Homework #2- Machine Learning for Robotics (RBE 577)

Vehicle Classification with Resnet

In autonomous driving we often need to classify the surrounding vehicles using the on-board vision system. The goal of this homework is to finetune resnet model to classify images of the road vehicles.

You obtain your dataset from here:

https://www.kaggle.com/datasets/marquis03/vehicle-classification/data

(you need to signup for Kaggle to be able to download the data).

The data consists of 2000 high-resolution images labeled with vehicle scene classification information (i.e. bus, truck, sedan, van, ...) and is already split in train/val/test for you.

You can obtain pretrained resnet that is trained on Imagenet dataset from Pytorch and finetune it for this application:

https://pytorch.org/vision/stable/models.html

You need to remove the resnet head and implement a new classification head for this application. You can either freeze the rest of the resnet weights/biases and only train the head OR you can finetune all the weights in the resent starting with the pretrained weights (obviously the latter requires more GPU).

Notes:

- You need to make sure you normalize your images the same way the pretrained weights are obtained (as discussed in the lecture)
- You need to apply proper regularization and data augmentation techniques that were discussed in the lectures to avoid overfitting and underfitting.
- You can use any version of resent such as resnet18, resnet34, resnet50, resnet101, or resnet152.

Team Collaboration:

- Teams of two can collaborate on the homework.

Final Deliverables:

1. Python code for the implementation along with a readme file containing the python version and version of all the packages used and how to run the code.

2. Using Tensorboard, you need to provide plots of loss function in training and validation data set as a function of epoch.

3. Using Tensorboard, you need to provide plots of accuracy in training and validation and test data set as a function of epoch.

4. 10 examples of the classified images from the test dataset and show that your model can correctly classify test images.

5. The pdf of the final report. It should contain the explanation of your methodology, lesson learned, all the plots, and hyperparameters of the neural network.