Assignment 3 - PyTorch Training Pipeline

Advanced Topics in Neural Networks

Due date: Week 8

Homework - 25 points

Implement a generic training pipeline using PyTorch. This pipeline must be configurable either through command line arguments or configuration files. Prepare a short report with the experimental results. The report can be Markdown or PDF file, should have at least 1 page, and will be included in the submission.

You will receive 8 points for the following features:

1. Pipeline is device agnostic.
2. You can configure classification training on the following datasets: MNIST, CIFAR-10, CIFAR-100, and OxfordIIITPet.
3. Datasets are efficient and support data augmentation.
4. Can use any of the following models: resnet18, resnet50, resnest14d, resnest26d, and MLP. Use timm or huggingface to load the models.
5. Can be configured to use any of the following optimizers: SGD, Adam, AdamW, Muon, SAM.
6. Can be configured to use one of the following learning rate schedulers: StepLR and ReduceLROnPlateau.
7. Integrates a batch size scheduler.
8. Is integrated with Tensorboard and/or wandb for metrics reporting. Must report relevant training and testing metrics. Supports an early stopping mechanism.

You will receive 8 points for the following features:

- Do a hyperparameter sweep using Wandb or a custom script + Tensorboard.
- Have at least 8 configurations that achieve over 70% accuracy on the CIFAR-100 dataset.

- Describe the parameters you varied during the sweep in the report.
- Add a table with the test accuracy for your experiments and the time spent for training.
- Include pictures from your metrics reporting system (Tensorboard or wandb).

You will receive 3 points for the following features:

- The training pipeline is efficient (training time or RAM usage or VRAM usage).
- You motivate why in the report and include measurements.
- Caching will not be considered, you have to do several other steps to achieve this.

You will receive 6 points for the following features:

- No pretraining:
  - Achieve 79% accuracy on CIFAR-100. (1 point)
  - Achieve 80% accuracy on CIFAR-100. (1 point)
  - Achieve 81% accuracy on CIFAR-100. (1 point)
- Using pretraining:
  - Achieve 82% accuracy on CIFAR-100. (1 points)
  - Achieve 85% accuracy on CIFAR-100. (2 points)
- Include a separate section in the report for these results (no pretraining vs pretraining), add a table, and include pictures from your metrics reporting system (Tensorboard or wandb).

For the report:

- You can prepare a PDF or Markdown file, longer than 1 page.
- Add a section at the end in which you estimate the score you would receive for each criteria.
- Consider describing the parameters you varied.
- Add tables with the results.
- Add images with the metrics.
- Add a "Setup + How to run" section. If it doesn't run, no points will be awarded for this homework.

You have to submit a link to the homework, preferably a Github repository. Remember to add the corrector (George Stoica) as a viewer if your repository is private. You may also submit a PDF/md report with links to Kaggle/Google Colab notebooks.