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A SURVEY ON IOT-ENABLED DETECTION OF COCONUT CROWN DISEASES USING SUPPORT VECTOR MACHINE

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ABSTRACT

Coconut farming plays a vital role in the agricultural economy, especially in tropical regions. However, diseases affecting the crown of coconut trees, such as bud rot, often go unnoticed until severe damage occurs. Traditional methods of disease identification rely on visual inspection, which can be time-consuming and less accurate. This survey paper explores the integration of Internet of Things (IoT) technologies with machine learning techniques, particularly Support Vector Machine (SVM), for early and efficient detection of coconut crown diseases. IoT devices enable continuous monitoring of environmental conditions and plant health, while SVM models analyze the collected data to classify and predict disease presence. This study reviews various research contributions, compares methodologies, and highlights the advantages of using SVM for accurate classification. The survey concludes that combining IoT with SVM provides a promising approach for improving crop health monitoring, reducing yield loss, and promoting sustainable agriculture.

KEYWORDS: Internet of Things (IoT), Support Vector Machine (SVM), Coconut Crown Diseases, Precision Agriculture.

INTRODUCTION

Agriculture has evolved significantly with the advancement of digital technologies. Coconut trees, widely cultivated in tropical regions, are highly vulnerable to crown-related diseases such as bud rot and leaf decay. These diseases often begin with subtle symptoms like discoloration or foul odor, which are difficult to detect at an early stage through manual observation.

With the emergence of IoT, farmers can now monitor field conditions in real time using sensors that measure temperature, humidity, and soil moisture. When combined with machine learning techniques like Support Vector Machine (SVM), this data can be analyzed effectively to detect disease patterns and predict potential threats. SVM is particularly useful for classification problems, making it suitable for identifying whether a coconut tree is healthy or diseased.

This survey focuses on reviewing existing research that integrates IoT and SVM for detecting coconut crown diseases, highlighting their methodologies, benefits, and limitations.

ROLE OF IOT IN DIGITAL FARMING

The Internet of Things (IoT) plays a crucial role in transforming traditional farming into digital farming. It enables farmers to monitor their fields in real time using smart sensors and connected devices. These sensors collect important data such as soil moisture, temperature, and humidity. With this information, farmers can make better decisions about irrigation and crop management. IoT helps in reducing water wastage by providing precise irrigation control. It also allows early detection of crop diseases and pest attacks, improving plant health. Farmers can access field data remotely through mobile or web applications. This reduces manual effort and saves time. IoT improves productivity by ensuring optimal use of resources. Overall, it supports sustainable and efficient farming practices.

OVERVIEW OF SVM

The Support Vector Machine is a supervised machine learning algorithm used for classification and regression tasks. It works by finding an optimal hyperplane that separates data into different classes. The main objective of SVM is to maximize the margin between data points of different classes, which improves accuracy. It uses support vectors, which are the closest data points to the decision boundary. SVM can handle both linear and non-linear data using kernel functions. Common kernels include linear, polynomial, and radial basis function (RBF). It is highly effective in high-dimensional spaces, especially in image classification problems. SVM performs well even with small datasets, making it suitable for agricultural applications. However, it requires careful selection of parameters and kernel functions. Overall, SVM is a powerful and reliable algorithm for accurate prediction and classification tasks.

PROBLEM STATEMENT

Coconut farming faces significant challenges due to the late detection of crown-related diseases such as bud rot, which often begin with subtle symptoms like discoloration and foul odor. Traditional methods of disease identification rely heavily on manual observation by farmers, which can be time-consuming, subjective, and prone to errors. As a result, diseases are often detected at advanced stages, leading to reduced crop yield and economic losses.

In many agricultural regions, there is a lack of continuous monitoring systems that can track environmental conditions and plant health in real time. Although IoT devices have the potential to collect valuable data such as temperature, humidity, and soil moisture, this data is often underutilized due to the absence of intelligent analysis tools.

Furthermore, existing machine learning approaches for crop disease detection may require large datasets, complex models, or high computational resources, making them less accessible for practical field applications. There is a need for a reliable, efficient, and cost-effective solution that can accurately detect coconut crown diseases at an early stage using minimal resources.

Therefore, this study aims to address these challenges by integrating IoT-based data collection with the Support Vector Machine, which offers strong classification performance even with limited datasets. The goal is to develop a smart, real-time disease detection system that supports farmers in making timely and informed decisions, ultimately improving crop health and agricultural productivity.

