

Computer Vision for Agriculture

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Overview

According to the Food and Agriculture Organization of the United Nations (FAO), plant pests and diseases cause about 40 percent of annual crop losses. Such losses are not only detrimental to farmers, but also to the communities with which they provide vital resources. In this project, I seek to accurately and consistently identify diseases in plant leaf images.

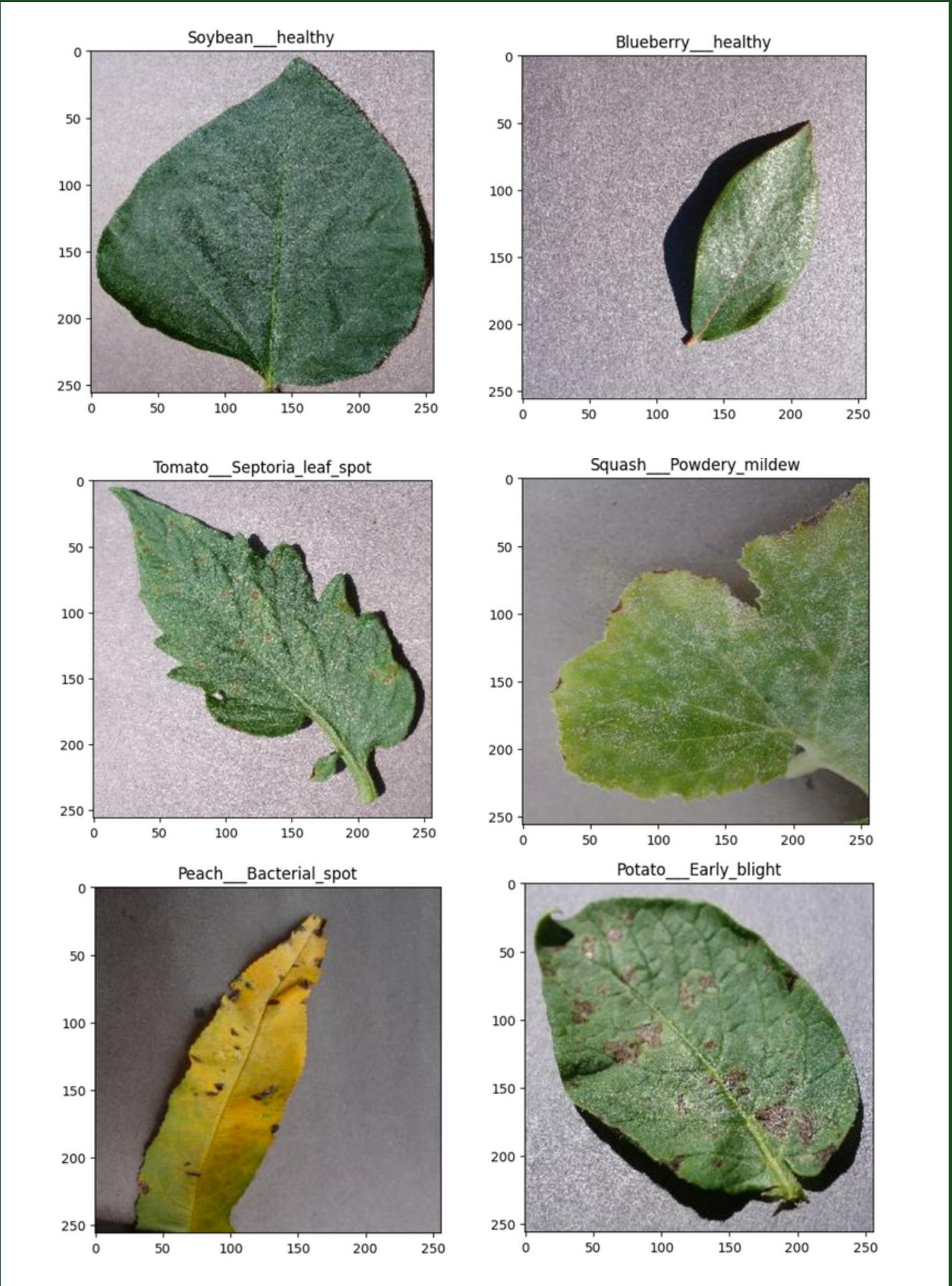


The Dataset

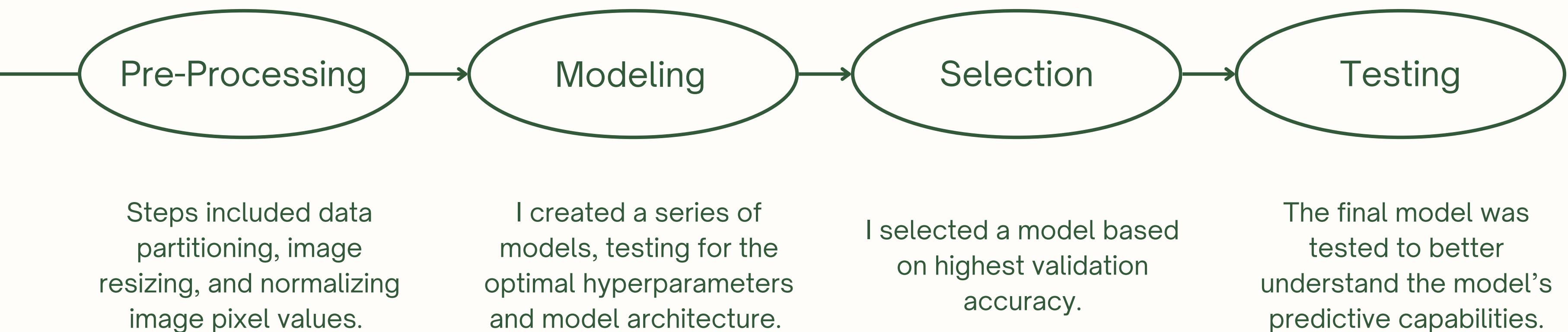
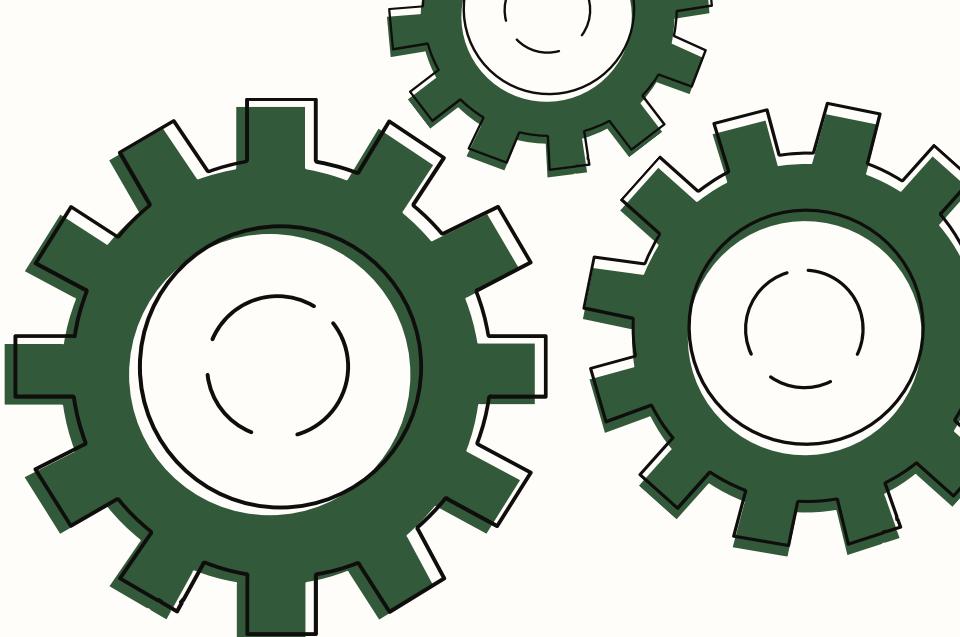
The PlantVillage dataset consists of 54303 healthy and unhealthy leaf images split into 38 categories by plant species and disease type .

