REPORT – TOMATO LEAVES DISEASE CLASSIFICATION

INTRODUCTION

In this project, we try to classify tomato leaf diseases from images. We train a deep learning model to distinguish between different classes of tomato leaf diseases.

DATASET

The dataset is available on Kaggle .
https://www.kaggle.com/datasets/kaustubhb999/tomatoleaf

The dataset comprises various types of diseases affecting tomato leaves, each presenting unique visual characteristics. These diseases include:

Tomato Mosaic Virus

Target Spot

Bacterial Spot

Tomato Yellow Leaf Curl Virus

Late Blight

Leaf Mold

Early Blight

Spider Mites Two-Spotted Spider Mite

Tomato (Healthy)

Septoria Leaf Spot

Each disease has distinct symptoms and manifestations on tomato leaves, ranging from discoloration and spots to wilting and deformations. By classifying images of tomato leaves into these disease categories, we can facilitate early detection and management strategies to mitigate crop losses and ensure plant health and productivity.

Model Architecture

Several other models were tried and then the upcoming model has been finalized . We employ the InceptionV3 architecture as our base model and then add some modifications to match our current task. InceptionV3 is a convolutional neural network architecture developed by Google. It is renowned for its efficiency and performance in image classification tasks. The architecture features multiple layers of convolutional and pooling operations, including inception modules, which allow for effective feature extraction while reducing computational complexity. InceptionV3 is a deep convolutional neural network architecture developed by Google Research. It is renowned for its efficiency and performance in image classification tasks.

To adapt InceptionV3 for our tomato leaf disease classification task, we remove the top layers of the pre-trained model and append custom classification layers. We freeze the weights of the pre-trained layers to prevent them from being updated during training, allowing us to leverage the learned features from ImageNet. We then compile the model with a categorical cross-entropy loss function and the SGD optimizer.

Inception Modules: These modules consist of multiple convolutional layers with varying filter sizes (1x1, 3x3, 5x5), enabling the network to capture features at different spatial scales efficiently.

Global Average Pooling: Instead of fully connected layers at the end, InceptionV3 uses global average pooling, which reduces the number of parameters and prevents overfitting.

Auxiliary Classifiers: InceptionV3 includes auxiliary classifiers at intermediate layers during training to encourage the propagation of gradients and combat the vanishing gradient problem.

