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Optimized Deep Learning Model for Disease Prediction in Potato Leaves

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Abstract

Food crops are important for nations and human survival. Potatoes are one of the most widely used foods globally. But there are several diseases hampering potato growth and production as well. Traditional methods for diagnosing disease in potato leaves are based on human observations and laboratory tests which is a cumbersome and time-consuming task. The new age technologies such as artificial intelligence and deep learning can play a vital role in disease detection. This research proposed an optimized deep learning model to predict potato leaf diseases. The model is trained on a collection of potato leaf image datasets. The model is based on a deep convolutional neural network architecture which includes data augmentation, transfer learning, and hyper-parameter tweaking used to optimize the proposed model. Results indicate that the optimized deep convolutional neural network model has produced 99.22% prediction accuracy on Potato Disease Leaf Dataset.

Keywords: Deep Learning, Artificial Intelligence, Machine Learning, Deep Convolutional Neural Network, Optimized Deep Convolutional Neural Network Model, Disease Prediction

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1. Introduction

In recent years, food production has been heavily impacted due to plant diseases. Plant diseases are caused by climate change, adverse impact on the environment, heavy usage of fertilizers and so on. Climate change has severely impacted potato yield due to a variety of diseases. The most destructive diseases in potato leaves are late blight and early blight. These diseases have largely emerged in the last few years [1] due to many reasons including climate change. The infections that damage plants, starting in the leaves before spreading to the entire plant, are the major causes of the yield decline in potato production. Potatoes are a largely consumed food item in the world. According to a report published in Statista, over 376 million metric tons of potatoes were produced in 2021 which is down 2% from 2020 crop [2]. Farmers heavily rely on human inspection to identify potato leaves diseases which are time consuming and have a high chance of error. In the present technological era, the use of new age technologies such as artificial intelligence (AI), deep learning, and computer vision (CV) etc. are very advantageous to speed up the potato disease prediction process. AI and deep learning have witnessed immense surge in the agriculture domain due to its capabilities of image identification, processing, image classification and image prediction [3].

A kind of machine learning [4-6] called deep learning (DL) has been demonstrated to be particularly good at

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