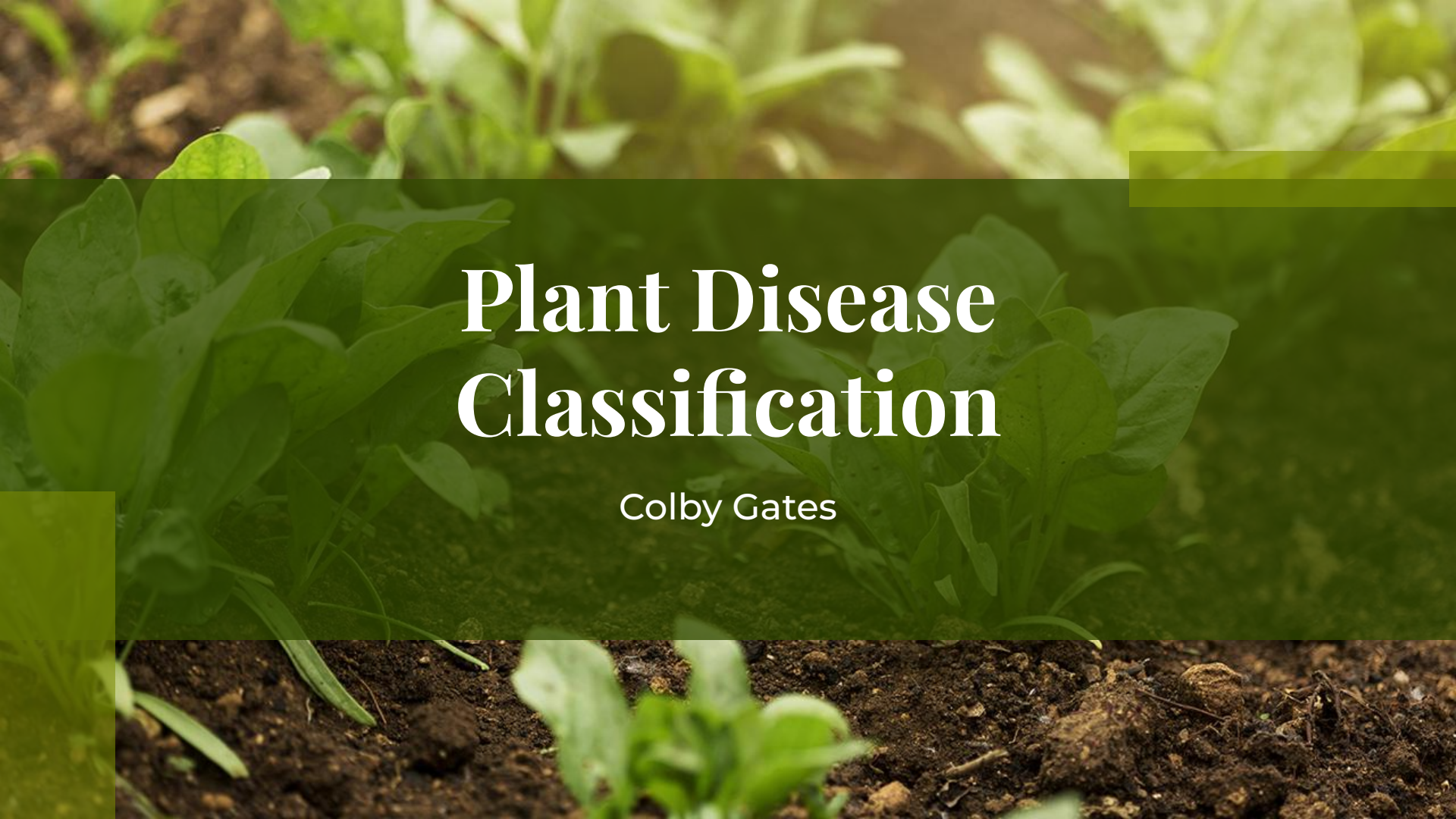


Plant Disease Classification

Colby Gates

Background

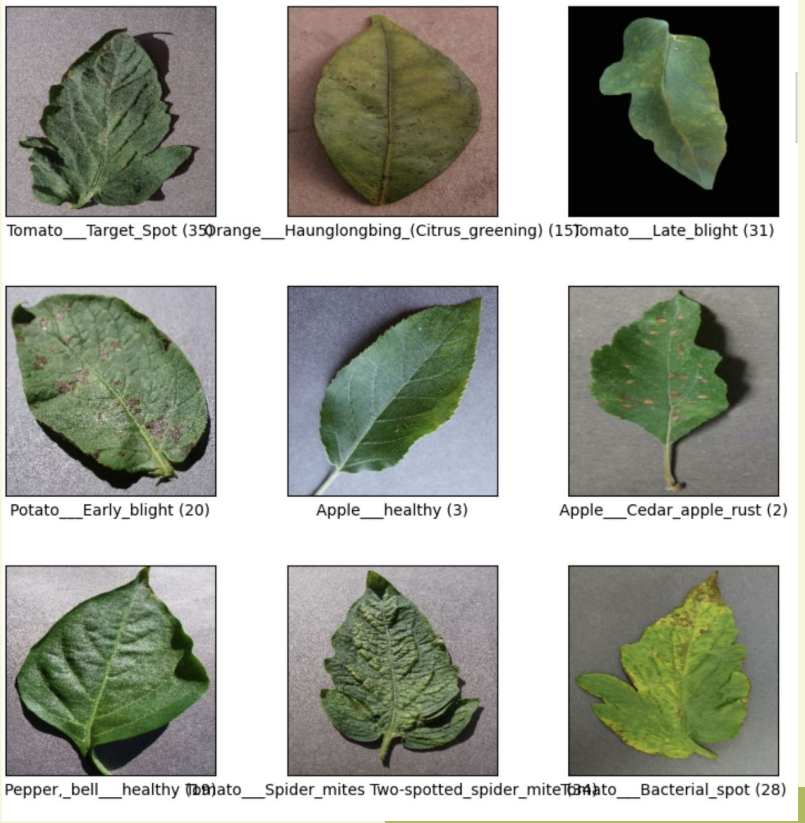
- Food stability is ever important
- Optimizing Agricultural Production
  - Crop yields
  - Control of pests/diseases
  - Reducing operational costs
- Biodiversity protection

Solution/Proof of Concept

- Build a Convolutional Neural Network to classify plant diseases
- ~50,000 images categorized into 38 categories by species and disease
- If successful many areas of application

Plant Village Data

- 14 crop species
  - 12 healthy images
- 26 diseases
  - 17 fungal
  - 4 bacterial
  - 2 mold
  - 2 viral
  - 1 mite caused disease