Species represented include:

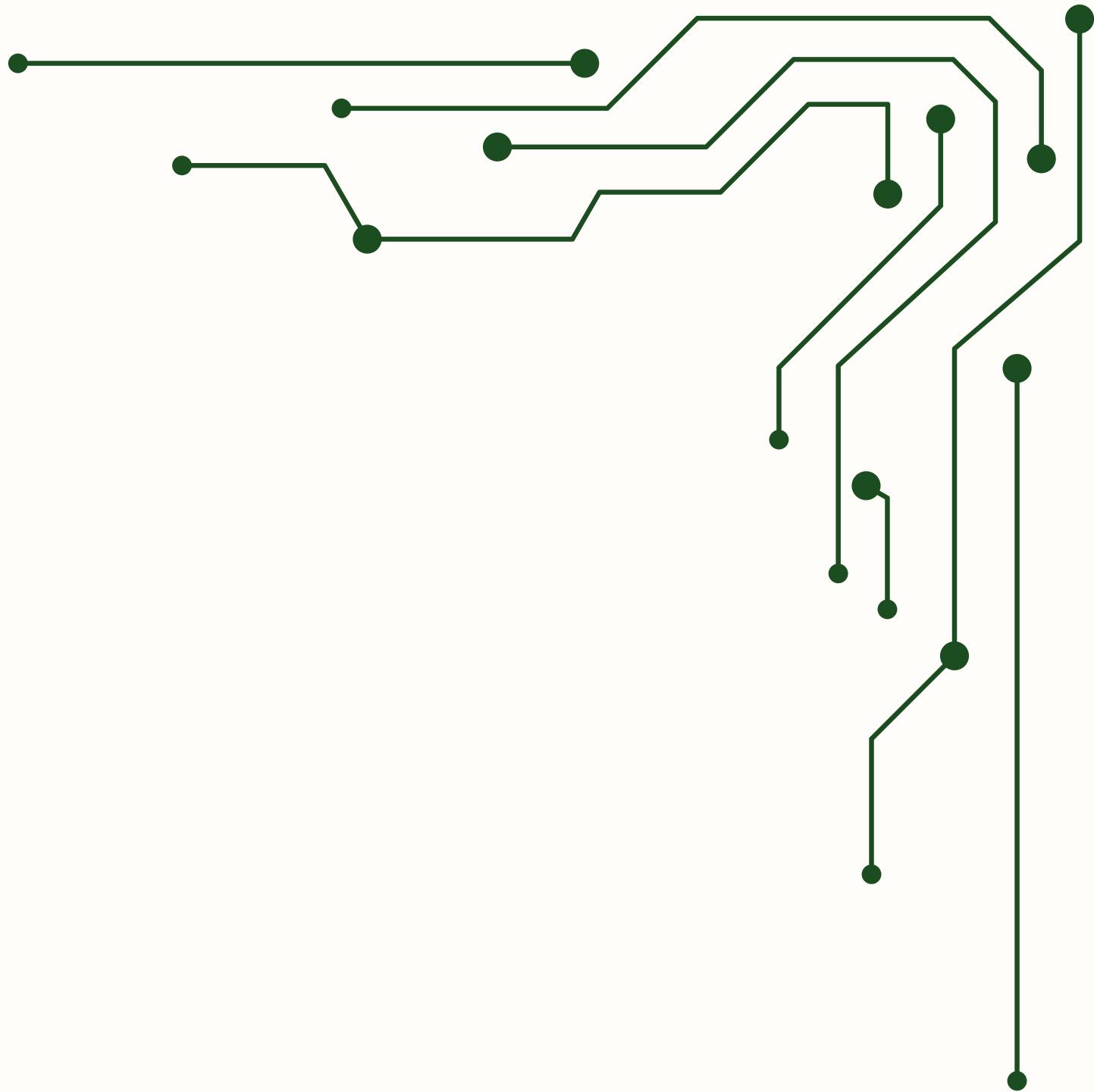
- Apple
- Blueberry
- Cherry
- Corn
- Grape
- Orange
- Peach
- Pepper
- Potato
- Raspberry
- Soybean
- Sqash
- Strawberry
- Tomato



