Shooting Large-scale Traffic Engineering by Combining Deep Learning and Optimization Approach

This is a Pytorch implementation of LO-TE presented on CoNEXT 2025. LO-TE provides a two-step approach to efficiently resolve large-scale traffic engineering problems: obtaining an initial solution and refining it to achieve a near-optimal TE solution.

Getting started

Hardware requirements

- **CPU**: 16+ cores (more cores recommended for parallel training with multiple samples).
- **Memory**: 64+ GB RAM (512+ GB recommended for larger topologies).
- **GPU**: 8+ GB memory (reduce `--max-flow-num` to lower GPU memory usage).
- **Operating System**: Linux (tested on Ubuntu 20.04 and 22.04).

Dependencies

- Run `pip install -r requirements.txt` to install Python dependencies

- Install gurobipy and get a gurobi license here.

Download traning and testing data

We have uploaded the training and testing data in LO-TE paper, including topology information, traffic demands, candidate paths，and labeled/unlabeled data for training and testing.

We recommend downloading the necessary data and copying it into the ./data directory before running the program.

Training and Testing LO-TE

We have listed the training and testing commands in `run_minmlu.sh`, `run_maxthrpt.sh`, and `run_minweight.sh`. We show an example of traning and testing LO-TE on Cogentco topology and traffic burst model below:

- Pretrain a general model with supervised learning

```
python3 train.py --objective min_mlu --init-te-solution his --log-dir
general-minmlu-his --train-data-dir ./data/train/minmlu/general --training-
epochs 10 --training-mode SL  --use-cuda --T 1 --max-flow-num 1000000
```

- Unsupervised learning for a specific topology and traffic model

```
python3 train.py --objective min_mlu --init-te-solution his --log-dir
minmlu_his_Cogentco_traffic_burst_USL --model-load-dir general-minmlu-his -
-train-data-dir ./data/train/minmlu/Cogentco_traffic_burst_unlabel100 --
training-epochs 50 --training-mode USL  --use-cuda --T 1  --num-sample-
process 5 --K 5 --alpha 1 --max-flow-num 1000000
```

- Testing LO-TE

```
python3 test.py --objective min_mlu --init-te-solution his --use-cuda    --
model-load-dir minmlu_his_Cogentco_traffic_burst_USL --test-data-dir
./data/test/minmlu/Cogentco_traffic_burst   --T 1 --max-flow-num 10000000
--alpha 10
```

Generating training and testing data by yourself

We have also provided the major data generation codes for generating your own training and testing data.
Refer to `./data_generation` for more details.

If you have any questions, please post an issue or send an email to chenyiliu9@gmail.com.

Citation

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