Cassava Leaf Disease Classification

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Jan 28th, 2021

Goal description

Cassava is a very important crop in tropical and subtropical developing countries, being an important food source. Creating a ML tool that automatically detects diseases from images taken from farmers would expedite its treatment.

We want to build an image classification model to predict if a cassava plant has one of four diseases or is healthy based on pictures of its leaves.

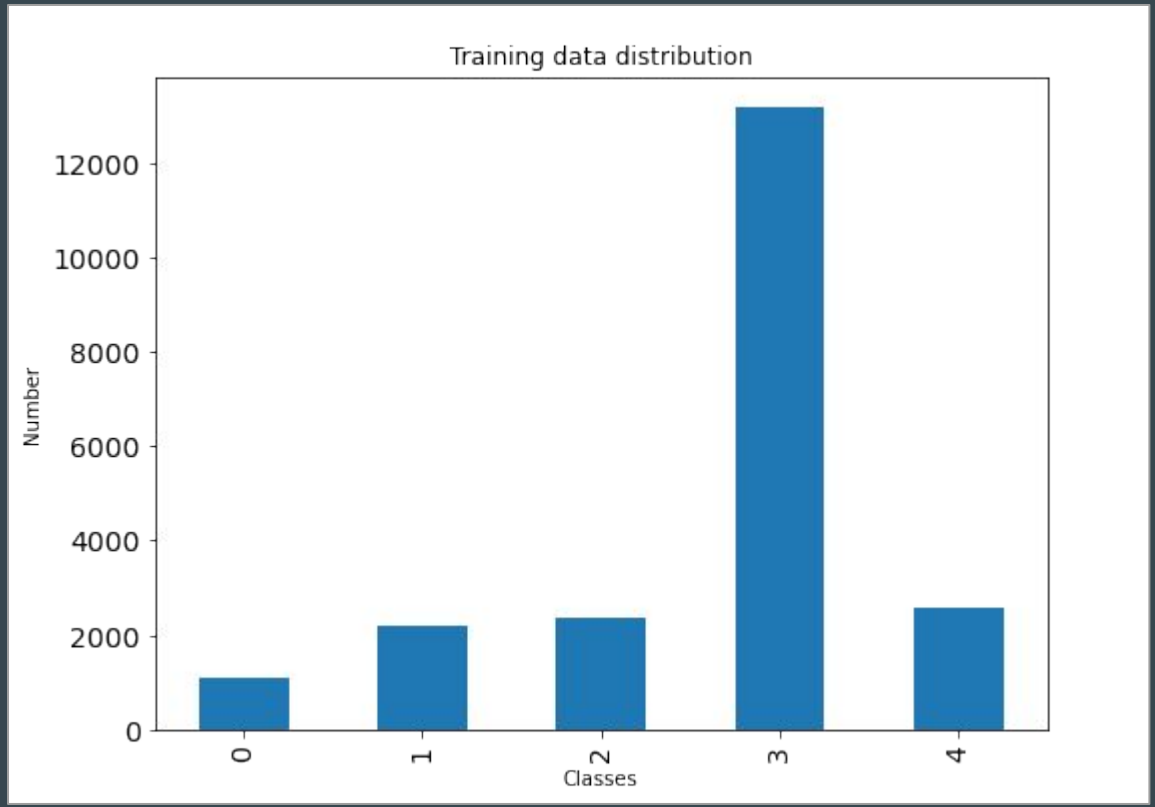
The model has to classify:

- Cassava Bacterial Blight (CBB)
- Cassava Brown Streak Disease (CBSD)
- Cassava Green Mottle (CGM)
- Cassava Mosaic Disease (CMD)
- Healthy

