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Plant Disease Detection using a Plant Image

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ABSTRACT
Rapid human population growth requires corresponding increase in food production. Easily spreadable diseases can have a strong negative impact on plant yields and even destroy whole crops. That is why early disease diagnosis and prevention are of very high importance. Traditional methods rely on lab analysis and human expertise which are usually expensive and unavailable in a large part of the undeveloped world. Since smartphones are becoming increasingly present even in the most rural areas, in recent years scientists have turned to automated image analysis as a way of identifying crop diseases. This paper presents the most recent results in this field, and a comparison of deep learning approach with the classical machine learning algorithms.
Keywords — machine learning, crop diseases, deep learning, Plant Disease detection.

I. INTRODUCTION

The aim of image-based plant disease detection is to develop automated systems that can accurately identify and diagnose diseases in plants using images. This field of research combines computer vision techniques with machine learning algorithms to enable early and efficient detection of plant diseases, which is crucial for crop management and ensuring food security.

There are two main approaches used in image-based plant disease detection: deep learning and classical machine learning algorithms. The aim of comparing these two approaches is to understand their strengths and weaknesses in terms of accuracy, efficiency, and scalability.

Deep learning algorithms, particularly convolutional neural networks (CNNs), have gained significant attention in recent years due to their ability to automatically learn relevant features directly from raw image data. The aim of using deep learning in plant disease detection is to train CNN models on large datasets of labeled plant images, enabling them to accurately classify and detect diseases based on visual patterns and features. Deep learning approaches often require a large amount of labeled training data, computational resources, and time for training the models. However, they have shown promising results in achieving high accuracy rates in disease detection tasks.

II. METHODOLOGY:

When using classical algorithms, certain pre-processing steps need to be taken. The basics are outlined in Figure 1.

The objective of comparing deep learning and classical machine learning algorithms in image-based plant disease detection is to assess their effectiveness and suitability for the task. The scope of comparing deep learning and classical machine learning algorithms in image-based plant disease detection is to evaluate their performance and effectiveness in this specific domain.

