorly contrasted backgrounds, and limited information on true boundaries. The system aims to create a more efficient and environmentally friendly solution for disease management.

II. LITERATURE SURVEY

A. *Severity recognition of aloevera diseases using AI in tensor flow domain.*

According to Muhammad, Nazeer, et al [11] Pretrained architectures include AlexNet and VGG19 CNNs. It is able to extract features from the provided data with exacting precision. The best subset of features are chosen by the convolutional neural network after extracting them, and they are then fed to a variety of classifiers, such as K-Nearest Neighbor, Support Vector Machine, Probabilistic Neural Network, Fuzzy logic, and Artificial Neural Network. On a self-collected dataset created during the augmentation process, the suggested technique is validated.

B. *Plant leaf disease classification using grid search based SVM*

According to Bhagat and Monu, et al [12] a computationally efficient approach for categorizing plant leaves ashealthy or sick and, if found unhealthy, for detecting plant leafillnesses. Support Vector Machine, which is the foundation ofour classification system, is optimized using the Grid Searchmethodology. A system for identifying and categorizing plantdiseases is being developed using SVM as an algorithm. Withminimal computing work, the farmers will benefit from thisstrategy's useful way for disease detection.

C. *A review on machine learningclassification techniquesfor plant disease detection*

According to Shruthi, U and V. Nagaveniet.allthe steps of a generic system for detecting plant illnessesand a comparison study of machine learning classification algorithms. In this paper, a comparison of five different machine-learning classification approaches is made to identify plant diseases.

When compared to other classifiers, the SVM classifier is used by numerous writers for the categorization of disorders.

D. *Antiglycation activity and HT-29 cellular uptake of Aloe Emodin, Aloin , and Aloe arborescens leaf extracts.*

According to Froldi, Guglielmina, et al [14] demonstrates that aloin and aloe-emodin are only partially responsible for the antiglycation and antiradical effects of the methanolic and hydroalcoholic A. arborescens leaf extracts. The two extracts entirely lack cytotoxicity, but these two anthraquinones have mild negative effects on cell survival.

III. SYSTEM ARCHITECTURE

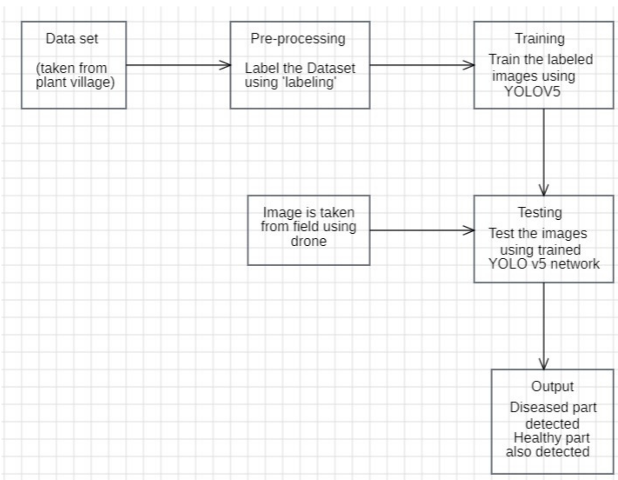

Fig. 1 flow of Architecture diagram.

IV. METHODOLOGY

The problem involves detecting plant diseases using drones in agriculture. Data collection involves gathering highquality data from drone imagery, including RGB, multispectral, and thermal images. Data preprocessing ensures consistency and removes noise. Feature extraction extracts relevant features like plant shape, color, and texture. Image segmentation helps focus analysis on specific areas. Disease detection algorithms, such as machine learning and computer vision techniques, can classify disease presence and severity. Training and validation involve training the detection model using labeled data, ensuring a diverse dataset. Real-time monitoring is implemented using drones equipped with disease detection models, either onboard processing or transmitting images to a ground station for analysis. An alert system is developed to inform farmers about the presence of diseases. This approach aims to improve the efficiency and effectiveness of agriculture.

