

Spring 2019 Energy-efficient Machine Learning System

Homework Assignment 5

Due date: May 6th 2019

Problem (Prune a LeNet-5). In this problem, you are asked to train and test a neural network for LeNet-5 on MNIST dataset. Some information is as follows:

- A main.py file is already given, it is used to train a dense model, and test your pruned model
- An incomplete sparse_to_fill.py file is given. You need to fill some part of this file to implement pruning function
- When your filled sparse_to_fill.py file is correct, you only need to run main.py file, it should automatically train a dense LeNet, prune it and report the sparsity and accuracy similar to follows:

```
(py35) bash-3.2$ python main.py
Downloading http://yann.lecun.com/exdb/mnist/train-images-idx3-ubyte.gz to
../data/MNIST/raw/train-images-idx3-ubyte.gz
100.1%Extracting ../data/MNIST/raw/train-images-idx3-ubyte.gz
Downloading http://yann.lecun.com/exdb/mnist/train-labels-idx1-ubyte.gz to
../data/MNIST/raw/train-labels-idx1-ubyte.gz
113.5%Extracting ../data/MNIST/raw/train-labels-idx1-ubyte.gz
Downloading http://yann.lecun.com/exdb/mnist/t10k-images-idx3-ubyte.gz to
../data/MNIST/raw/t10k-images-idx3-ubyte.gz
100.4%Extracting ../data/MNIST/raw/t10k-images-idx3-ubyte.gz
Downloading http://yann.lecun.com/exdb/mnist/t10k-labels-idx1-ubyte.gz to
../data/MNIST/raw/t10k-labels-idx1-ubyte.gz
100.4%Extracting ../data/MNIST/raw/t10k-labels-idx1-ubyte.gz
Processing...
Done!
Train Epoch: 1 [0/60000 (0%)] Loss: 2.297226
Train Epoch: 1 [640/60000 (1%)] Loss: 2.262743
Train Epoch: 1 [1280/60000 (2%)] Loss: 2.262075
Train Epoch: 1 [1920/60000 (3%)] Loss: 2.253222
Train Epoch: 1 [2560/60000 (4%)] Loss: 2.204502
Train Epoch: 1 [3200/60000 (5%)] Loss: 2.149553
Train Epoch: 1 [3840/60000 (6%)] Loss: 2.080098
Train Epoch: 1 [4480/60000 (7%)] Loss: 2.003978
Train Epoch: 1 [5120/60000 (9%)] Loss: 1.826507
Train Epoch: 1 [5760/60000 (10%)] Loss: 1.629725
```

```
ch: 10 [55680/60000 (93%)] Loss: 0.00310
ch: 10 [56320/60000 (94%)] Loss: 0.00966
ch: 10 [56960/60000 (95%)] Loss: 0.10472
ch: 10 [57600/60000 (96%)] Loss: 0.01202
ch: 10 [58240/60000 (97%)] Loss: 0.18112
ch: 10 [58880/60000 (98%)] Loss: 0.00580
ch: 10 [59520/60000 (99%)] Loss: 0.02517

Average loss: 0.0389, Accuracy: 9876/10000
ty of model is 0.500
```

Performance Requirement and Submission:

- The test accuracy should achieve above 95%
- Submission should include your source codes and screen snapshot of your test accuracy after pruning and your sparsity ratio

Suggestion for hyperparameter setting (not necessary to follow): Check the default setting in the main.py file. You are allowed to change them

Hint: You can use some reference code in the slides of Lecture 12 if useful.