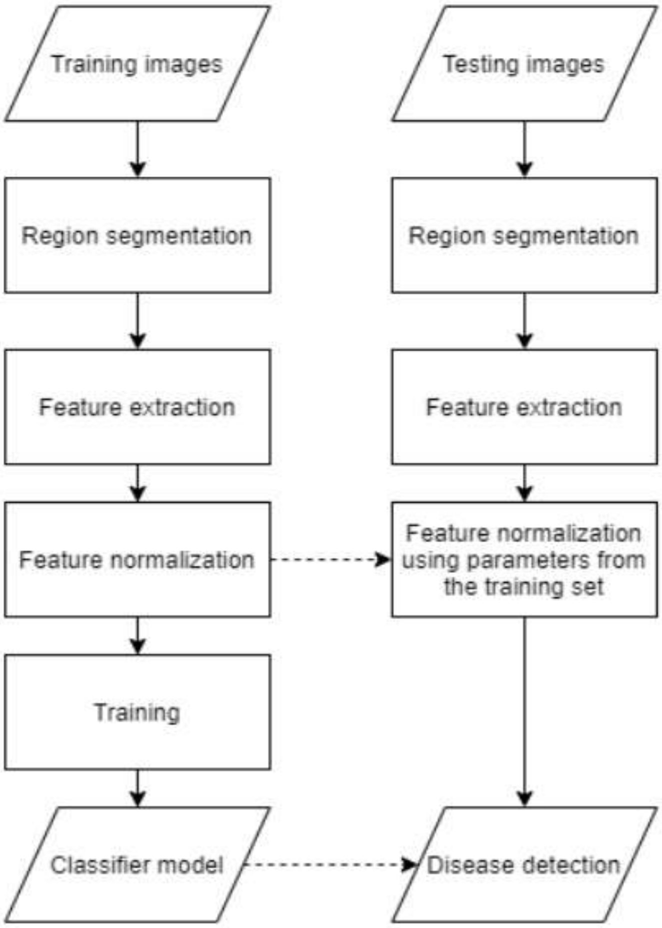

Figure 1: Flowchart of the basic training and testing steps

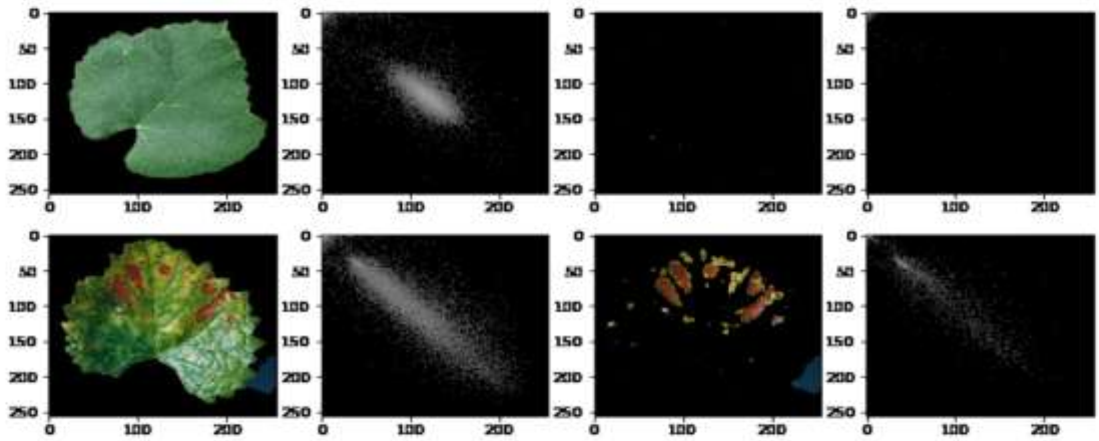

Figure 2: Example of two leaf images (top: healthy, bottom: diseased). From left to right: Full image, GLCM calculated on a full image, image with removed green pixels, GLCM calculated on image with removed green pixels

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III. RESULTS:

