Chapter 14
Machine Learning Algorithms for Predictive Pest Modeling

Muhammad Umair Sial
https://orcid.org/0000-0002-5865-8927
Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Rashad Rasool Khan
Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Rizwan Ahmed
Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Zain ul Abdin
Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Umm E. Ummara
Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad, Pakistan

ABSTRACT

Effective management of crop pests is crucial due to their detrimental impact on productivity. Therefore, it is imperative to prioritize early detection and prevention strategies. Machine learning methodology is being employed to forecast crop pests by utilizing data from different modalities. The utilization of machine learning applications is significantly influencing the worldwide economy through the alteration of data processing techniques and decision-making processes. It devises effective techniques for automatically detecting, identifying, and forecasting pests and diseases in agricultural crops. The objective of this chapter is to enhance the advancement

DOI: 10.4018/979-8-3693-3061-6.ch014

of smart farming and precision agriculture by advocating for the development of techniques that enable farmers to enhance the quality and yield of their crops.

INTRODUCTION

By utilising the principles of precision agriculture and remote pest detection, farmers are able to implement suitable strategies to mitigate the presence of insects or decrease the overall insect population. When insect populations go beyond the economical threshold, this will affect plant productivity hence causing a reduction in crop yield. On the other hand, information about the pest occurrence and abundance is essential in avoiding unnecessary use of pesticide that would only waste resources and endanger the environment. The actual determination of pests in a given area involved the assessment of adhesive planes within insect traps, typically with assessments performed via count on captivated insects. The setting up of an initial strategy in such a manner requires human intervention in the form of daily checking of the trap sticky bases which of course are capital intensive exercises involve time, petrol and cars among others. This is because traps can be placed or sited over a very large geographical area which makes them very effective. To this effect, the technology that is central to the use of precision agriculture is being utilized to remotely monitor the conditions inside the bug trap irrespective of where the latter is situated. This paper offers a detailed discussion on several methodologies and sensors used in the automation of the identification and monitoring of pest insects (Lima et al., 2020). The main goal was to spot pests using infrared sensors acoustic sensors, and image-based sorting methods. The talk also showed new progress in machine-learning techniques. The use of machine learning (ML) is growing in precision farming to handle large amounts of data from remote sensing tools (Chlingaryan et al., 2018).

Predictive analytics plays a key role in looking at current and past data to forecast future events or unexpected situations with high accuracy (Mishra & Silakari, 2012). It uses many different methods, including data mining, stats, and machine learning. Machine learning, a big part of AI, works to make statistical and analytical models run on their own. This lets computers learn from data, spot patterns, and make predictions without much human help. Some of the most common machine learning methods used in predictive analytics are logistic regression, K-nearest neighbor, support vector machines (SVM), decision trees random forest, and naive bayes (Kendale et al., 2018; Rajeshkanna et al., 2020). We need machine learning predictive analytics in many real-world areas like healthcare, industry, finance, farming, education social media, cyber security, and text mining. Machine learn-