Process



Final Model



Eight Layer CNN

Parameters

Training Time: 32 minutes

Parameters: 2,104,916

Image Size: (128, 128, 3)

Batch Size: 64

Number of Epochs: 30

Optimizer: Adam

Loss: Sparse Categorical Cross Entropy

Metrics: Accuracy

Layer (type)	Output Shape	Param #
conv2d_9 (Conv2D)	(None, 126, 126, 32)	896
conv2d_10 (Conv2D)	(None, 124, 124, 32)	9,248
max_pooling2d_6 (MaxPooling2D)	(None, 62, 62, 32)	0
conv2d_11 (Conv2D)	(None, 60, 60, 64)	18,496
conv2d_12 (Conv2D)	(None, 58, 58, 64)	36,928
max_pooling2d_7 (MaxPooling2D)	(None, 29, 29, 64)	0
conv2d_13 (Conv2D)	(None, 27, 27, 128)	73,856
max_pooling2d_8 (MaxPooling2D)	(None, 13, 13, 128)	0
conv2d_14 (Conv2D)	(None, 11, 11, 128)	147,584
max_pooling2d_9 (MaxPooling2D)	(None, 5, 5, 128)	0
flatten_2 (Flatten)	(None, 3200)	0
dense_4 (Dense)	(None, 128)	409,728
dropout_2 (Dropout)	(None, 128)	0
dense_5 (Dense)	(None, 38)	4,902