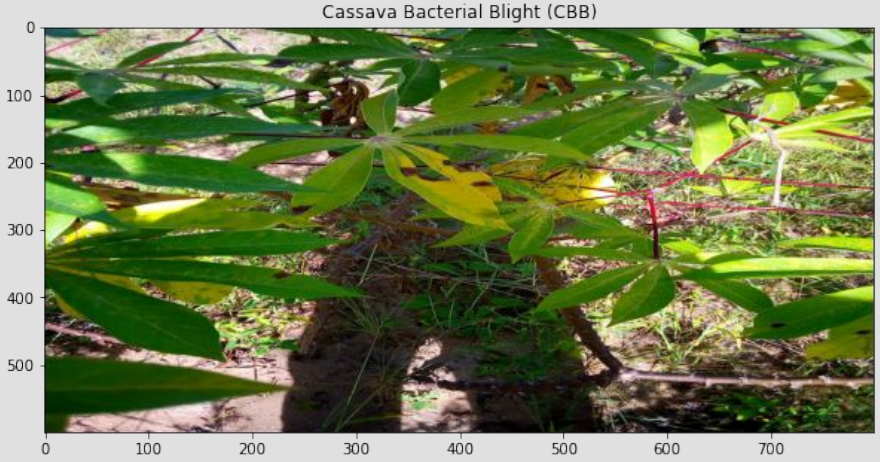
Data availability

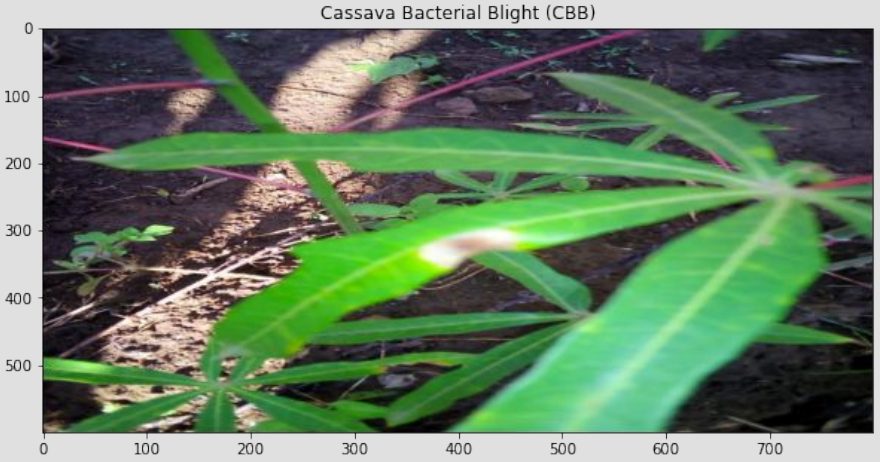
21,400 images taken by Ugandan farmers and labelled by experts.

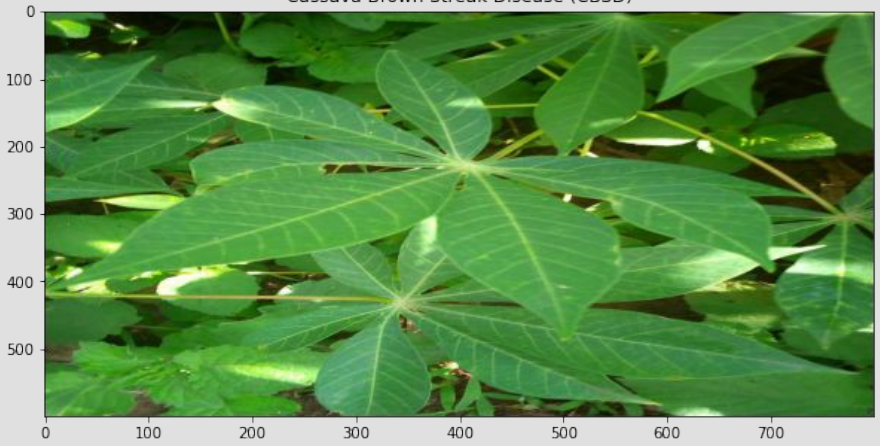
The dataset is clearly unbalanced towards images of plants with Cassava Mosaic Disease

