

How to Launch experiments for the paper:

"Improved Theory for Error Feedback: From Quadratic to Arithmetic Mean of Smoothness Constants"

Prerequisites

The experiments for the paper "**Improved Theory for Error Feedback: From Quadratic to Arithmetic Mean of Smoothness Constants**".

Experiments were constructed by modifying FL_PyTorch <https://arxiv.org/abs/2202.03099>, [GitHub link](#) simulation tool.

The first step is preparing the environment. Preparation of environment described in [README.md](#) files of this publicly available repository.

If you have installed the [conda](#) environment and package manager then you should perform only the following steps for preparing the environment:

```
conda create -n fl python=3.9.1 -y
conda install -n fl pytorch=1.10.0 torchvision numpy cudatoolkit=11.1 h5py=3.6.0
coloredlogs matplotlib psutil pyqt pytest pdoc3 wandb -c pytorch -c nvidia -c conda-forge -y
conda activate fl
```

Our experiments have been carried out utilizing computation only in CPU. Our modification of the simulator is located in [./fl_pytorch](#).

Please use this version that we're providing instead of the Open Source version.

The place with Execution Command Lines for launch experiments

The next directories contain a command line for launching the computation work:

Experiments with synthetic datasets

- [./fl_pytorch/show_topk.py](#) - Experiment for section **Practical Role of Improvement for EF21**. It demonstrates dependence $\sqrt{\beta/\theta}$ as a function of dimension d for fixed compressor TopK with K equal to 1, 5, 10, 50, 100.
- [./fl_pytorch/launch_scripts/full_synthetic](#) - Experiments for **EF21** and **EF21-W** Algorithms in sythetic datasets.
- [./fl_pytorch/launch_scripts/pp_synthetic](#) - Experiments for **EF21-PP** and **EF21-W-PP** Algorithms sythetic datasets.

Experiments with several LIBSVM datasets

- [./fl_pytorch/launch_scripts/full_libsvm](#) - Experiments for **EF21** and **EF21-W** Algorithms for LIBSVM real datasets.
- [./fl_pytorch/launch_scripts/pp_libsvm](#) - Experiments for **EF21-PP** and **EF21-W-PP** Algorithms in LIBSVM datasets.
- [./fl_pytorch/launch_scripts/sgd_libsvm](#) - Experiments for **EF21-SGD** and **EF21-W-SGD** Algorithms in LIBSVM datasets.

Experiments with stepsize multipliers and utilizing Natural compressor

- [./fl_pytorch/launch_scripts/full_australian_step_size_mult](#) - Experiments for **EF21** and **EF21-W** Algorithms for AUSTRALIAN real datasets.

Visualization of the Results: Standalone

Result binary files can be loaded into the simulator [./fl_pytorch/fl_pytorch/gui/start.py](#). After this plots can be visualized in the *Analysis* tab. Recommendations on how to achieve this are available in [TUTORIAL.md](#) provided with [flpytorch](#) simulator.

Visualization of the Results: Online

If you want to use the [WandB](#) online tool to track the progress of the numerical experiments please specify:

- `--wandb-key "xxxxxxxxxx"` with a key from your wandb profile: <https://wandb.ai/settings>
- `--wandb-project-name "vvvvvvvvvv"` with a project name that you're planning to use.

You should replace `--wandb-project-name "vvvvvvvvvv"` with a project name that you're planning to use or leave the default name. These keys should be replaced manually inside launched scripts if you're interested in WandB support.