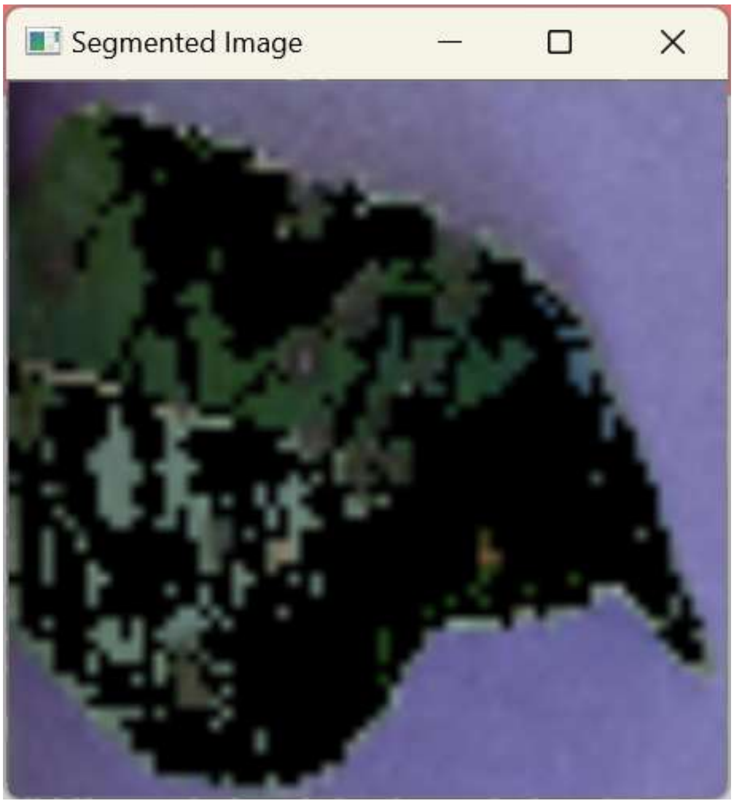

Figure 3: Segmented Image by clustering algorithm

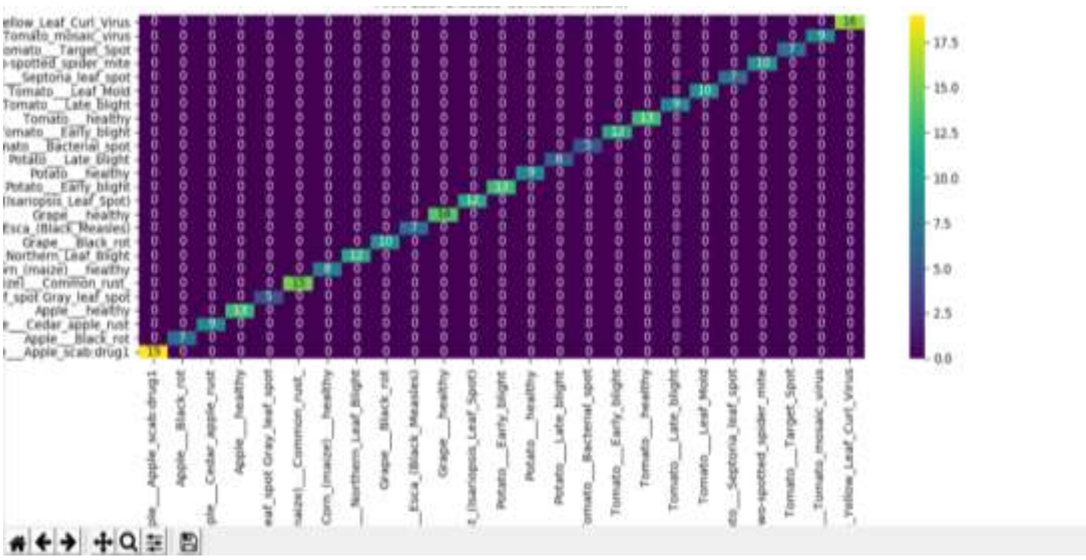

Figure 4: Confusion Matrix

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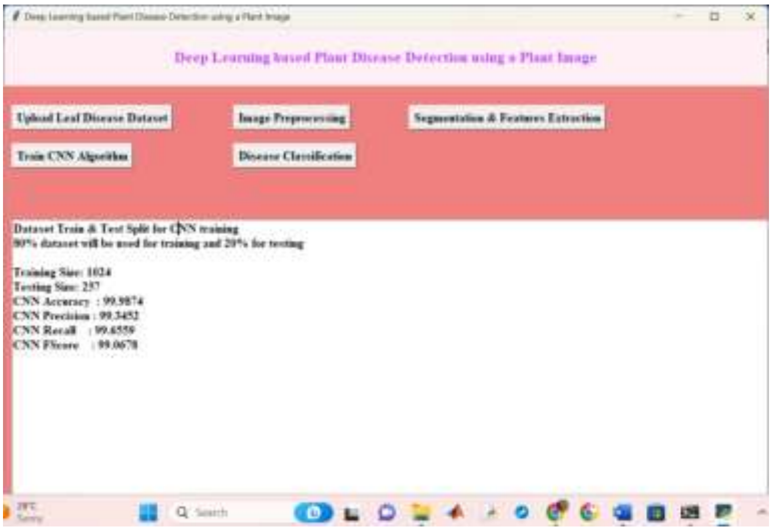

Figure 5: Performance Metrics obtained by proposed model

Figure 6: Segmented Image

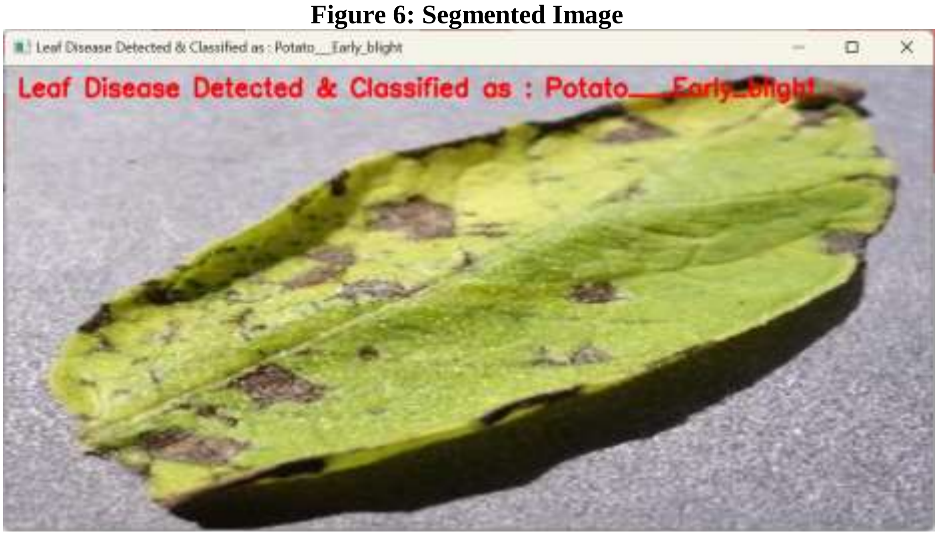

Figure 7: Disease is classified using CNN

IV. CONCLUSION

This paper presents the dominance of the DL method over the classical ML algorithms. Both the simplicity of the approach and the achieved accuracy confirm that the DL is the way to follow for image classification problems with relatively large datasets. As the achieved accuracy of the DL method is already very high, trying to improve its results on the same dataset would be of little benefit. Further work with the DL model could be done by expanding the dataset with more diverse images, collected from multiple sources, in order to allow it to generalize better. The considered ML algorithms achieved relatively high accuracy, but with error rates still an order of magnitude higher than the DL model. Further work in improving accuracy of the classical approach can be done by experimenting with other algorithms and by improving the features, as most likely they are the limiting factor of this approach.

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