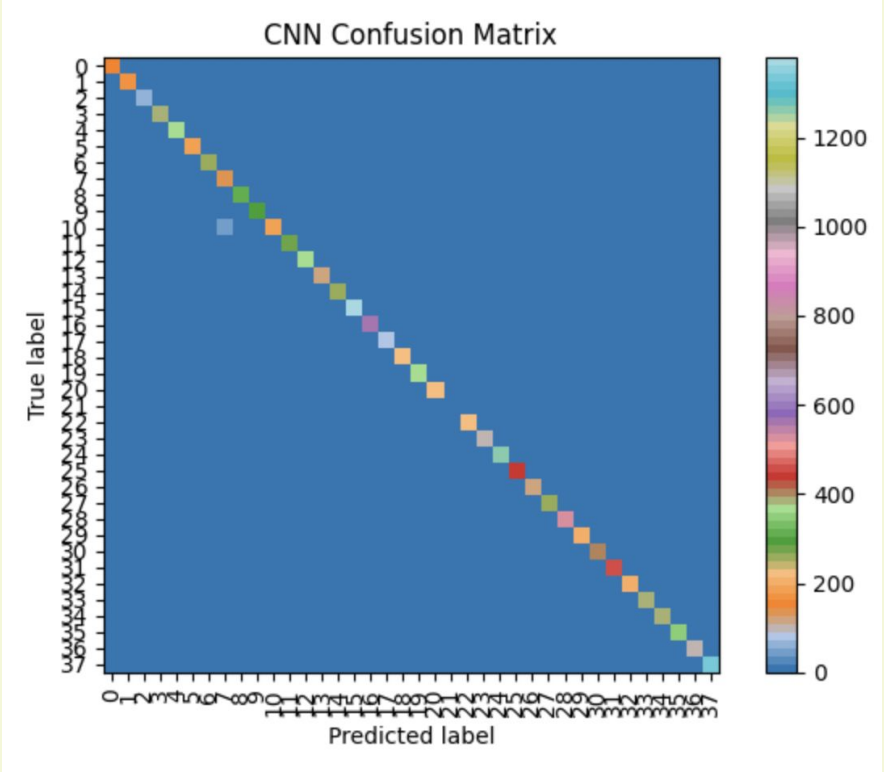


Convolutional Neural Network

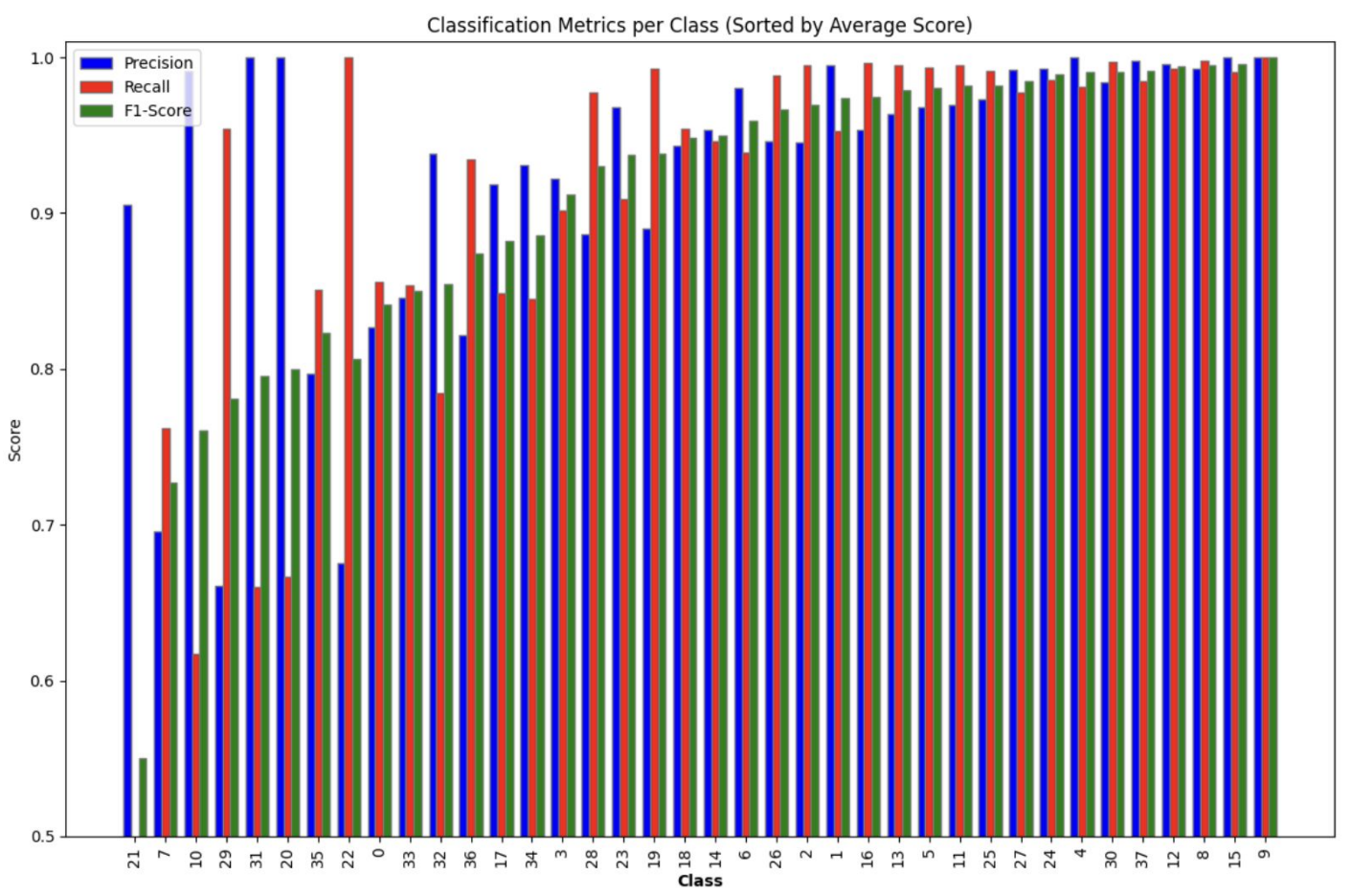
Summary

- 4 blocks of layers
- 3 Conv2D layers with Max Pooling at the end per block
- 8,388,672 params in layer before output layer

```
Accuracy: 0.969
Precision: 0.962,
Recall: 0.946
```



4 Block CNN


