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Machine Learning Techniques for Detection of Diseases in Plants.

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***Abstract**: Plant diseases, in addition to major production and economic losses, can also cause a decrease in the quality and quantity of agricultural products. Nowadays, daily disease detection is receiving more attention in crop management. Farmers face great difficulties in transitioning from one disease control policy to another. Visual experts are a way to diagnose and identify diseases in practice. Diseases caused by bacteria, viruses and fungi can often be prevented using a diagnostic method. Plant protection plays an important role in the maintenance of agricultural products. Machine learning techniques are often used to identify images of relevant pages. This study discusses various machine learning algorithms used to determine whether a plant is infected with a virus. It is accomplished through several steps such as image acquisition, feature extraction, disease classification, and visualization results. This article also requires proper review of various techniques for identification of plant diseases. The goal is to use image analysis to identify plant diseases. He also prescribes the fertilizer to be used in case of disease detection. The pests and insects responsible for the epidemic are also described.*

***Keywords**:* Machine Learning, Disease detection, feature extraction, classification.

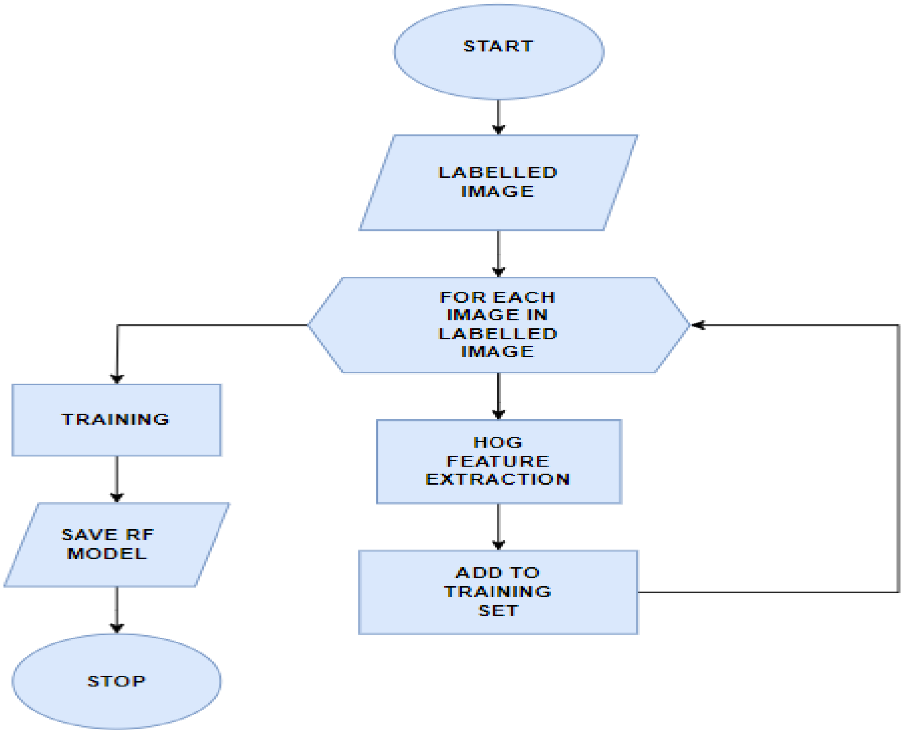
INTRODUCTION

Diseases are the main reason for the decrease in productivity and efficiency of agricultural products. Therefore, early diagnosis, treatment and control of plant diseases is very important. Farmers make a lot of effort to choose the best seeds and the right climate for plants to grow, but there are many diseases that affect plants and cause plant diseases. Controlling agricultural seed disease as early as possible can reduce damage, reduce production costs and increase profits. Most of the time the human eye alone cannot accurately detect the disease. In the past, farmers allowed experts to perform visual inspection on infected plant samples
or experts went into the field to do a spot check. >Lessons for situations. In this way, it becomes difficult to find reliable experts and solutions in various fields do not work very well, technology takes a long time. Plant diseases are a global threat to food security, but can also harm small farmers whose livelihoods depend on healthy crops. Other organizations, such as agricultural extension groups or native plant clinics, encouraged disease detection. During this period, the classical technique often seems weak and it is difficult to get better results. In general, this approach is expensive due to the need for regular maintenance. Agriculture is the basis of every country's economy and accurate and timely diagnosis of agricultural diseases is very important.
Therefore, we need some fast, accurate and low-cost technology methods to identify the disease. Leaf identification, disease detection, fruit disease etc. Many agricultural practices have been developed for All of these systems contain images captured with digital cameras. The imaging and analysis process is continuous to capture images to obtain important data for analysis. In this paper, we explore different strategies for crop disease prevention and treatment planning using image analysis and machine intelligence for simple, random, truncated and accurate detection and classification. The purpose of this article is to identify plant diseases based on various methods such as image analysis.

