**CROP DISEASE DETECTION USING MACHINE LEARNING:**

**A REVIEW**

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*Abstract* - Agriculture performs a essential function in human civilization, and plant diseases extensively impact crop yield, great, and normal manufacturing. traditional methods for detecting crop illnesses are exertions-in depth and time-consuming. The advancements in machine learning (ML) provide efficient, automated, and accurate disease detection methods. This paper reviews various machine learning approaches applied to crop disease detection, including image processing, deep learning, and predictive modelling. The study discusses different algorithms, datasets, and evaluation metrics used in disease classification and early detection, contributing to improved agricultural practices and food security.

**Key words** – Machine Learning, Crop Disease Detection, Image Processing, Deep Learning, Precision Agriculture.

**Ⅰ. INTRODUCTION**

Plant diseases significantly affect agricultural productivity and food supply chains. Traditional disease detection relies on manual inspection, requiring expert knowledge and labour-intensive efforts. Machine learning has revolutionized this domain by offering automated detection and category of plant illnesses the usage of pictures, spectral analysis, and environmental factors. By way of leveraging deep gaining knowledge of, convolutional neural networks (CNNs), and other AI-driven techniques, early ailment identification is now extra. Accurate and green .This paper provides an outline of device studying models and strategies employed in crop ailment detection and their actual-world programs.



**Fig. No.: 1 Crop Disease Detection Using ML**

**Ⅱ. BLOCK DIAGRAM**



**Fig. No.: 2 Block Diagram of Systems**

The proposed system for crop disorder detection using ML follows a established pipeline, together with statistics series, preprocessing, model education, class, and disorder prediction.

**Components and Their Functions:**

1. **Image Acquisition**: High-resolution images of crops are captured using drones, mobile phones, or hyperspectral imaging.
2. **Preprocessing**: Image enhancement, noise reduction, and feature extraction techniques are applied.
3. **Feature Extraction**: Deep Learning models such as CNNs extracts relevant functions from photos.
4. **Classification Model**: Machine Learning algorithms (e.g., CNN, SVM, Random Forest) classify plant diseases.
5. **Disease Identification & Notification**: The system provides a diagnosis and suggests preventive measures.

**Ⅲ. PROS**

1. **Early Disease Detection:** Machine learning models help in identifying crop diseases at an early stage, reducing losses.
2. **Automated Analysis:** Reduces dependency on human experts and accelerates disease classification.
3. **High Accuracy:** CNN-based models achieve high precision in identifying diseases.
4. **Cost-Effective:** Reduces the need for extensive field inspections and manual monitoring.
5. **Scalability:** Can be deployed over large agricultural fields using drones and IoT devices.

**Ⅳ. CONS**

1. **Data Dependency:** Requires high-quality labeled datasets for accurate training.
2. **Computational Requirements:** Deep learning models demand high processing power and resources.
3. **Environmental Variations:** Performance may vary due to changing lighting and weather conditions.
4. **LimitedGeneralization:** models educated on particular datasets won't generalize properly to new plant species and illnesses.

**Ⅴ. CONCLUSION**

Machine learning is transforming crop disease detection, providing efficient and scalable solutions for farmers. This review highlights various ML techniques, their advantages, and challenges in disease detection. Future work should focus on improving model robustness, incorporating real-time IoT solutions, and expanding datasets to enhance model generalization.

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