Classification Metrics per Class (Sorted by Average Score)
Precision
Recall
F1-Score
Score
1.0
0.9
0.8
0.7
0.6
0.5
21 7 10 29 31 20 35 22 0 33 32 36 17 34 3 28 23 19 18 14 6 26 2 1 16 13 5 11 25 27 24 4 30 37 12 8 15 9
Class

Class: Corn___Cercospora_leaf_spot Gray_leaf_spot (ID: 7)

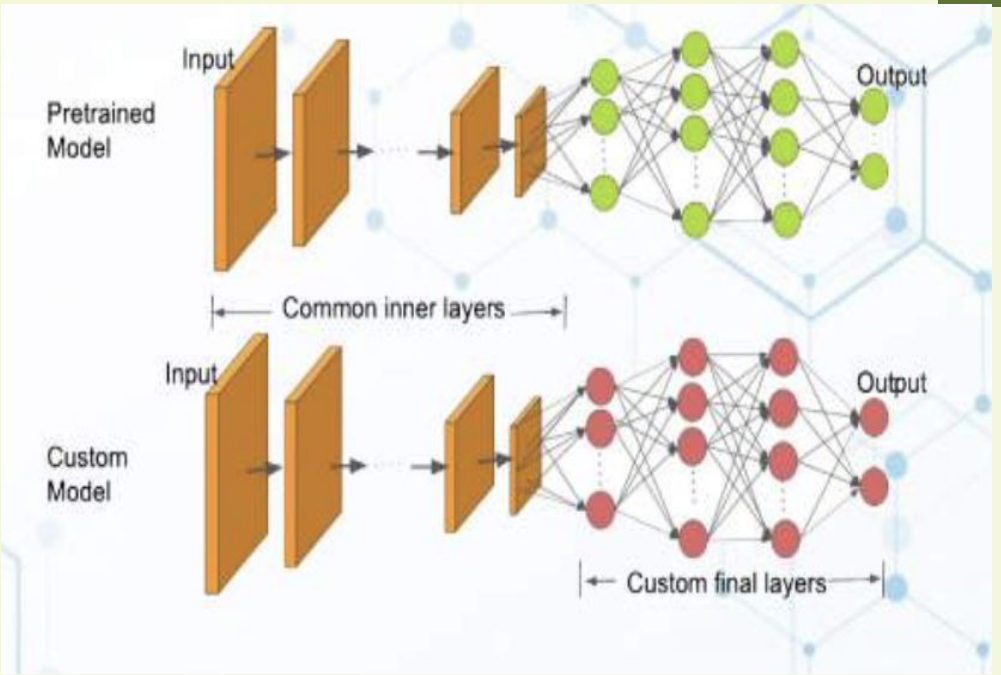
Class: Corn___Northern_Leaf_Blight (ID: 10)

