

Real-Time Plant Leaf Diseases Detection and Identification using a Convolutional Neural Networks on an Embedded Platform

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Abstract

Plant diseases are responsible for the major production reduction and economic losses in agriculture. In the field of agriculture, real-time detection and classification of plant leaf diseases is highly desired. For this work proposed a machine learning approach that is based on improved convolutional neural networks (CNNs) for real-time detection of plant leaf diseases. The proposed system has been achieved higher accuracy comparative to AlexNet.

Introduction

As shown in Figure 1, our proposed system is able to estimate the class based on the probability of a plant leaf disease and its location in the image display as a bounding box containing the infected area of the plant.



Figure 1: System Flow of plant leaf detection and disease classification

Main Objectives

- Analysis as well as exploration of different plant disease dataset.
- Real-time detection of crop diseases using trained SSD MobileNet.
- Real-time plant disease classification using proposed trained convolutional neural networks (CNNs).
- Deployment of the developed Machine Learning algorithm on different Embedded platforms for inference.

Proposed Method

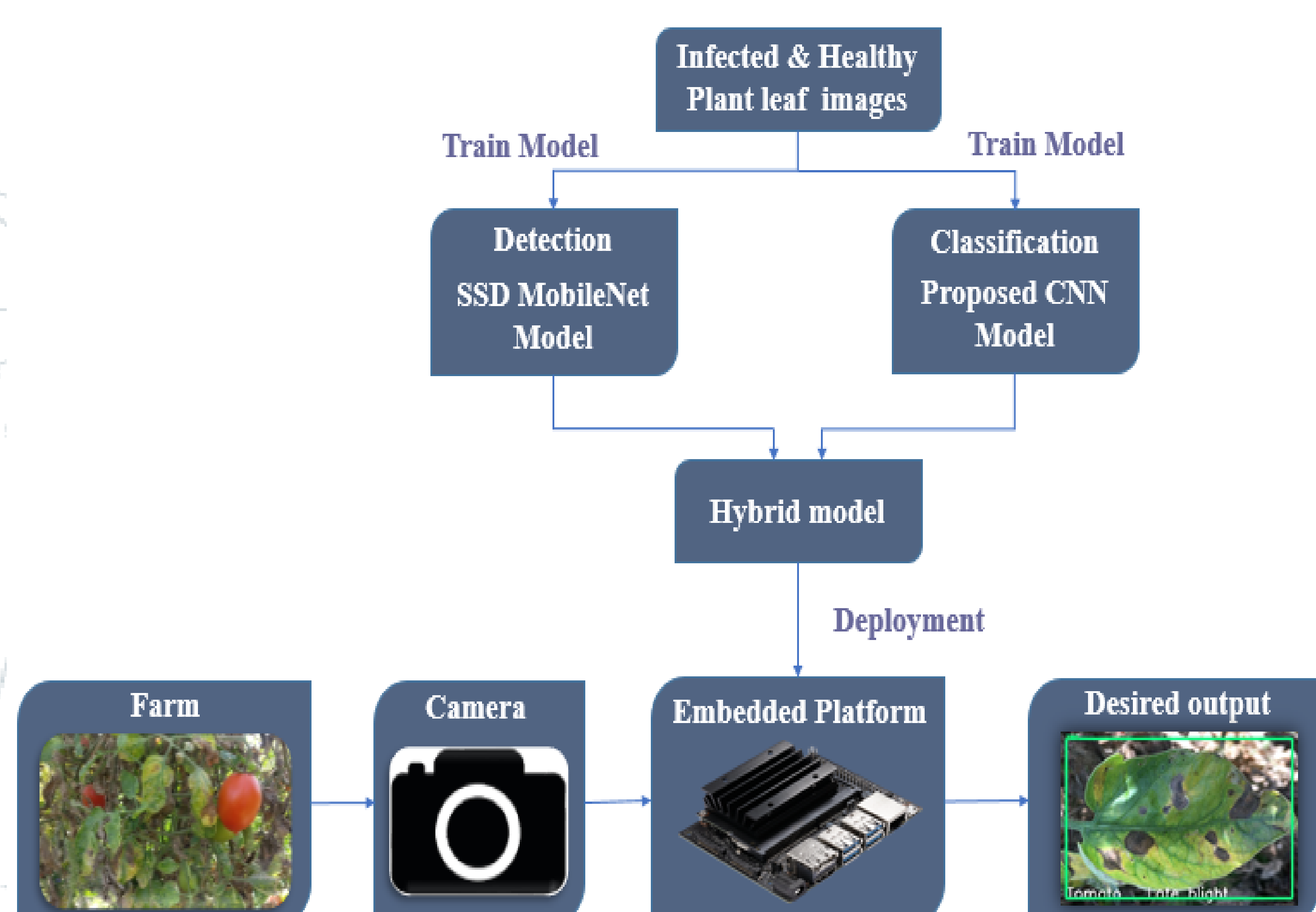


Figure 2: Proposed system Block diagram of crop disease detection

Dataset Used

The dataset consists of 21,978 healthy and infected leaf images of different plants for disease classification. Moreover, total 500 leaf images were used for leaf detection. Sample images from the dataset are shown in Figure 3.

