ABSTRACT

Protecting maize crops from devastating plant diseases ensures global food security. Accurate disease identification is essential for implementing effective control measures. However, traditional visual analysis of symptomatic leaves used by maize farmers in Kenya is time-consuming, costly, subjective and prone to errors. Embracing computer vision technologies, such as deep learning and machine learning, offers promising solutions to these challenges, enhancing crop productivity. The general objective of this study was to develop models for maize lethal necrosis (MLN) disease, maize streak disease (MSD) and Gray leaf spot diseases (GLS) detection and classification using AlexNet and ResNet 50 convolutional neural networks (CNN) architectures and machine learning Support Vector Machine (SVM). The specific objectives of this study were to: identify maize leaf disease (MLN, MSD and GLS) using AlexNet, ResNet-0 and SVM models, to evaluate the performance of the AlexNet, ResNet-50 and SVM models in the classification of MLN, MSD and GLS. Digital maize leaf disease images were collected from maize farms in Embu County, resulting in a dataset of 3200 images, with 800 images for each disease category. The results indicate that AlexNet and ResNet50 achieved high accuracy in identifying maize leaf diseases, recording average accuracies of 98.3% and 96.6%, respectively. In contrast, the SVM model exhibited the lowest average accuracy of 85.5%. AlexNet demonstrated exceptional accuracy in classifying Maize Streak Virus (MSV) with a rate of 99.85%, followed by ResNet50 at 99.2%. Conversely, SVM had a lower recall value of 81.7% for Grey Leaf Spot disease. By incorporating these advanced models, farmers and stakeholders in maize crop protection can identify diseases early, allowing for timely interventions and improved disease management strategies. Consequently, this will lead to increased maize productivity and enhanced crop quality. Early disease detection also facilitates the judicious use of pesticides, safeguarding the environment and human health. The findings underscore the importance of leveraging these technologies to enhance food security, optimize agricultural practices, and promote sustainable maize production.