LITERATURE REVIEW

The previous research work done in this path did refer to several studies devoted to the subject in order to understand in detail about this survey. The survey of literature is done in sequential order:-

1. 2015 - Jagadesh D. Pujari et al.
    - Discusses early prediction of leaf pathogens using image collection, feature selection, and techniques for identifying fungal disease symptoms.
    - Emphasizes timely identification of fungal infections.
    - Reports classification results for various agricultural products affected by diseases.
2. 2016 - Sharada P. Mohanty et al.
    - Trains a deep belief network to classify crops and diseases using a large database of healthy and infected leaf images.
    - Achieves a high accuracy rate of 99.35% on the testing dataset.
    - Highlights the potential for smartphone-based plant disease diagnosis.
3. 2016 - Srdjan Sladojevic
    - Introduces a crop disease recognition system based on deep convolutional networks.
    - Develops a model for detecting and classifying 13 different plant diseases.
    - Reports testing results with accuracy ranging from 91% to 98%.
4. 2017 - P. Ferentinos
    - Uses neural networks to detect and diagnose plant diseases.
    - Trains models with a large dataset of images and achieves high accuracy, up to 99.53%.
    - Focuses on identifying various disease categories.
5. 2018 - Muhammad Sharif et al.
    - Addresses the impact of citrus diseases on citrus fruit production.
    - Proposes a hybrid technique for citrus disease categorization, achieving high classification accuracy.
    - Identifies injury spots on tropical fruit leaves and buds.
6. 2018 - S. Sannakki et al.
    - Presents a classification system based on the segmentation of defected regions, color, and texture characteristics.
    - Uses various techniques, including artificial neural networks and support vector machines.
    - Discusses the use of computer vision and fuzzy logic for leaf disease identification.
7. 2019 - Tejal Chandiwade et al.
    - Proposes a method for plant disease detection using image processing and Convolutional Neural Networks (CNN).
    - Discusses the use of drones for capturing images of plants.
    - Emphasizes disease control and increased productivity.
8. 2020 - Yan Guo et al.
    - Introduces a mathematical model for detecting and recognizing plant diseases, focusing on deep learning.
    - Utilizes an area proposal network and the Chan-Vese algorithm for disease segmentation.
    - Achieves an accuracy of 83.57%, surpassing traditional methods.
9. 2020 - Aliyu M. Abdu et al.
    - Compares the implementation of support vector machines (SVM) and deep learning for plant disease detection using leaf images.
    - Discusses the shift from "shallow" machine learning to deep learning for image recognition.
    - Evaluates the performance of both SVM and deep learning models.



METHODOLOGY

1.Problem description: - State the problem, specify the process, type of disease to be detected and type of crop.
2. Data collection:- Collection of different data regarding plant images with healthy and diseased samples. This information is important for training and testing machine learning models.
3.Data Preprocessing: -Cleans and preprocesses collected images, including resizing, normalizing, and enhancing to create sample datasets.
4.Feature Extraction: - Extract relevant features from the previous image. This may include colour, texture, shape or other image characteristics that may be helpful in identifying disease.
5.Model selection:- Choose a good machine learning or deep learning model for your project. Options include convolutional neural networks (CNN), support vector machines (SVM), random forests, or others, depending on the dataset and complexity of the problem.
6. Model training: - Distributed data into the training process and validation process.
- Shows the selected model of the report. This includes fine-tuning hyperparameters, optimizing the model architecture, and increasing model convergence.
7. Model evaluation:- Uses valid data to evaluate the performance of the model. Measurements such as accuracy, precision, recall, F1 score and confusion matrix can be used.
8.Hyperparameter Tuning: - If necessary, perform hyperparameter tuning to improve the accuracy and generality of your model.
9.Test:- Tests the model alone without seeing the test data to evaluate real-world performance.

RESEARCH RESULT

In 2018, Sharif and their team employed SVM for classification, focusing on Citrus Infections using the Picture Gallery Dataset. They achieved a commendable accuracy of 97% on the Picture Gallery Dataset and 89% on a combined dataset.In 2018, S. Sannakki and colleagues employed Artificial Neural Networks (ANN) and Support Vector Machines (SVM), achieving a commendable 70% accuracy on a supervised image dataset. The subsequent year, Tejal Chandiwade and team utilized ANN and SVM techniques, demonstrating a 78% accuracy on a supervised manual dataset. Moving forward to 2020, Yan Guo and their study introduced Convolutional Neural Networks (CNN), attaining an improved accuracy of 83.75% on the supervised PlantVillage dataset. A significant stride in accuracy was seen in the same year as Aliyu M. Abdu and their group leveraged Support Vector Machines (SVM) alongside Deep Learning, accomplishing a remarkable 96.33% accuracy, particularly for SVM models with Radial Basis Function (RBF) kernels, across datasets like PlantVillage and DigiPathos. These findings illustrate the dynamic evolution of plant disease identification techniques, emphasizing the role of deep learning and the impact of dataset choice in achieving higher accuracy rates.

CONCLUSION

The research suggests a review of machine learning classifiers for the identification of plant diseases. There are mainly four different machine learning classifiers which were investigated, and the authors compared their performance for disease classification. Here's a summary of the findings:

SVM Classifier: Many authors tend to use the Support Vector Machine (SVM) classifier for disease classification. SVM is a popular choice for its ability to create a clear boundary between different classes.

CNN Classifier: The Convolutional Neural Network (CNN) classifier outperformed other classifiers in terms of disease detection accuracy. CNNs are well-suited for image classification tasks, making them effective for plant disease identification.

Naïve Bayes Classifier: The Naïve Bayes classifier was mentioned as a potential classifier for identifying diseases in crops. Naïve Bayes is a simple and probabilistic classification algorithm.

Decision Tree Classifier: The mention of using decision tree classifiers in the future suggests an interest in exploring other machine learning methods for disease identification in crops.

It's important to note that the choice of classifier can significantly impact the accuracy and efficiency of disease identification. While SVM and CNN are well-established choices, Naïve Bayes and decision trees offer different advantages and may be explored for specific applications.

This review indicates a growing interest in using machine learning for plant disease identification and highlights the potential for improving disease detection and diagnosis in the agricultural sector. Different classifiers may be preferred based on the specific requirements of the task, the nature of the data, and the desired level of accuracy.

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