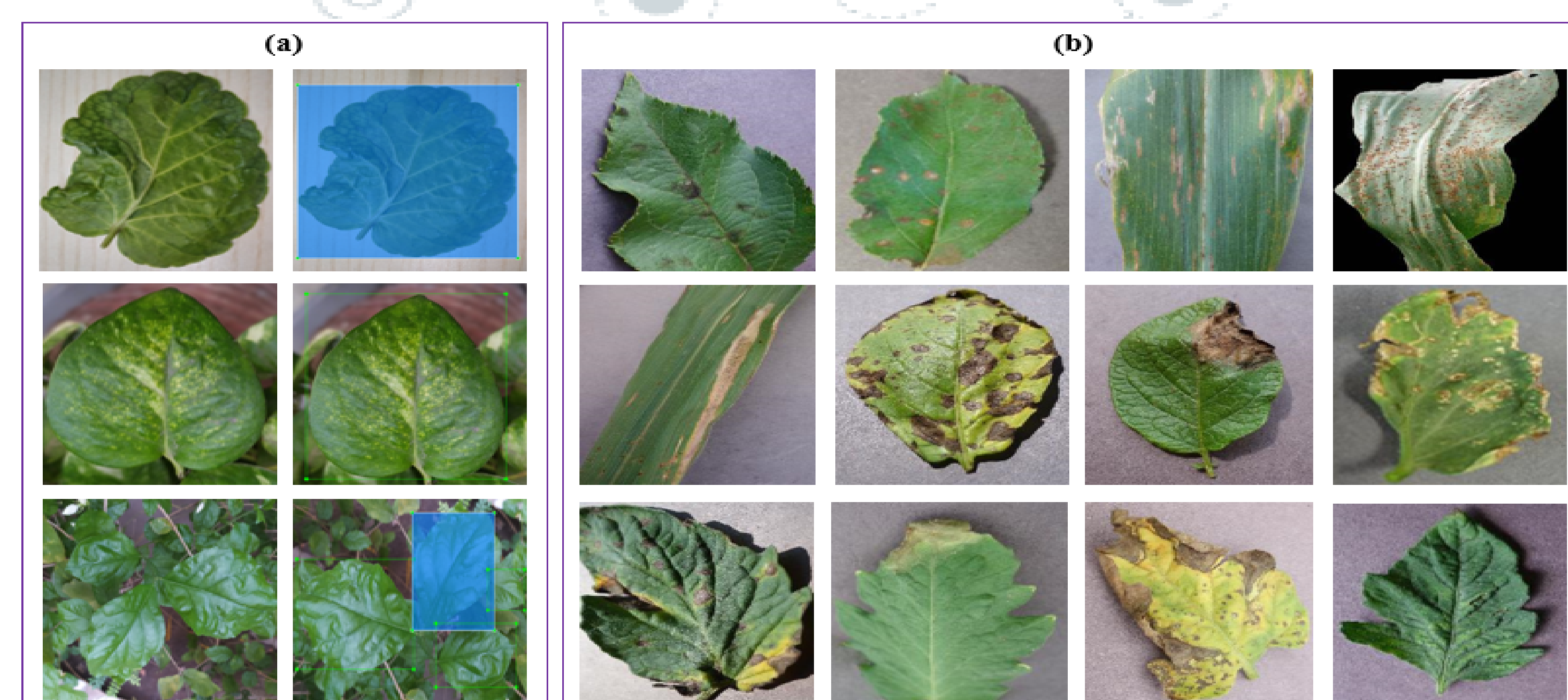


Figure 3: Sample images of (a) the leaf detection dataset. (b) the healthy and diseased plant leaves from the PlantVillage dataset.