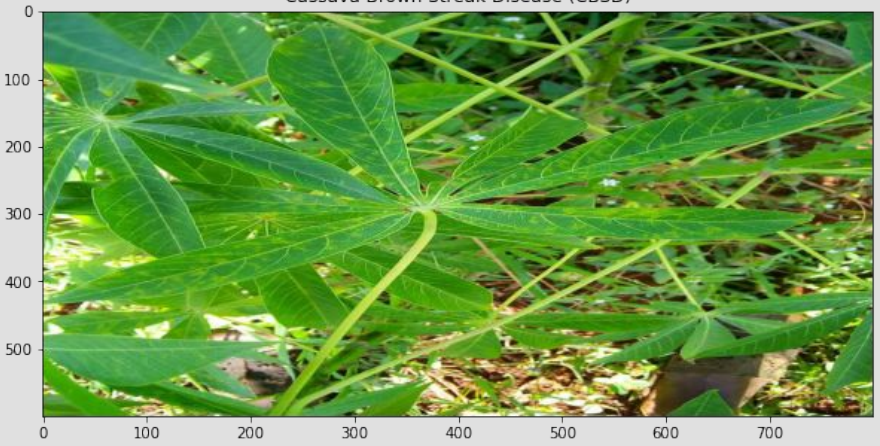


Images

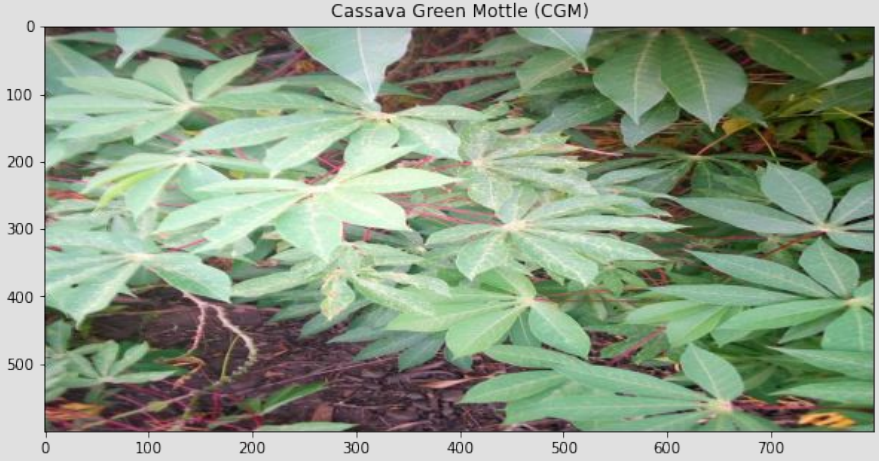

Cassava Bacterial Blight (CBB)
0
100
200
300
400
500
0
100
200
300
400
500
600
700

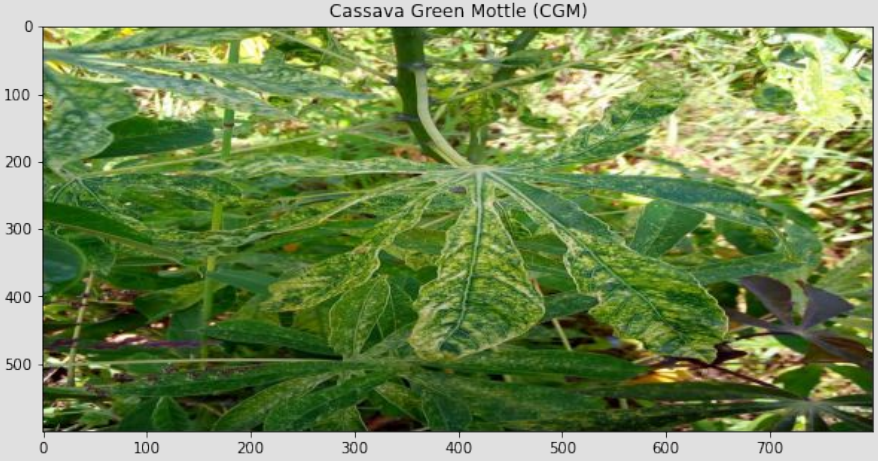

Cassava Bacterial Blight (CBB)
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Cassava Brown Streak Disease (CBSD)
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Cassava Brown Streak Disease (CBSD)
0
100
200
300
400
500
0
100
200
300
400
500
600
700

Images


Cassava Green Mottle (CGM)
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Cassava Green Mottle (CGM)
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Cassava Mosaic Disease (CMD)
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Cassava Mosaic Disease (CMD)
0
100
200
300
400
500
0
100
200
300
400
500
600
700

