Computer Vision
Homework 3: Big vs Small Models

Due on Wednesday, November 16, 2022

Overview

In this homework, you will train a model from scratch and know the relationship between the accuracy, model size, and the training dataset size.

Model & Dataset

ResNet
One of the most common publications for image classification. First, we train the model without the pre-trained weight. Second, we train with the pre-trained weight for the discussion part.

CIFAR10
A common dataset for image classification. It consists of 60000 32x32 color images in 10 classes. (Airplane, automobile, bird, cat, deer, dog, frog, horse, ship, and truck.)

Environment

We recommend you use the colab to finish this homework whether you have a GPU.

If you don't want to use colab, please use the following command to install the required python libraries.

```
conda create -n cv-hw3 python=3.7
conda activate cv-hw3
conda install pytorch torchvision torchaudio cudatoolkit=10.2 -c pytorch
conda install jupyter matplotlib numpy pandas pillow tqdm
```

Problems

1. (30%) Finish the rest of the codes for Problem 1 and Problem 2 according to the hint. (2 code cells in total.)

2. Train **small model (resnet18)** and **big model (resnet50)** from scratch on 'sixteenth_train_dataloader', 'half_train_dataloader', and 'train_dataloader' respectively.

3. (30%) Achieve the best performance given all training data using **whatever model and training strategy**. (You cannot use the model that was pretrained on CIFAR10)

Discussion

Write down your insights in the report. The file name should be **report.pdf**.

- (30%) The relationship between the accuracy, model size, and the training dataset size. (Total 6 models. Small model trains on the sixteenth, half, and all data. Big model trains on the sixteenth, half, and all data. The result is similar to Fig. 1.)

- (10%) What if we train the ResNet with ImageNet initialized weights (weights="IMAGENET1K_V1"), how would the relationship change?
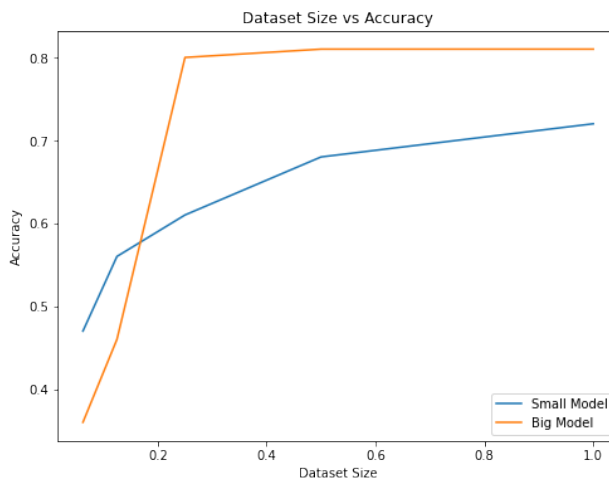
Figure 1: Dataset Size vs Accuracy

Submission

Remember to provide your source code for Problem 3 in **homework-3.ipynb**.

Please compress **homework-3.ipynb** and **report.pdf** in a single zip file, and upload it to the eLearn system. The name should be **HW3_YOUR_STUDENT_ID.zip**.

Contacts

If you find anything wrong or have questions about this homework, please contact me via email (Hung-Ju Liao, hankliao87@gmail.com).

Reference

[1]   Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. "Deep Residual Learning for Image Recognition". In CoRR 2015.

[2]   Alex Krizhevsky, Vinod Nair, and Geoffrey Hinton. "CIFAR-10 (Canadian Institute for Advanced Research)". http://www.cs.toronto.edu/~kriz/cifar.html.