Transfer Learning

- Pretrained model (more generalized)
  - Freeze all the layers
  - Drop classifying layer

- Acts as a generalized pretrained feature detector

- Add trainable layers on top specialized to the task

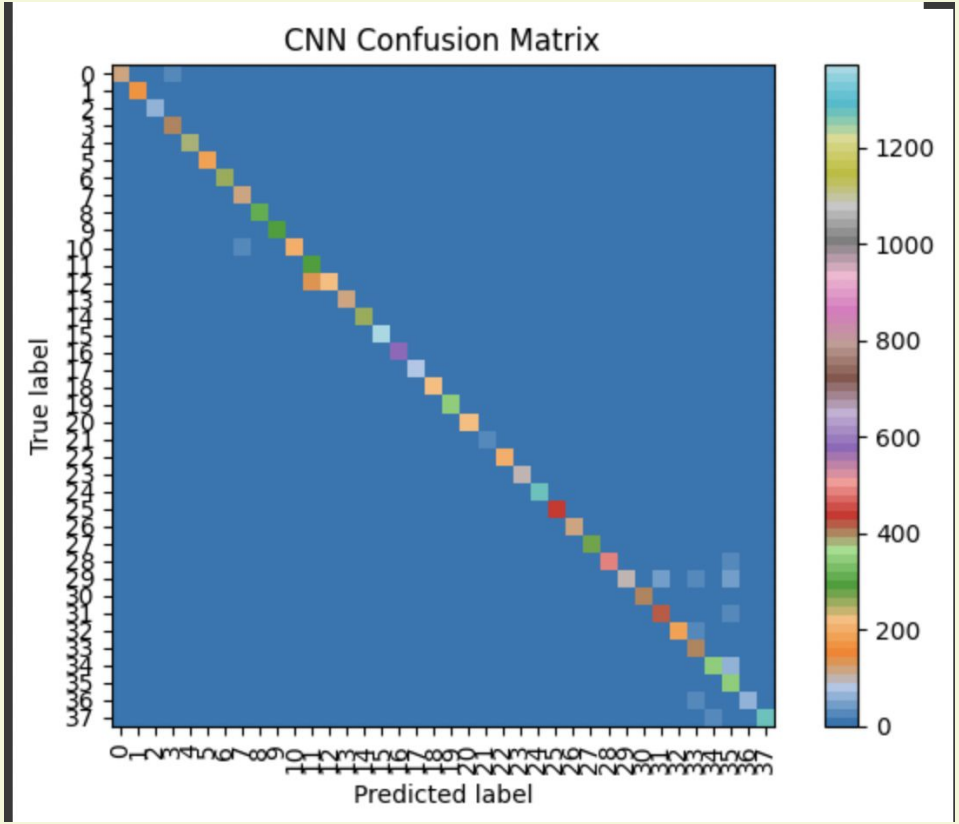


CNN W/ BatchNorm and Transfer Learning

Summary

- Input in vgg model
- 3 Conv2D layers with Batch Normalization with Max Pooling at the end
- Global Max Pooling before classification
- 32,832 params

```
Accuracy: 0.932
Precision: 0.927
Recall: 0.907
```



Conclusions

1. Using CNNs to identify plant disease is a viable option

2. Features extracted from general images in the vgg model were applicable to this problem

Next Steps

1. Generalize to broader images
2. Try more specifically targeted transfer learning
3. Implementation with hardware

Questions?