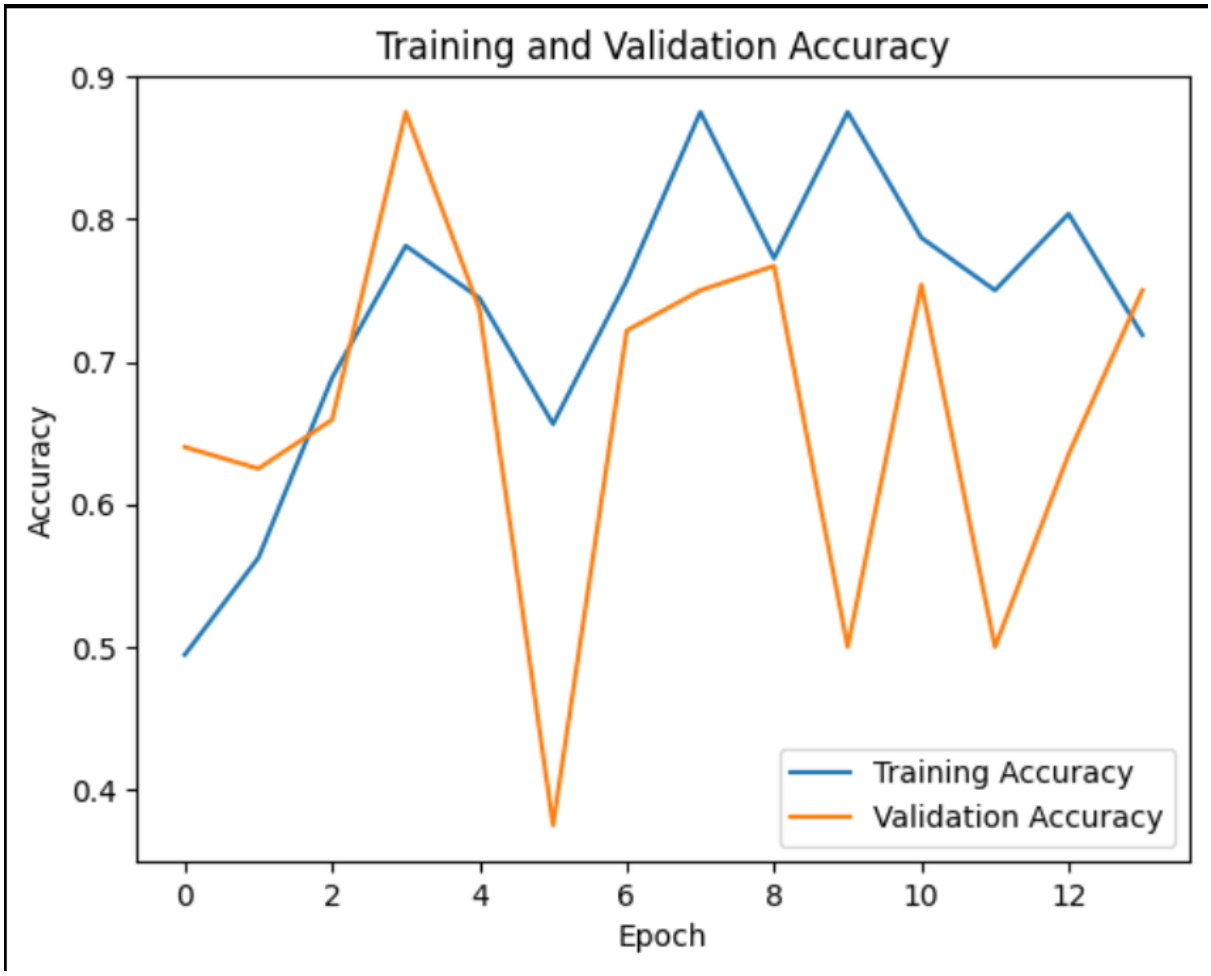
Leveraging transfer learning with InceptionV3 allows us to utilize the learned features from ImageNet and adapt the model to our specific tomato leaf disease classification task, resulting in efficient training and high classification accuracy.

Results:

