

# 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

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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

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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.