Plant Pathology

FGCV 2021 Challenge

Paweł Kołakowski - 165452
Komalben Poshiya - 179686
Imeh Akpan - 183179
Nsar Garari - 179582

The problem

Story (Kaggle): Apples are one of the most important temperate fruit crops in the world. Foliar (leaf) diseases pose a major threat to the overall productivity and quality of apple orchards. The current process for disease diagnosis in apple orchards is based on manual scouting by humans, which is time-consuming and expensive.

Objective (Kaggle): The main objective of the competition is to develop machine learning-based models to accurately classify a given leaf image from the test dataset to a particular disease category, and to identify an individual disease from multiple disease symptoms on a single leaf image.

Category: Multi-label classification (A leaf can suffer from multiple diseases)

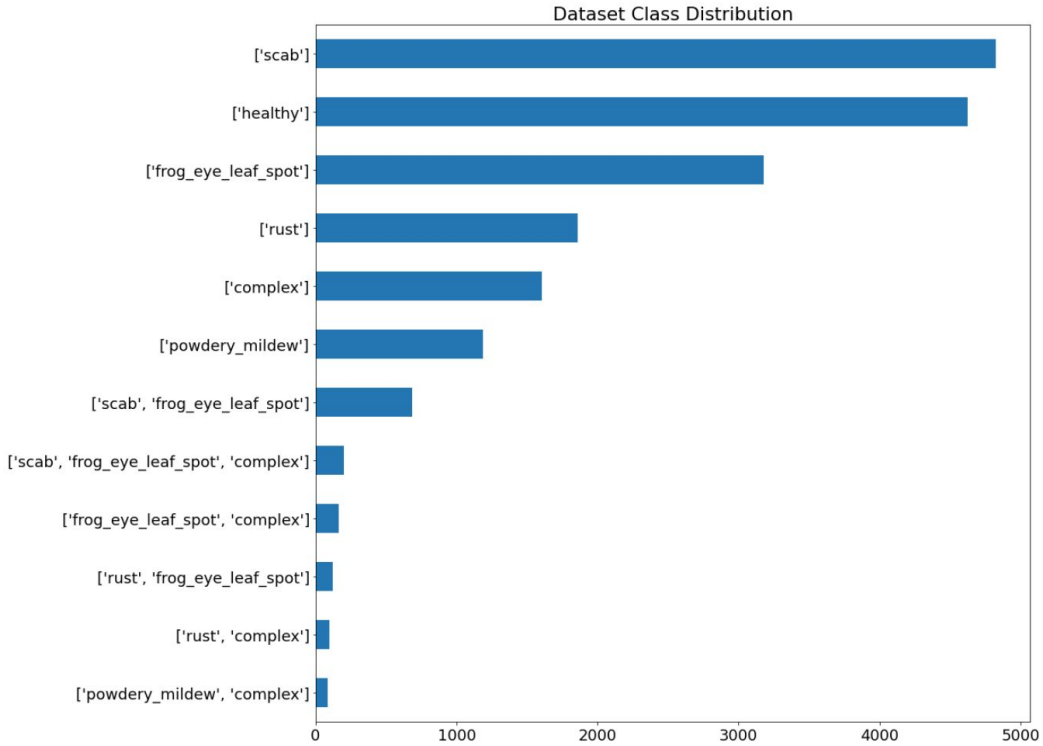
Evaluation: Mean F1 Score

Link: https://www.kaggle.com/c/plant-pathology-2021-fgvc8

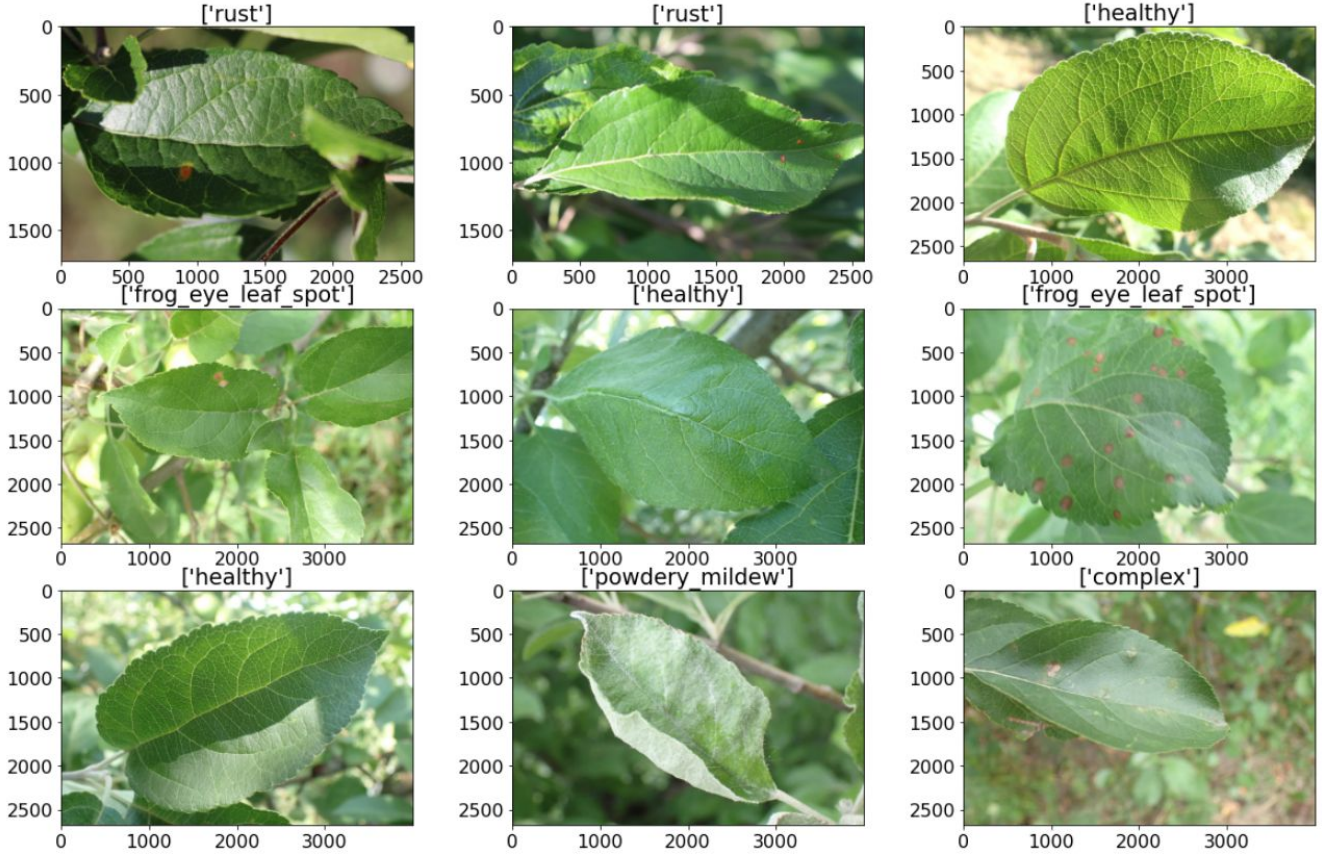
Dataset

Dataset consist of **18632** images belonging to **one or more** of the following classes:

1. Scab
2. Healthy
3. Frog Eye Leaf Spot
4. Rust
5. Complex
6. Powdery Mildew



Dataset - Example Images



Solution

Transfer Learning Approach:

- Basic Image Augmentation
- Manual hyper-parameter tuning
- Fine-tune one of pretrained models:
  - DenseNet169
  - Inception-ResNet v2
  - EfficentNet B4
  - EfficentNet B7
- Use Early Stopping for optimal training duration
- Choose the best model