Eight Layer CNN

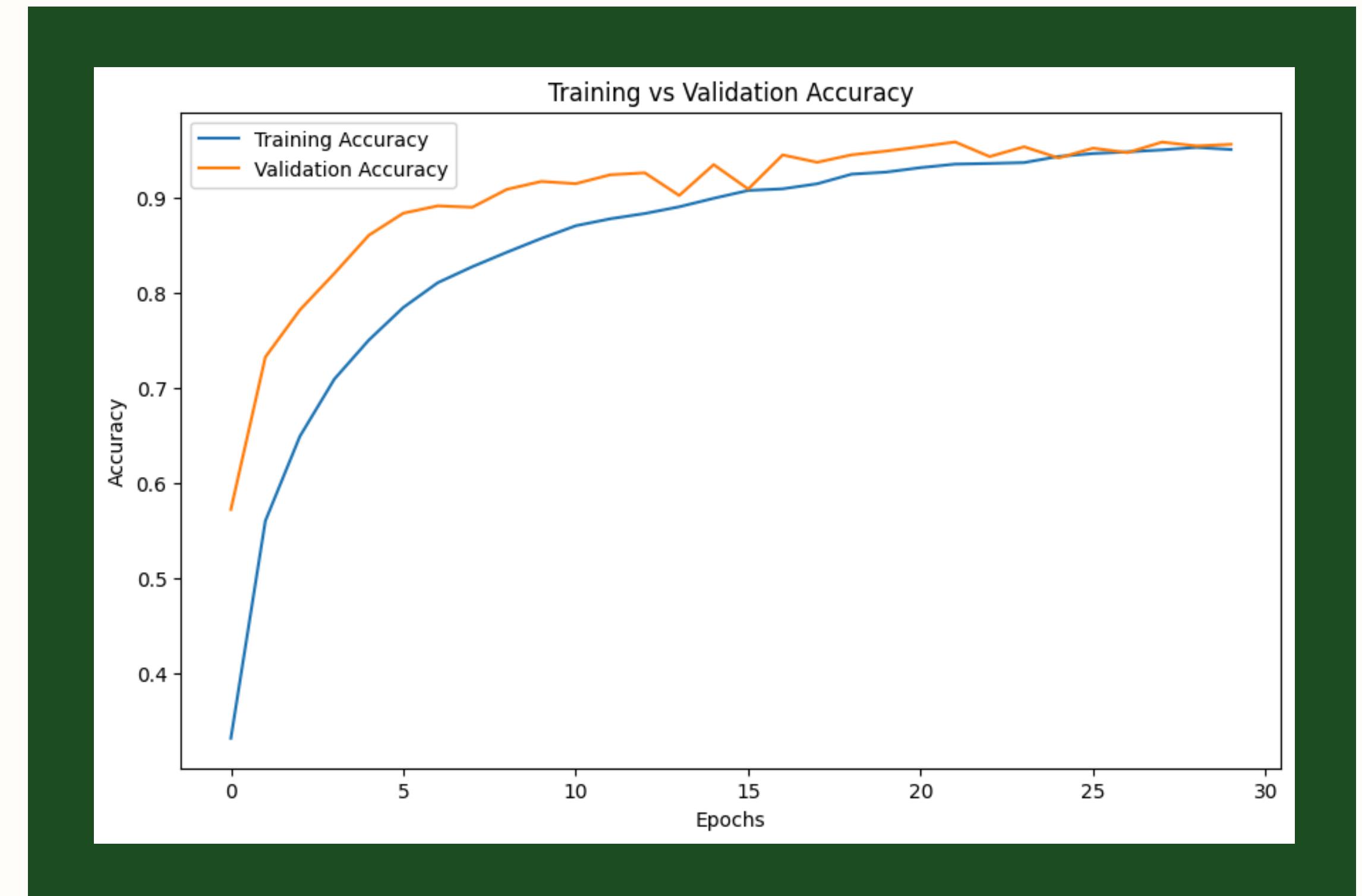
Training & Validation

Training Accuracy

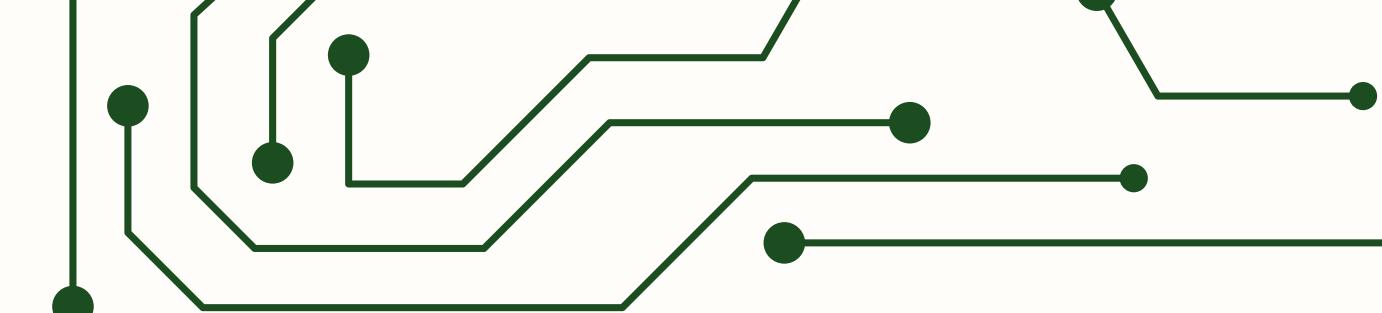
99.01%

Validation Accuracy

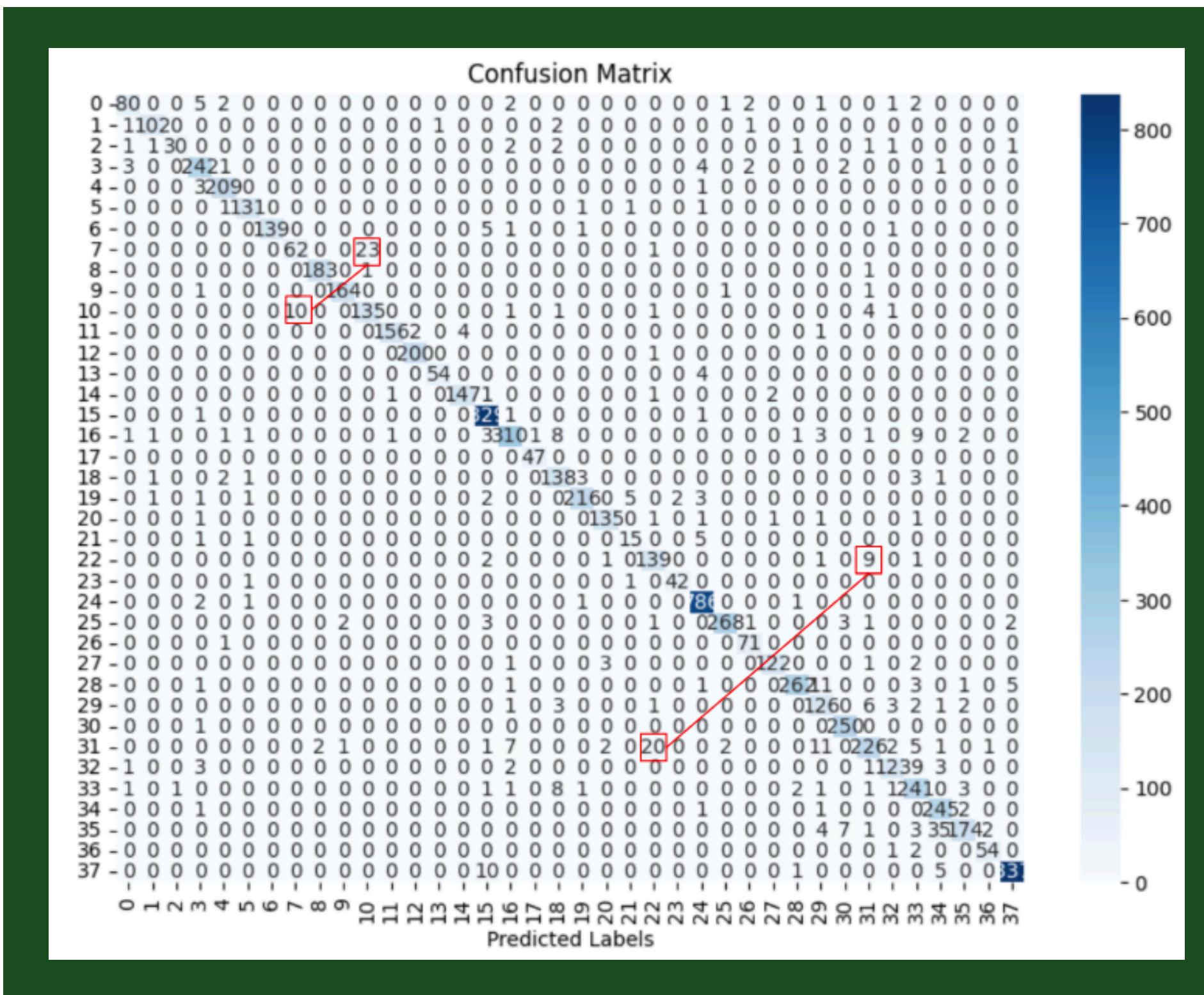
95.75%



Eight Layer CNN



Testing



Test Accuracy

95.96%

Common Misclassifications:

Corn leaves with cercospora leaf spot and corn leaves with northern leaf blight.