Images

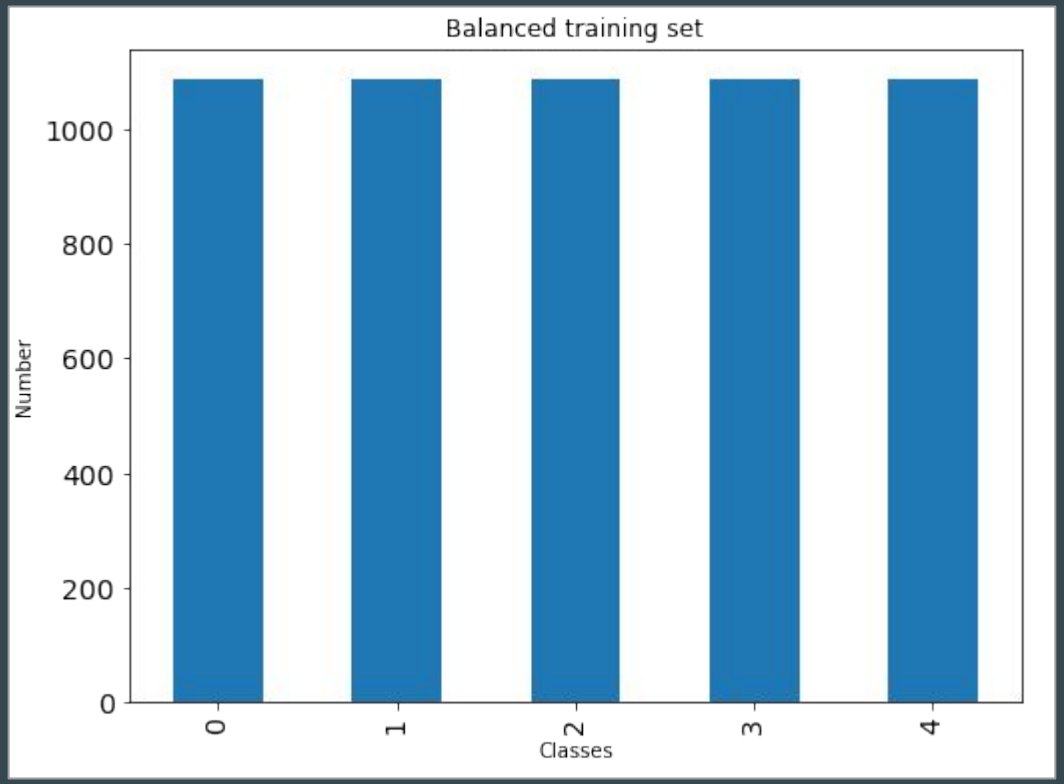

Healthy
0
100
200
300
400
500
0
100
200
300
400
500
600
700


Healthy
0
100
200
300
400
500
0
100
200
300
400
500
600
700

Restrictions

Due to memory restrictions in Kaggle and to better balance the training data I used a smaller dataset.

Also, image resolution was lowered to ⅕ its original resolution.



Approach to the problem

Python code:

- reads the training images
- selects a training and validation datasets
- trains a neural network
- analyzes the output
- predicts unlabeled images

Tested network architectures

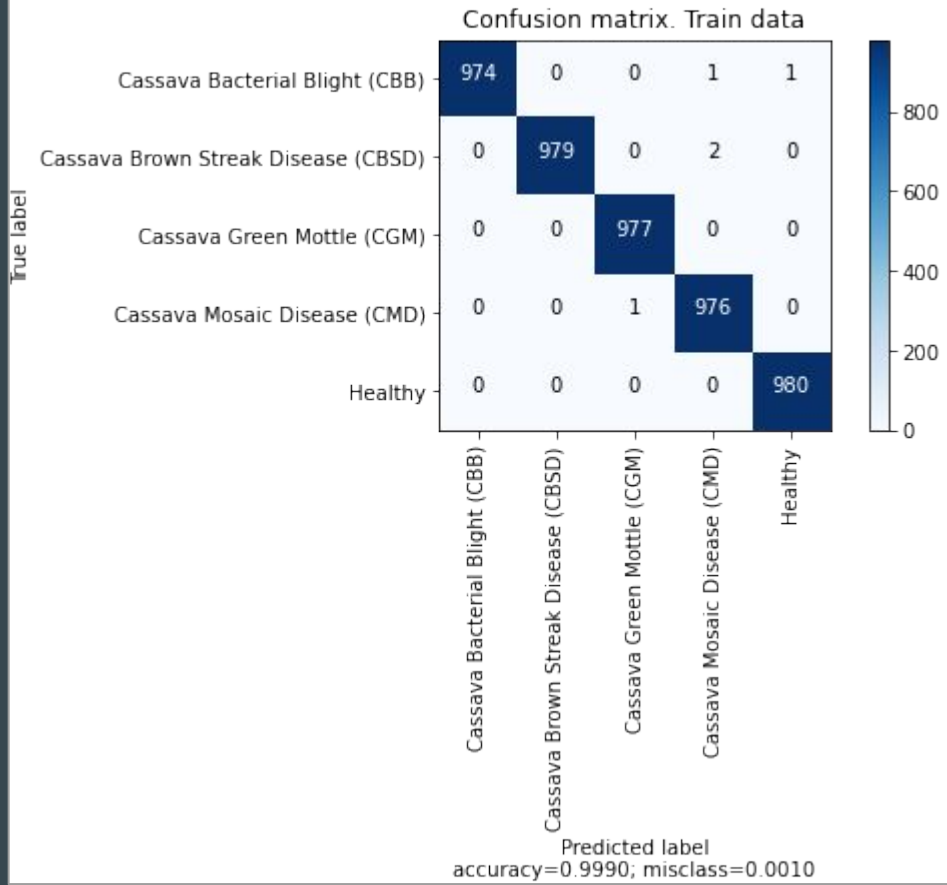
Tried several Convolution Neural Networks architectures (simple CNN, ResNet50, VGG16, Xception), achieving the best results by using the ResNet50 architecture

