Review on Detection and Prediction of Diseases in Arecanut Trees

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Abstract **- In this study, we propose a method for detecting and predicting diseases in arecanut plants using image processing. The proposed method consists of three main steps: image acquisition, image segmentation, and disease detection and prediction. The performance of the proposed method is evaluated using a dataset of arecanut leaf images with various diseases. The results show that the proposed method can accurately detect and predict the presence of diseases in the arecanut plants with high precision and recall rates.**

Keywords**:** Arecanut, Machine learning, Convolutional neural networks.

1.INTRODUCTION

Arecanut, also known as betel nut, stands as a pivotal cash crop across numerous regions of Asia, boasting significant economic importance for farmers. Yet, the susceptibility of arecanut crops to various diseases poses a considerable threat to agricultural productivity and farmer livelihoods. Among the primary diseases affecting arecanut palms are Bud Rot, Fruit Rot, Yellow Leaf Disease (YLD), and Red Ring Disease, each capable of inflicting substantial damage if left unchecked. Early detection and prediction mechanisms are paramount to mitigate these threats. Implementing regular field surveys, empowering farmers with symptom recognition skills, employing remote sensing technologies, utilizing data analytics for predictive modeling, developing disease-resistant varieties, and adopting Integrated Pest Management (IPM) strategies collectively serve as crucial tactics in disease management. By integrating these approaches, farmers can proactively identify, prevent, and manage diseases in arecanut crops, thereby safeguarding their yields and ensuring sustained profitability. Moreover, ongoing research and collaborative efforts among agricultural stakeholders are vital for continually enhancing disease management practices and securing the long-term viability of arecanut cultivation.

2. LITERATURE SURVEY

In this section, various authors have presented various Image Processing and Deep Learning techniques in Machine Learning.

In [1], identification and categorization of disease in arecanut: a machine learning approach. Utilising a method of machine learning. This article discusses the diagnosis and categorization of diseases in arecanut plants with the use of machine learning, specifically convolutional neural networks (CNNs). The proposed approach uses a proprietary dataset of healthy and ill arecanuts with an 80:20 train-test data ratio.

In [2], a study on identification of coconut diseases using deep learning The key focus is on the various deep learning models in predicting coconut diseases and the severity of damage caused by pests. Additionally, the paper provides specific details about the performance of different machine learning and deep learning models in terms of accuracy and suitability for coconut disease prediction.

In [3], a study on identification of coconut diseases using deep learning The key focus is on the various deep learning models in predicting coconut diseases and the severity of damage caused by pests. Additionally, the paper provides specific details about the performance of different machine learning and deep learning models in terms of accuracy and suitability for coconut disease prediction

In [4], prediction of fruit rot disease incidence in arecanut based on weather parameters. The study compares the performance of these deep learning models with traditional machine learning models and proposes the Vanilla LSTM model as the best prediction model for Arecanut fruit rot disease, with a low MSE of 1.5.

In [5], arecanut diseases dataset creation and validation using machine learning techniques based on weather

parameters. According to the study, random forest regression (RFR) had the best accuracy of all the models with the lowest mean absolute error (MAE) of 0.9. Following feature selection, support vector regression (SVR) got the greatest MAE of 1.7. 945 samples were used to test the dataset, and the prediction models demonstrated accuracy in predicting the severity and incidence of the condition.

In [6], plant disease detection using deep learning. This model uses deep learning (DL) models, specifically Convolutional Neural Network (CNN) and Deep Neural Network (DNN), for the detection and classification of crop diseases.

In [7], detection of diseases in arecanut using convolutional neural networks. Here, the detection of diseases in arecanut is done using Convolutional neural networks (CNN). The dataset consists of 620 images, including healthy and diseased arecanuts and their leaves. The CNN model is trained using 80:20 training and test data split with 50 epochs.

In [8], early prediction of plant diseases using CNN and GAN's. By using CNN to extract information from photos, such as horizontal and vertical edges as well as red, green, and blue values, this model analyses leaf images to detect diseases in plants. These techniques are best suited for fewer categories and typically concentrate on particular situations because even slight system modifications might result in a significant reduction in resolution

In [9], a modern approach for detection of leaf disease using image processing and ML based SVM classifier. The results show that random forest regression provides the lowest mean absolute error, indicating high accuracy. After feature selection, the accuracy of the machine learning models improves, with random forest regression showing the highest accuracy.

In [10], a literature review of the detection and categorization of various arecanut diseases using image processing and machine learning approaches. The study focuses on disease prediction, detection, and classification using techniques such as CNN, SVM, KNN, and image processing methods like segmentation, feature extraction, and disease classification. Additionally, the document presents a SWOC analysis to assess the strengths, weaknesses, opportunities, and challenges associated with the proposed research agenda.

In [11], a mobile based system for detecting plant leaf diseases using deep learning. It draws attention to how important early disease diagnosis is for efficient crop security. In addition to highlighting thresholding approaches, color space conversion, and the usefulness of SVM for disease classification, the document also discusses the use of image recognition systems for crop disease detection.

In [12], arecanut disease detection using image processing technology. The key focus is on the classification of arecanut based on texture features, with the use of various image processing techniques such as Wavelet, Gabor, Local binary (LBP), Gray Level Difference Matrix (GLDM), and Gray Level CoOccurrence Matrix (GLCM) for feature extraction. The system utilises an image acquisition setup with a colour camera and computer vision software, along with the HSI (Hue, Saturation, Intensity) model for feature extraction.