Potato leaves with late blight and tomato leaves with late blight

Common Misclassifications

Label: Corn_Cercospora_leaf_spot_Gray_leaf_spot (7)



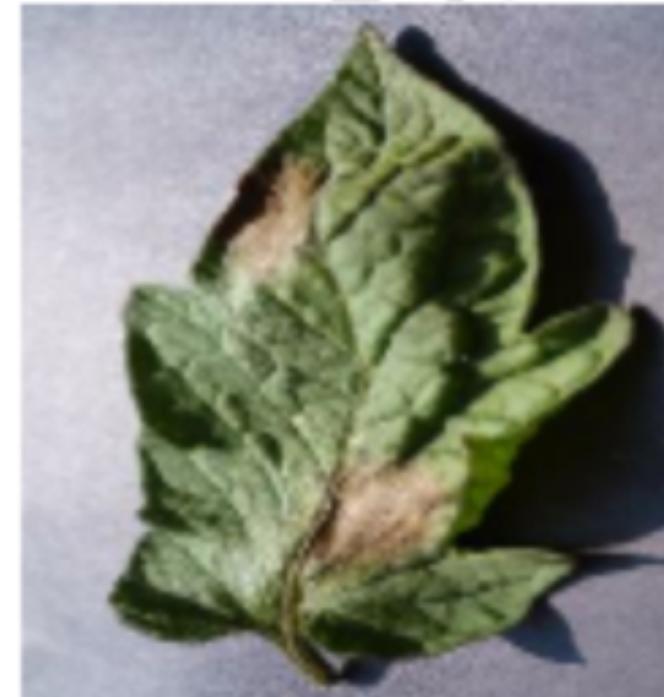
Label: Corn_Northern_Leaf_Blight (10)



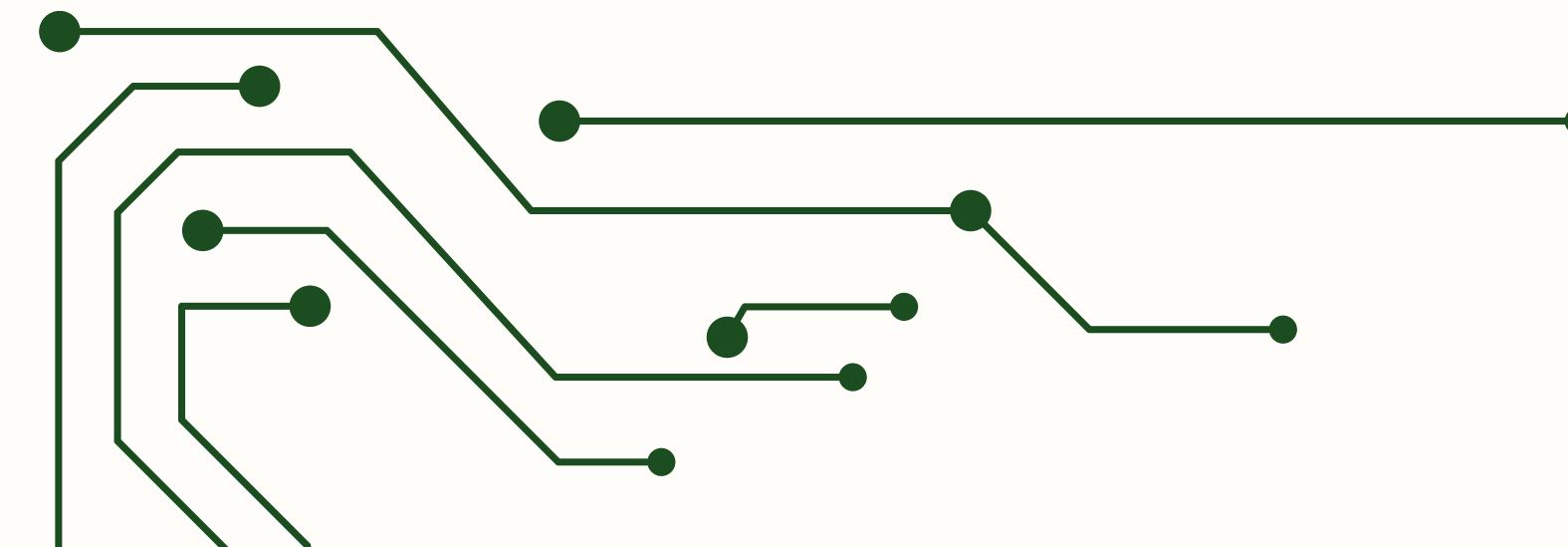
Label: Potato_Late_blight (22)