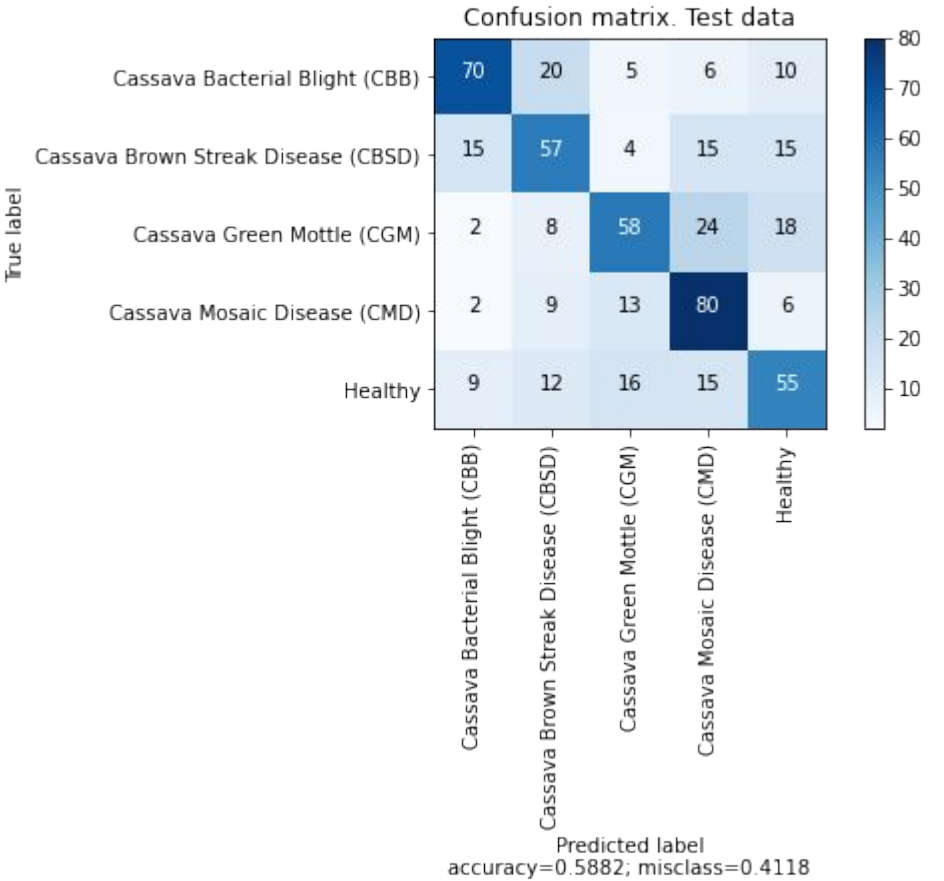
CNN type	Validation data set accuracy
Basic v1	0.27
Basic v2	0.30
Basic v3	0.36
Xception	0.50
ResNet50	**0.58**

ResNet50

- A convolutional neural network 50 layers deep
- Weights pre-trained on ImageNet (a database of millions of images)
- Excellent results in image classification
- Developed by Microsoft researchers in 2015

Results (so far): Transfer learning using ResNet50





Next steps

- Validation set accuracy of 0.58 is clearly not enough
- Check mislabeled images (?)
- Use a different approach to images:
  - First: create an object recognition model that crops images of single leaves.
  - Second: use a similar image classification algorithm than the one implemented here, but using cropped images of leaves..