Project for The Data Incubator's Data Science Training Program
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1 Introduction

Manihot esculenta, commonly called cassava is cultivated as an annual crop in tropical and subtropical regions for its starchy and tuberous root and it serves a major source of carbohydrate. Cassava serves as food for over half a billion of people in the developing world [1] . Cassava has both economic and health benefits. It can be used as biofuel and animal feed. It can also be used to curb or cure fever, diarrhea and stomach aches. Unfortunately, cassava crops are prone to some plant diseases. The aim of this project is to develop a model to classify cassava leaves diseases among 4 common cassava disease.

2 Data set

2.1 Data

The dataset consists of leaf images of the cassava plant, with 9,436 annotated images and 12,595 unlabeled images of cassava leaves.
The data set has 4 categories of disease leaves, which are: Cassava Brown Streak Disease(CBSD), Cassava Green Mite(CGM), Cassava Bacterial Blight(CBB) and Cassava Mosaic Disease(CMD) and 1 category of healthy leaves. [2]

2.2 Data Preprocessing

The image size used is 224x224. We used horizontal flip, random resized crop, center crop and random rotation on the images as a form of data augmentation.

3 Models

I tried a lot of pretrained models. I again ensemble a lot of these models and the outputs were quit good.

Comparing with other models, Resnext101-32x8d gives the best accuracy (91%). (it was 90% during validation test), see Section 4: Table 1. The model is pretrained and we just remove the last layer (the classifier)and add two additional fully connected layers and a Relu function in between. The first layer takes 2048 inputs and 128 output, the second layer has 128 input and 5 outputs(5 is the number of classes). Model parameters: I initialize the learning Rate(LR) with 0.0001 and use LR scheduler to find the best learning rate for each epoch.

4 Results and Findings

In this section, I introduce the results of some of the models used. A number of pre-trained models have been performed such as: ResNet101 ResNet152, DenseNet 121 , and EfficientNet and VGG19. These Models recorded accuracies

between 83% and 86%. Table 1 describes the Models with high accuracies. I ensemble ResNet101 and VGG19 and obtained as accuracy of 86% on the validation set. I implemented these models using only pytorch.

Model Type	Accuracy	Epochs	Batch Size	Optimizer
Resnet50	87.00	25	32	Adam
Resnet101	88.06	25	32	Adam
Se_resnext101-32x4d	89.00	30	32	Adam
Resnext101-32x8d	91.00	25	32	Adam

Table 1: Summary of used Models during Validation test.

5 Conclusion and Limitations

5.1 Limitations

There was lack of adequate GPU and GCP. I needed more computational resources(power) to perform a lot of experiments.

5.2 Conclusion

In conclusion, I observed that Adam optimizer performed better other than optimizers like Stochastic Gradient Descent(SGD) and on all the models. Se_Resnext101-32x4d also performed well but was quit slow. Using learning rate scheduler helped us a lot to obtained a good accuracy on the Public Leader Board. Increasing the number of epochs usually improve the accuracy of train data, however it will usually end up with over-fitting. I then limited our number of epochs to be between 25-30 and also validated on the training set showed by the table. I again observed that Cross Entropy Loss performed better than Negative Log Likelihood Loss(NLL Loss) on all our models.
I believe that when our model is deployed, it will help in detecting cassava leave disease. This will help farmers increase their productivity and earn much money.

References

[1] website: https://en.wikipedia.org/wiki/Cassava , [access:7, May 11:00 pm]

[2] Mwebaze, E., Gebru, T., Frome, A., Nsumba, S. and Tusubira, J., 2019. iCassava 2019Fine-Grained Visual Categorization Challenge. arXiv preprint arXiv:1908.02900.