

Neural Networks from Scratch
Winter Term 2024

Exercise 3

- Return electronically until Tuesday, November 12, 2024, 09:00
- Include your names on the top sheet. Hand in only one PDF.
- A maximum of three students are allowed to work jointly in a group.
- When you include plots add a short explanation of what you expected and observed.
- Hand in source code if the exercise required programming. You can bundle the source code along with the PDF in a .zip file.

3.1 Neural network on GPU

In this exercise we are going to move our CPU only implementation of the small MLP onto the GPU. Following this we will evaluate when and by how much a GPU can help in speeding up computations. Note: If you would like to complete this exercise on your own machine you must have an Nvidia GPU present and accessible to CuPy.

- For this exercise we provide a source code template called `exercise03_template.py` you can use this as a starting point for all exercises on this sheet. The template implents a working numpy MLP of the previous exercise.
- First, activate your conda environment on the cluster or on your own machine, as explained in the cluster user manual. Run `conda activate eml` on the cluster to activate it.
- Implement the MLP using CuPy, this is mostly a direct drop-in replacement. Make sure to use only CuPy for computations. PyTorch is only to be used for the dataloaders.
- Run a training run with the new network implementation once on the CPU and once on the GPU (with the default parameters and for 30 epochs) and plot the test accuracy over time, not over the number of epochs.
- Discuss the results obtained in the previous plot.
- Now increase the size of the intermediate layers for the MLP and measure both the CPU and GPU time for one epoch (at least 7 measurement points).
- Plot the time per epoch for both CPU and GPU, dependent on the intermediate layer size.
- Plot the speedup of the GPU implementation over the CPU implementaiton, dependent on the intermediate layer size.
- Discuss the results obtained in the previous plots.