Chapter 14
Automated Plant Disease Detection Using Efficient Deep Ensemble Learning Model for Smart Agriculture

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ABSTRACT

Early diagnosis of plant diseases is essential for successful plant disease prevention and control, as well as agricultural production management and decision-making. In this research, an efficient weighted average deep ensemble learning (EWADEL) model is used to detect plant diseases automatically. Transfer learning (TL) is a technique used to enhance existing algorithms. The performances of several pre-trained neural networks with DL such as ResNet152 DenseNet201, and InceptionV3, in addition to the usefulness of a weighted average ensemble models, are demonstrated for disease linked with leaf identification. To that aim, a EWADEL methodology is being researched in order to construct a robust network capable of predicting 12 different diseases of apple, Pomegranate, and tomato crops. Several convolutional neural network architectures were examined and ensemble to increase predictive performance using the EWADEL. In addition, the proposed approach included an examination of several deep learning models and developed EWADEL models.

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INTRODUCTION

The effect of global warming has grown substantially in recent years. It is impacting all stages of cultivation and requiring farmers to adjust and adapt their agricultural practises through the use of new data-driven technology. As biotic and abiotic stressors are the limiting elements of agricultural output, disease of plants prediction has become a research focus. Instead of depending solely on an outside expert, technology instruments may now be used to assess whether a plant has a disease and what type of sickness it isAs the quality of picture collection by technological equipment increases, object identification, categorization, processing of images, and computational intelligence algorithms yield astoundingly good results Khan, R.U. (2021). Traditional optimisation and predictions approaches are outperformed by ML and DL. For starters, these systems can learn from vast volumes of data automatically, whereas older methods need human feature extraction and are restricted by data quantity. Second, unlike previous approaches, ML and DL models generalise effectively to new data. Third, ML and DL models, unlike previous approaches, can learn complicated, non-linear data connections. As a result, ML is superior at dealing with numerous variables, particularly complicated interactions. Artificial intelligence applications have been widely used in a wide range of fields. In this situation, precise and prompt identification and categorization of illnesses in plants is critical. Artificial intelligence advancements now allow for automated plant disease identification from raw images.

To categorise illnesses in plant leaves, this chapter investigates DL approaches, which are a subtype of ML techniques. Conventional ML approaches use human feature development to train classification algorithms, whereas DL techniques discover the features dynamically from the image itself. This chapter investigates a range of cutting-edge deep learning models for diagnosing and classifying diseases of plants using pictures from the Plant Village data set in addition to images collected individually (Domingues et al.2022). A database may be expanded using techniques like data augmentation, which employs rotation, flipping, and contrast. Three different and effective deep learning models, namely ResNet 152, Dense Net201, and InceptionNetv3, are evaluated and trained on these images. The performance study is conducted using accuracy metrics, and the top-performing deep learning model is ultimately selected. An efficient Weighted deep ensemble Learning (EWADEL) model which make it more efficient to achieve improved accuracy. Finally, the EWADEL model will be compared with its original version to prove the efficacy. The validation and results of the EWDEL model is also discussed in detail in this chapter.

LITERATURE SURVEY

This paper Javidan et.al (2023) provides a unique weighted majority voting ensemble strategy for detecting tomato leaves by distinguishing red, green, and blue pictures. As basic classifiers, six machine learning approaches were used. The proposed methods were then employed to improve sickness classification, with precision rates of 93.49% and 95.58%, correspondingly. The suggested technique's performance was compared to two well-known DL algorithms, which produced poor results. The suggested framework based on weighted majority voting beat the underlying ML, according to the study's findings. An infection identification method for crops has been developed employing either diseased and healthy leaves from different plant classes during this investigation Kondaveeti, et.al (2023). The fundamental models achieved accuracy levels below 90% based the crop illness data. The core algorithms now contain hard and soft voting categories to increase the system's accuracy. Soft voting entails examining the antici-