Assignment 5 - Finetuning

Advanced Topics in Neural Networks

31 October 2023

Homework

Deadline End-of-Day 6 November 2023

Using the previously built pipeline (or implement a new one), compare multiple optimizers and do hyper-parameter tuning. The dataset that is to be used is a minimized CIFAR-10, in which you must include these transformations in your training pipeline, for both training and validation images:

```
from torchvision.transforms import v2

transforms = [
    v2.ToImage(),
    v2.ToDtype(torch.float32, scale=True),
    v2.Resize((28, 28), antialias=True),
    v2.Grayscale(),
    torch.flatten,
]
```

You can use any PyTorch feature to build your model, except for convolution, recurrent or attention layers. Do multiple experiments and compare the performance of optimizers and their parameters using Tensorboard and weights & biases.

1. Implement the logging system using Tensorboard. You should log at least the following metrics:
   (a) epoch training loss
   (b) batch training loss
   (c) epoch training accuracy
   (d) epoch validation loss
   (e) epoch validation accuracy
   (f) model norm
   (g) learning rate

(h) batch size

(i) optimizer

You may also choose to log other hyper-parameters (1 point).

2. Use weights & biases to hyper-tune your parameters. (1 point).
3. Evaluate the performance of multiple optimizers, at least 3 configurations for each:
   - SGD and Adam (1 point);
   - RMSProp, AdaGrad (1 point);
   - SGD with SAM (1 point).
4. Find a configuration which achieves over 40% validation accuracy (1 point).
5. Find a configuration which achieves over 50% validation accuracy (1 point).
6. **Bonus:** Find a configuration which achieves over 60% validation accuracy (1 point).
7. **Bonus:** Find a configuration which achieves over 70% validation accuracy (1 point).

Your training pipeline must run both on CPU and GPU, using a device parameter.
You must include the Tensorboard log files and the weights & biases link in your submission and a README.md file in which you summarize what you did, your results, and the expected number of points.
You must also include an image in which you plot the validation accuracy of each configuration, with a corresponding legend. If one plot is not clear enough (due to the number of experiments), include multiple plots by grouping configurations with common attributes, and add another plot with the top configurations.
Upload your homework in the /Lab05/Solution directory. If you are doing your homework in a Jupyter Notebook, add the "Open in Colab" option.