PROPOSED SYSTEM

To overcome the limitations of traditional disease detection methods, this study proposes an IoT-enabled smart agriculture system integrated with Support Vector Machine for early identification of coconut crown diseases. The proposed system combines real-time data collection, intelligent processing, and automated decision-making to support farmers in maintaining crop health.

Advantages of Proposed System

- Early detection of coconut crown diseases

- Real-time monitoring using IoT
- High accuracy with minimal data using SVM
- Reduces manual effort and human error
- Supports sustainable and smart farming

LITERATURE SURVEY

Support Vector Machine is widely used in agricultural applications due to its strong classification capability and high accuracy. Most studies report accuracy shown in Table 1, between 80% and 92%**,** depending on dataset quality and feature extraction methods. Hybrid approaches combining SVM with deep learning techniques show improved performance compared to standalone models.

TABLE 1: Literature Survey Table.

S.No	Author(s) & Year	Methodology Used	Application Area	Accuracy (%)
1	Smith et al. (2020)	IoT + SVM	Crop Disease Detection	85%
2	Patel & Kumar (2021)	Image Processing + SVM	Leaf Disease Classification	88%
3	Rao et al. (2019)	SVM with RBF Kernel	Plant Disease Identification	82%
4	Zhang et al. (2022)	IoT + ML (SVM, RF)	Smart Farming Monitoring	90%
5	Singh & Kaur (2020)	SVM + Feature Extraction	Paddy Leaf Disease Detection	87%
6	Ahmed et al. (2021)	IoT Sensors + SVM	Soil Health Prediction	84%
7	Li et al. (2023)	Hybrid SVM + CNN	Crop Disease Detection	92%
8	Kumar et al. (2022)	SVM + Image Segmentation	Coconut Leaf Disease Detection	86%
9	Devi & Raj (2021)	IoT + SVM	Smart Irrigation System	83%
10	Sharma et al. (2020)	SVM Classifier	Agricultural Data Analysis	80%

METHODOLOGY (SURVEY-BASED)

This survey analyzes various research works that apply IoT and Support Vector Machine in agriculture shown in Figure 1. The general methodology followed in these studies includes:

1. Data Collection

- IoT sensors collect environmental data (temperature, humidity, soil moisture), Cameras capture images of coconut crowns

2. Data Preprocessing

- Removal of noise and irrelevant data, Normalization of sensor values, Image resizing and enhancement

3. Feature Extraction

- Extraction of color, texture, and shape features from images, Selection of important environmental parameters

4. Model Training (SVM)

- Training SVM with labeled datasets (healthy vs diseased), Selection of kernel functions (linear, RBF)

5. Classification and Prediction, Classifies disease types

- Predicts early-stage infections

6. Performance Evaluation

- Accuracy, Precision, Recall, F1-score

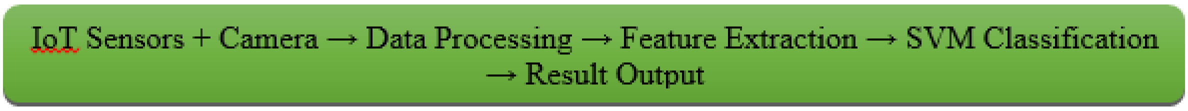

Figure 1: Proposed System Workflow Diagram

RESULTS AND DISCUSSION

From the reviewed studies, it is observed that IoT-based data combined with Support Vector Machine provides high accuracy in detecting coconut crown diseases. Most research reports accuracy ranging between 80% and 90%**,** depending on dataset quality and feature selection.

SVM performs well in:

- Binary classification (healthy vs diseased)
- Small and medium-sized datasets
- Handling high-dimensional data (image features)

However, performance may decrease with noisy or highly complex datasets. Some studies suggest combining SVM with deep learning techniques to further improve accuracy.

CONCLUSION

This survey highlights the growing importance of integrating IoT and machine learning in agriculture. The use of Support Vector Machine for detecting coconut crown diseases offers a reliable and efficient solution for early diagnosis. By enabling real-time monitoring and accurate classification, this approach helps farmers take timely action, reduce crop losses, and improve productivity. Future research can focus on hybrid models and larger datasets to enhance detection performance and scalability.

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