Results

Table 1: Comparison of plant Disease classification results

Model	No. of parameters	Epoch	Accuracy
AlexNet	62,378,344	150	95.53%
Proposed model	6,076,980	100	96.88%

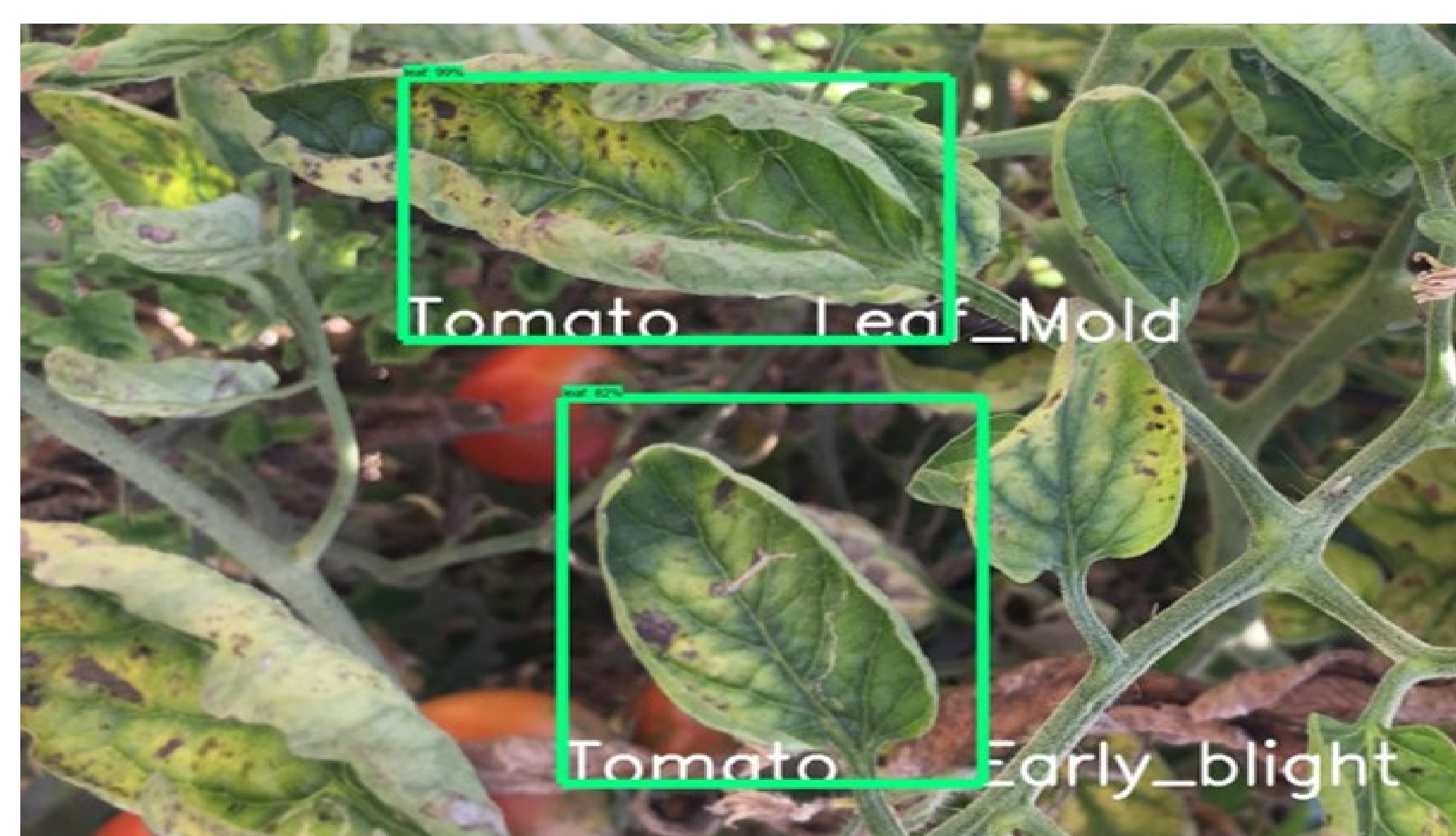


Figure 4: Real-time In field testing result

Conclusion

In this work, a system to detect and identify diseases from plant leaves using CNN, on an embedded platform is proposed. The classification accuracy of the proposed model is better as compared to AlexNet. The model for leaf detection and classification is successfully deployed on NVIDIA Jetson TX1 and NVIDIA Jetson Nano to perform real time disease detection in the field.

References

- [1] A. Géron, Hands-on machine learning with Scikit-Learn and TensorFlow: concepts, tools, and techniques to build intelligent systems. " O'Reilly Media, Inc.", 2017.
- [2] A. Fuentes, S. Yoon, S. Kim, and D. Park, "A robust deep-learning-based detector for real-time tomato plant diseases and pests recognition," Sensors, vol. 17, no. 9, p. 2022, 2017.
- [3] H. Durmus, E. O. Günes, and M. Kırıcı, "Disease detection on the leaves of the tomato plants by using deep learning," in 2017 6th International Conference on Agro-Geoinformatics, pp. 1–5, IEEE, 2017.
- [4] "PlantVillage Dataset",Dataset of diseased plant leaf images and corresponding labels.Website link