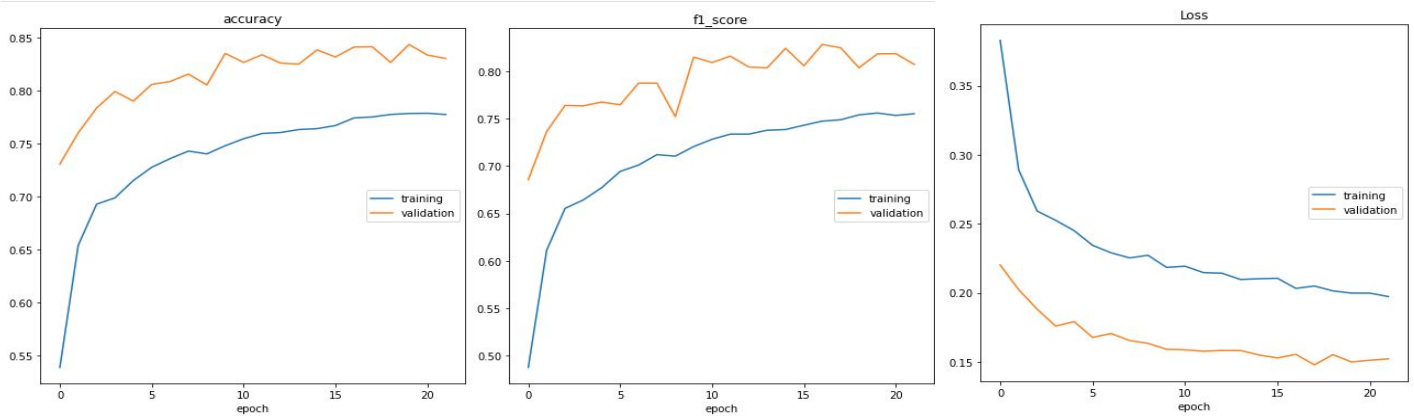
Best Solution

Base model: EfficientNet B4
Base model trainable: No
Pretrained weights: ImageNet
Input Image Size: 512x512
Class threshold: 0.43

Best Score (Late Submission - not visible in the global Leaderboard)**:**

1. **Private Score** (~81% of test dataset): 0.70736
2. **Public Score** (~19% of test dataset): 0.69500

Status	Private Score	Public Score	Use for Final Score
Succeeded	0.70736	0.69500	☐
Succeeded	0.69252	0.68897	☐
Succeeded	0.63344	0.61879	☐
Succeeded	0.35194	0.35301	☐

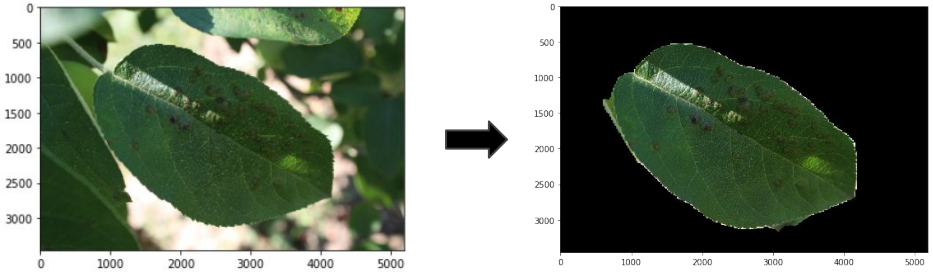


Applied improvements

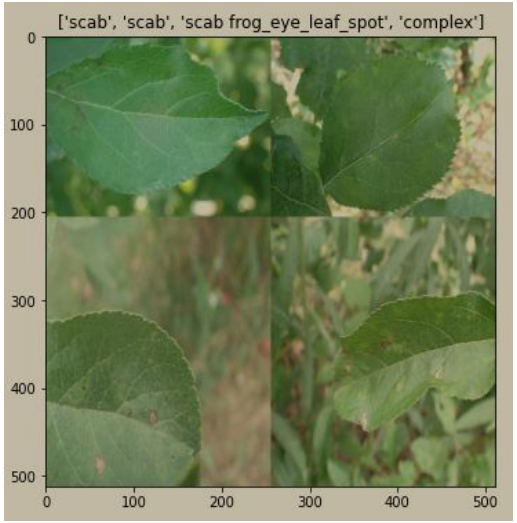
1. Bigger model -> more trainable parameters. E.g. EfficientNet B4 -> B7
2. Bigger image resolution -> more information passed to the neural network
3. Data augmentation -> H/V Flip, Rotation, Shear, Zoom, etc.
4. “Unfreeze” the base model

Others' Solutions

- Self-defined models (no fine-tuning)
- Background removal
- Enhanced augmentation (e.g. noise)
- Automatic hyper parameters tuning
- Advanced threshold mechanisms
- Focal Loss function
- Averaging multiple models predictions
- Multi-label augmentation -> mosaic(1st place)



Source: https://www.kaggle.com/aithammadiabdellatif/background-removal



Source: https://www.kaggle.com/c/plant-pathology-2021-fgvc8/discussion/243042

Thank You

For your attention