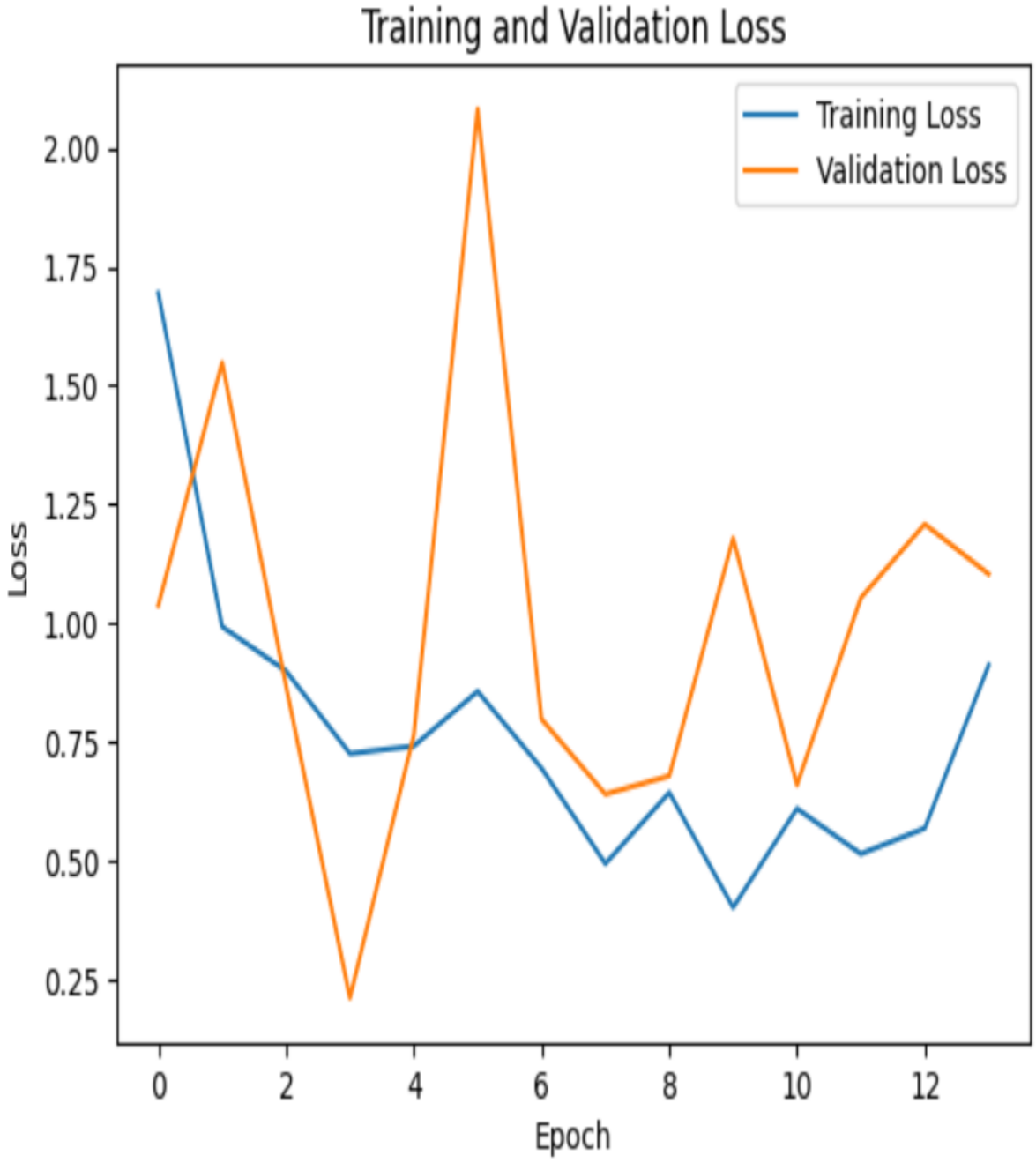
The trained model achieves a high validation accuracy, indicating its effectiveness in classifying tomato leaf diseases.

Validation Accuracy of **88 %** is achieved .

The plots of training and validation accuracy and loss provide insights into the model's learning process and performance.



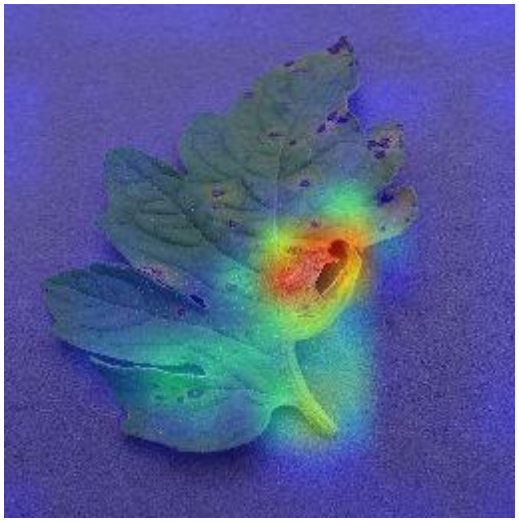
Plot for Accuracy



Plot for Loss

Gradcam Visualization Example

Septoria Leaf Spot



EXAMPLE PREDICTIONS

Predicted: Tomato___Early_blight, Actual: Tomato___Early_blight

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