In [13], a literature survey: plant leaf diseases detection using image processing techniques. It highlights the significance of accurate disease detection in the early stages for effective crop protection. The document highlights the use of image recognition systems for crop disease diagnosis, the significance of colour space conversion, thresholding techniques, and the effectiveness of SVM for disease classification.

In [14], crop disease prediction using IoT and Machine learning. The study evaluates different machine learning algorithms and determines that RFC performs better in predicting disease occurrences in crops. It is observed that the RFC algorithm reduces overfitting and increases accuracy compared to other algorithms.

In [15], classification of diseased arecanut based on texture features. This paper discusses discusses the classification of diseased and undiseased arecanut based on texture features, using methods such as Local Binary Pattern (LBP), Haar Wavelets, GLCM, and Gabor.

Authors	Title	Research focus	Remarks
Ajit Hegde et al. [1],2023	Identification and Categorization of disease in Arecanut: a Machine Learning approach	On the identification and categorization of diseases in arecanut plants using a machine learning approach, particularly through the utilization of CNN.	High accuracy CNN model
Kavitha M G et al. [2],2023	A study on identification of Coconut diseases using Deep Learning	On the application of deep learning techniques for the identification and prediction of coconut diseases.	Application of deep learning in coconut disease prediction and prevention.
Balanagouda Patil et al. [3],2022	Exploring the impact of climatic variables on Arecanut fruit rot epidemic by understanding the disease dynamics in relation to Space and Time	On understanding the spatial and temporal dynamics of Arecanut Fruit Rot Epidemic in Karnataka, India, and its correlation with climatic variables.	Understanding the spatio-temporal dynamics and the impact of climatic variables on Arecanut Fruit Rot Epidemic using geostatistical and GLM analysis.
K Rajashree et al. [4],2022	Prediction of fruit rot disease incidence in Arecanut based on weather parameters	Developing deep learning models for predicting fruit rot disease in Arecanut crops using historical weather data.	On the development and comparison of deep learning models, specifically LSTM and GRU variants.
Prema K V et al. [5],2022	Arecanut diseases dataset creation and validation using Machine Learning techniques based on weather parameters	On creating a dataset and developing a prediction model for the incidence of fruit rot disease in areca nut crops based on weather parameters using machine learning techniques.	Early prediction of diseases based on weather parameters
Kowshik B et al. [6],2021	Plant disease detection using Deep Learning	On the use of deep learning techniques,particularly CNN and DNN.	The automated detection and classification of plant diseases using leaf images
Karibasaveshwara T G et al. [7], 2021	Detection of diseases in arecanut using Convolutional Neural Networks	The early detection of diseases in arecanut plants using Convolutional Neural Networks and the development of a system to suggest remedies for the detected diseases.	Using Convolutional Neural Networks for early detection of diseases in arecanut plants and providing remedies for the detected diseases.
Ahmed Ali Gomaa et al. [8], 2021	Early prediction of plant diseases using CNN and GAN's	On the application of image processing technology for the detection and classification of arecanuts, with an emphasis on automating disease detection and accuracy.	The application of image processing technology for the detection and classification of areca nuts, focusing on automating disease detection and accuracy.
Nitin Purohitb et al. [9],2021	A modern approach for detection of leaf disease using Image processing and ML based SVM classifier	On the modern approach for detecting leaf diseases using image processing and machine learning-based SVM classifier.	Emphasizing the four main stages of preprocessing, segmentation, feature extraction, and disease classification.

Puneeth B R et al. [10],2021	A literature review of the detection and categorization of various Arecanut diseases using Image processing and Machine learning approaches	On the detection and categorization of various arecanut diseases using image processing and machine learning approaches	Addressing critical gaps in arecanut disease identification, and quality assessment through innovative technology and machine learning approaches.
Gopireddy Harshavardhan Reddy et al.[11],2021	A Mobile based system for detecting plant leaf diseases using Deep Learning	On developing a mobile-based system for detecting plant leaf diseases using deep learning.	High accuracy Deep Learning model.
Dhanuja K C et al. [12],2020	Arecanut disease detection using image processing technology	On the early prediction of plant diseases using deep learning models, specifically CNN and GANs.	Early plant disease prediction.
K.Narsimha Reddy et al. [13],2020	A literature survey: Plant leaf diseases detection using Image processing techniques	A comprehensive survey of various image processing techniques used for the detection and classification of plant leaf diseases.	Comprehensive survey on plant disease.
Vikram Kumar et al. [14],2020	Crop disease prediction using IoT and Machine learning	On using IoT and machine learning to predict crop diseases based on environmental conditions.	Aiming to aid farmers in taking proactive measures to prevent crop damage.
Suresha M et al. [15],2014	Classification of diseased Arecanut based on texture features	On the classification of diseased and undiseased arecanut using texture features and a kNN classifier	Aiming to automate the labor-intensive and inconsistent manual sorting process.

3.CONCLUSION

This research presented a survey showing that CNN outperforms ANN in categorization. While BNN classification can be utilised in embedded systems, requiring less memory and enabling faster calculation, its accuracy is not as high as that of CNN. It is still possible to improvise in CNN even when using the basic CNN algorithms. With up to 152 layers, ResNet is the most well-liked and effective model for image processing. This is capable of handling the vanishing gradient issue as well. Therefore, for optimal results, a customised CNN model using ResNet can be created.

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