

Chapter 6

Comparative Analysis of Detection of Diseases in Apple Tree Leaves Using ResNet and CNN

S. Aditi Apurva

 <https://orcid.org/0000-0002-1730-8592>

Indian Institute of Information Technology, Ranchi, India

ABSTRACT

The modern era has become an era of machine learning as an essential tool for developing IoT (internet of things) application. Machine learning for IoT can be used to depict future trends, detect anomalies, and argument intelligence by ingesting images, videos, and audios. Introducing IoT and machine learning in agricultural has empowered farmers to make and take well informed decision in optimal resource utilization as well as mitigation of pest and disease control. IoT and machine learning has aided in revolutionizing the farming sector. IoT sensors placed in the soil measure parameters like moisture content, pH levels, and nutrient levels. This chapter delves into a comparative analysis of two deep learning architectures, the residual neural network (ResNet), and convolutional neural network (CNN), for detecting diseases in apple tree leaves. By employing these models, the study aims to determine their performance in accurately identifying and classifying diseased apple tree leaves against healthy ones.

DOI: 10.4018/979-8-3693-1686-3.ch006

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INTRODUCTION

The modern era has become an era of machine learning as an essential tool for developing IoT (Internet of Things) application. Machine Learning for Internet of Things can be used to depict future trends, detect anomalies and argument intelligence by ingesting images, videos and audios. Introducing Internet of Things and Machine Learning in agricultural has empowered farmers to make and take well informed decision in optimal resource utilization as well as mitigation of pest and disease Control. Internet of Things and machine learning has aided in revolutionizing the farming sector. Internet of Things sensors placed in the soil measure parameters like moisture content, pH levels, and nutrient levels. Machine learning models can analyze these data to predict optimal planting times, irrigation schedules, and nutrient supplementation.

Internet of Things weather stations collect real-time weather data from the farm and with the help of Machine learning models can predict weather patterns, helping farmers make informed decisions about planting, harvesting, and irrigation. Internet of Things devices equipped with cameras and sensors can capture images of crops. Machine learning algorithms can analyze these images to detect early signs of diseases, pests, or nutrient deficiencies. Farmers receive real-time alerts, enabling timely interventions.

Traditionally the farmers used to detect disease and healthy plants manually by extracting the color, texture, and shape features of diseased leaf images (Mahlein *et al.*, 2013) (Yuan *et al.*, 2014) (Qin *et al.*, 2016) (International Journal of Computer Science & Network Security, n.d.) due to which there was a lack in keeping track of the important parameters such as soil type, humidity, temperature amount of macro and micro nutrients in the soil and nutrients requirement of the crop.

Apple cultivation faces considerable challenges due to various diseases affecting its leaves. The accurate and timely detection of diseases in apple plant-leaves will be of paramount importance for ensuring optimal crop health and maximizing agricultural productivity.

This paper aims to contribute a chapter presenting an overview of comparative analysis of Convolutional Neural Networks (CNNs) (Murali & Nagaraju, 2023) (Jianxin, 2017) (Aghdam & Heravi, 2017) (Albawi & Al-Zawi, 2107) with Residual Neural Network (ResNet) (Li & Rai, 2020) (Alsayed & Arif, 2021) for the automated detection of diseases in apple plant leaves.

ResNet, stands for “Residual Network”. It is a deep neural network architecture which is designed to address the challenges of training very deep neural networks. It was introduced by Kaiming He et al. in the paper titled “Deep Residual Learning for Image Recognition” in 2015. ResNet is particularly well-known for its success

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