V. EQUATIONS

Functions can be represented mathematically, e.g., $f(x)=wx+b$ in the context of linear classification algorithms like Support Vector Machines, where w represents weights, x represents feature vectors, and b is the bias term.

- I = Input plant disease data.
- P/N = Preprocess and Normalization:
- T1 = Training Module Dataset
- T2= Testing Module Dataset
- A=Result and Analysis
- Set Theory

Let S be as system which allow users to predict the disease

S = {In, P, Op, A}

Identify Input In a

s In = {Q}

Where, Q = Input plant disease dataset

Identify Process P as

P = {PR, No, FE, CL}

Where,

PR = Perform Preprocessing on the input plant disease dataset

No= Perform Normalization on the input preprocessing

FE = Extractions of Features and storingfor further comparison

CL = Classification using CNN

Identify Output Op as

Op = {UB}

Where, UB = Update result

A=Analysis Graph (Accuracy)

- Precision

P=TP/TP+FP

- Recall

R=TP/TP+FN

- Average Precision (AP) and Mean Average PrecisionmAP AP (average precision) is calculated by averagingthe precision for recall value over 0 to 1. In other words,AP is the area under curve for a precision–recall curve .

The equation for AP is given in Equation

AP =
Z 1
0
P(R)d(R) …… (1)

where P and R denote precision and recall,respectively.Finding the mean of AP for all classes gives usthe mAP Equation

mAP =
1
cls
X
i=cls
AP(i) ……(2)

VI. RESULT

The study reveals that blight and wilt are the most commonly studied disease types, with over 10 disease types covered by a single study. Fungus accounts for 64% of the diseases drones were used for, with viruses, nematodes, and abiotics only studied in 10% of the studies. Grape and watermelon are widely studied, while kiwi, squash, pear, lemon, onion, and rice are less studied. Most studies use drones for classification tasks, with 58% using field images and 14% using leaf or plant images. The most used algorithm is CNN, likely because it has been the basis for deep learningbased models like VGG16, GoogleNet, and VGG-Net. Further research is needed to fully understand drones' potential in disease detection.

VII. DISCUSSION

The study focuses on the use of drone data for detecting diseases in agriculture, specifically blight and wilt, which are visible symptoms. The dominant drone type used is quadcopter, primarily due to financial reasons. Drones are often used to detect diseases in grapes, olive, citrus, cotton, and wheat production.

Grapes, watermelon, and tomatoes are frequently mentioned in relation to disease-causing pathogens, indicating that drones are likely used for multiple purposes. The results show that classification is the dominant task performed in disease detection by drones, assessing a plant or part of the field as healthy or not healthy in relation to the investigated disease but not necessarily detecting the disease.

Farmers seem to be involved in all cases, as they need to take action after the data is analyzed. 29% of the identified papers stated that their data is available for future work. The data gathered in disease detection is diverse, possibly due to the active area of research. Researchers are experimenting with cameras mounted on drones flown at various heights and conditions, leading to the application of many different algorithms. Challenges encountered in the study indicate the need for further investigation.

Advanced deep learning algorithms, such as transformers, long short-term memory (LSTM), and autoencoders, can be investigated for disease detection using drones. More research can also be done on detecting diseases that do not have visible symptoms. The study has identified challenges and potential solutions, such as processing time and training time, and recommends considering advanced data infrastructures and techniques such as distributed machine learning and hierarchical federated learning in future studies.

VIII. CONCLUSIONS

Automatic disease detection systems are used in the agriculture industry.In this system, we used a computer vision technique and a machine learning algorithm. In this system, drone can accurately identify disease without human interaction. These systems reduce the cost of labor. Also, they can reduce the use of herbicides and pesticides this system can save the soil pollution. We cannot use pesticides hence this system is environment friendly. These systems are used 24*7. There are still some challenges that need to be addressed to fully realize the potential of drone. these include improving the accuracy and reliability of the disease detection algorithm. Developing more advanced and effective disease detection systems and addressing issues related to terrain and weather conditions. In this system we trained the model over the YOLOv5 algorithm we will compare to another YOLO version to acquire better accurace.

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