AI-Driven Agriculture: A Comprehensive Review of Machine and Deep Learning Applications

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ABSTRACT

Purpose: This study assesses and consolidates Artificial Intelligence (AI) and robotic-based farm automation advancements, focusing on machine learning (ML) and deep learning (DL). The paper compares AI algorithms and architectures for plant disease detection, weed and crop identification, fruit counting, land cover classification, and crop and plant recognition.

Design/methodology/approach: This article analyses the current ML and DL algorithm advances in agricultural robotics over the last decade using a systematic literature review. Region-based Convolutional Neural Networks (RCNN), ResNet-18, and Fully Convolutional Networks (FCN) are compared to traditional ML algorithms like Multi-Layer Perceptron (MLP), K-nearest Neighbour (KNN), Random Forest (RF), and Support Vector Machine (SVM) to determine their precision and effectiveness.

Findings: RCNNs identify plant diseases at 79.78% vs 57.18% for MLP and KNN. ResNet-18 has a high Area Under the Curve (AUC) of 91.74% for crop-weed separation. This discriminates better than RF and SVM. FCN outperforms SVM and RF in land cover classification at 84.9%. The data show that DL techniques improve agricultural automation very well.

Practical implications: This investigation shows that DL algorithms can considerably improve agricultural automation. Agriculture professionals may enhance disease identification, crop classification, and land coverage analysis by using advanced DL models.

Originality value: This paper analyses the current ML and DL breakthroughs in agricultural automation to expand knowledge. It offers fresh viewpoints on AI model efficacy and highlights key research areas.

Keywords: *AI-Driven Agriculture, Machine Learning, Deep Learning, Agricultural Robotics, Systematic Review*