

# AgroMind: AI-Based Plant Health and Stress Analysis System Using Deep Learning

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**Abstract:** Agriculture faces significant challenges in early detection of plant diseases and stress conditions, leading to substantial crop losses and reduced agricultural productivity. Traditional methods of plant health assessment rely on manual inspection by experts, which is time-consuming, subjective, and often unavailable to small-scale farmers. This paper presents AgroMind, an innovative AI-based system that leverages deep learning techniques for automated plant health and stress analysis. The system employs Convolutional Neural Networks (CNN) for accurate plant disease detection across 38 different disease classes spanning 13 crop types including tomato, potato, apple, corn, and grape. Additionally, Long Short-Term Memory (LSTM) networks analyze temporal sensor data to predict plant stress conditions based on environmental parameters. The system provides real-time disease identification with confidence scores, treatment recommendations, and explainable AI features that help farmers understand the reasoning behind diagnoses. Experimental results demonstrate high accuracy in disease classification and stress prediction, making it a practical solution for precision agriculture. The system's web-based interface ensures accessibility for farmers across different technological backgrounds, contributing to sustainable farming practices and improved crop yields.

**Keywords:** Artificial Intelligence, Plant Disease Detection, Deep Learning, Convolutional Neural Networks, LSTM, Precision Agriculture, Computer Vision

