

## Research Article

# An Intelligent System for Cucumber Leaf Disease Diagnosis Based on the Tuned Convolutional Neural Network Algorithm

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Received 8 July 2022; Revised 22 November 2022; Accepted 7 December 2022; Published 22 December 2022

Academic Editor: Sebastian Podda

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In agriculture farming, pests and other plant diseases are the most imperative factor that causes significant hindrance to cucumber production and its quality. Farmers around the globe are currently facing difficulty in recognizing various cucumber leaf diseases, which is imperative to preventing leaf diseases effectively. Manual techniques to diagnose cucumber diseases are often time-consuming, subjective, and laborious. To address this issue, this paper proposes a tuned convolutional neural network (CNN) algorithm to recognise five cucumber diseases and healthy leaves that comprises image enhancement, feature extraction, and classification. Data augmentation methods were utilized as a preprocessing step to enlarge the datasets, and it was also to decrease the chance of overfitting. Automatically features are extracted by using CNN layers. Finally, five cucumber leaf diseases and one healthy leaf are classified. Furthermore, to overcome the lack of a public dataset, a new dataset of cucumber leaf diseases has been constructed that includes spider, leaf miner, downy mildew, powdery mildew, one viral disease, and healthy class leaves. The dataset has a total of 4868 cucumber leaf images. In order to prove the authenticity of the proposed CNN, comparative experiments were conducted using pretrained models (AlexNet, Inception-V3, and ResNet-50). The proposed CNN achieves a recognition accuracy of 98.19% with the augmented dataset and 100% with the publicly plant disease dataset. The experimental results confirm that the proposed CNN algorithm was efficient for recognizing the cucumber leaf diseases compared with other algorithms.

## 1. Introduction

The agricultural sector is considered one of the strongest pillars and has a crucial role in the economic development of many countries; developed and developing countries' economies are particularly dependent on the profitability of agricultural production. This sector will provide employment opportunities to many employers in rural areas and provide breathable oxygen, contribute to producing food, and be used in medicine and industry.

Due to several factors in the agriculture field, farmers cannot simply control the weather and other environmental conditions that are affecting agricultural crops. Plant

diseases are one of the principal serious and longstanding problem factors that have to be considered in the case of farming practices. It has a devastating effect on interrupting normal plant growth, production quality, quantity, and economic loss.

Nowadays, one of the widely used plant spices is cucumber. The cucumber is a broadly cultivated plant in the gourd family, Cucurbitaceae, and the most globally nutritious and favourite vegetable in the world, which is quick and easy to grow in a short period of time and easily grows in temperate regions. Cucumbers are seriously affected by diseases due to nonbiological factors, the impact of various factors, and a bad ecological environment. This has a major