

Intelligent crop management system for improving yield in maize production: evidence from India

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Abstract

Purpose – Managing weeds and pests in cropland is one of the major concerns in agriculture that greatly affects the quantity and quality of the produce. While the success of preventing potential weeds and pests is not guaranteed, early detection and diagnosis help manage them effectively to ensure crops' growth and health

Design/methodology/approach – We propose a diagnostic framework for crop management with automatic weed and pest detection and identification in maize crops using residual neural networks. We train two models, one for weed detection with a labeled image dataset of maize and commonly occurring weed plants, and another for leaf disease detection using a labeled image dataset of healthy and infected maize leaves. The global and local explanations of image classification are obtained and presented

Findings – Weed and disease detection and identification can be accurately performed using deep-learning neural networks. Weed detection is accurate up to 97%, and disease detection up to 95% is made on average and the results are presented. Further, using this crop management system, we can detect the presence of weeds and pests in the maize crop early, and the annual yield of the maize crop can potentially increase by 90% theoretically with suitable control actions

Practical implications –The proposed diagnostic models can be further used on farms to monitor the health of maize crops. Images obtained from drones and robots can be fed to these models, which can then automatically detect and identify weed and disease attacks on maize farms. This offers early diagnosis, which enables necessary treatment and control of crops at the early stages without affecting the yield of the maize crop

Social implications – The proposed crop management framework allows treatment and control of weeds and pests only in the affected regions of the farms and hence minimizes the use of harmful pesticides and herbicides and their related health effects on consumers and farmers.

Originality/value – This study presents an integrated weed and disease diagnostic framework, which is scarcely reported in the literature
Keywords Maize, Residual neural network, Local interpretable model-agnostic explanations, Weed control, Pest control, Productivity
Paper type Research paper

Journal Name: International Journal of Productivity and Performance Management

Year: April 2024

Keywords: Adoption; Barriers; Electric vehicle; Electric transportation; Fuzzy-AHP; Stakeholders

DOI: DOI 10.1108/IJPPM-11-2023-0620