Label: Tomato_Late_blight (31)



Overall, the model misclassified a small, but not insignificant percentage of images. The model sometimes misclassified plant type, not disease. Identifying differences between diseases is more relevant to the scope of this project than plant species identification, so not all of the misclassifications present a large issue to the overall efficacy of the model.

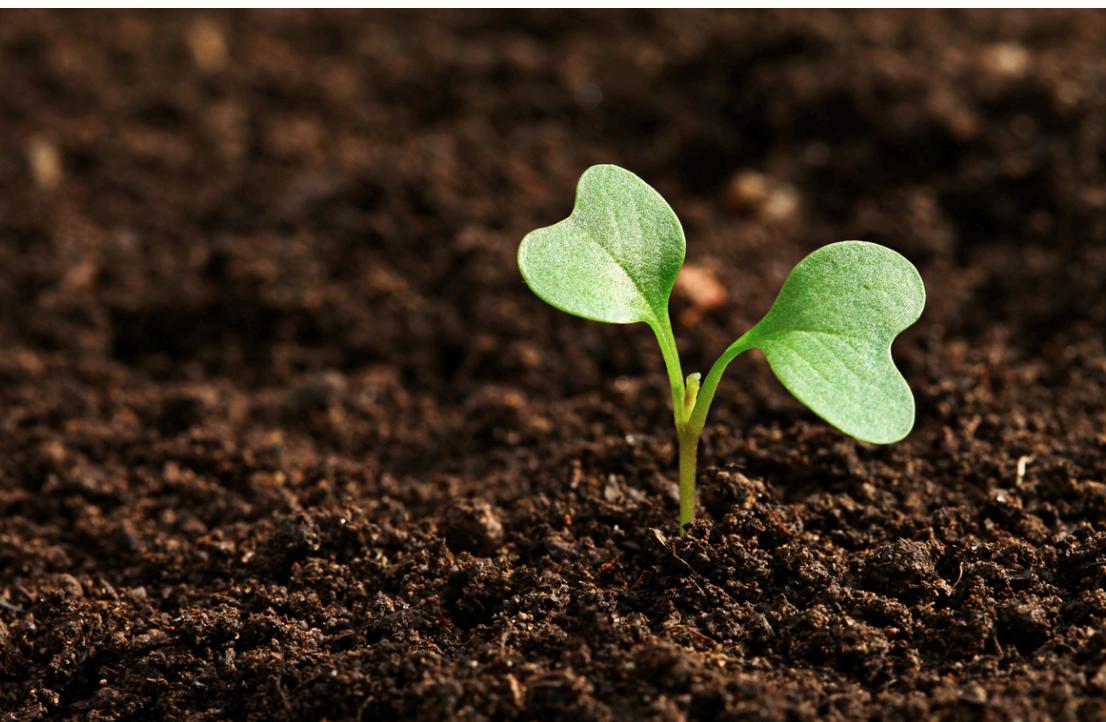


Conclusion

A test accuracy of about 96% signals that this model is effective in its ability to identify diseases in plants and differentiate between healthy and unhealthy plant images.

Although this project is for educational purposes, models similar to this could have many real-world applications.

The ability to combat plant disease more effectively could have an incredible effect on the field of agriculture and help to solve issues such as food insecurity.





Thank you!