CSCI-GA.3033-022 Lab2

Date : 20181027

Name : Yuqiong Li

UID : yl5090

C1: see code.

C2: The results are attached below, running on Prince with the following configurations.

Configuration:

SBATCH --nodes=1

#SBATCH --ntasks-per-node=1

#SBATCH --cpus-per-task=2

#SBATCH --time=5:00:00

#SBATCH --mem=8GB

#SBATCH --job-name=visionExperiment

#SBATCH --mail-type=END

#SBATCH --mail-user=yl5090@nyu.edu

#SBATCH --output=slurm\_%j.out

Results:

This is epoch0

Waiting time : 336.9140309970826 secs

Compute time : 54.10260959342122 secs

Epoch time : 391.02214116603136 secs

This is epoch1

Waiting time : 336.83822311321273 secs

Compute time : 54.28430272685364 secs

Epoch time : 391.12363370414823 secs

This is epoch2

Waiting time : 410.20431612664834 secs

Compute time : 52.16937217442319 secs

Epoch time : 462.37474297266454 secs

This is epoch3

Waiting time : 325.32706746831536 secs

Compute time : 53.89947357773781 secs

Epoch time : 379.22757972497493 secs

This is epoch4

Waiting time : 354.654990457464 secs

Compute time : 53.163443291559815 secs

Epoch time : 407.8195492569357 secs

**C3**

Results attached below for number of workers increasing from 2 to 36. The number of workers are highlighted in yellow.

Conclusion: 24 workers are good enough for best performance. When keep increasing the number, time will increase as a result for overhead.

Number of workers 2

This is epoch0

Waiting time : 882.0130517631769 secs

Compute time : 41.19710404379293 secs

Epoch time : 923.2111178715713 secs

Number of workers 2

This is epoch1

Waiting time : 230.8063620813191 secs

Compute time : 58.58630386227742 secs

Epoch time : 289.39349669823423 secs

Number of workers 2

This is epoch2

Waiting time : 156.1685389955528 secs

Compute time : 58.57784634409472 secs

Epoch time : 214.74724402232096 secs

Number of workers 2

This is epoch3

Waiting time : 99.78026999067515 secs

Compute time : 53.93105484591797 secs

Epoch time : 153.71213587978855 secs

Number of workers 2

This is epoch4

Waiting time : 94.68459060648456 secs

Compute time : 53.876126632560045 secs

Epoch time : 148.56157326931134 secs

Number of workers 4

This is epoch0

Waiting time : 488.4206365956925 secs

Compute time : 40.39304074505344 secs

Epoch time : 528.8290420160629 secs

Number of workers 4

This is epoch1

Waiting time : 362.29514878755435 secs

Compute time : 44.0019585066475 secs

Epoch time : 406.31459263386205 secs

Number of workers 4

This is epoch2

Waiting time : 133.1883670105599 secs

Compute time : 63.603955023456365 secs

Epoch time : 196.79318878008053 secs

Number of workers 4

This is epoch3

Waiting time : 64.11337553802878 secs

Compute time : 59.638811827171594 secs

Epoch time : 123.76853013876826 secs

Number of workers 4

This is epoch4

Waiting time : 84.48716916656122 secs

Compute time : 59.36896401224658 secs

Epoch time : 143.85697863111272 secs

Number of workers 8

This is epoch0

Waiting time : 221.5496346335858 secs

Compute time : 59.350017393473536 secs

Epoch time : 280.9302802509628 secs

Number of workers 8

This is epoch1

Waiting time : 236.1803433895111 secs

Compute time : 59.63246555952355 secs

Epoch time : 295.83406716398895 secs

Number of workers 8

This is epoch2

Waiting time : 195.24518889840692 secs

Compute time : 63.121997143141925 secs

Epoch time : 258.39306045509875 secs

Number of workers 8

This is epoch3

Waiting time : 79.61109937960282 secs

Compute time : 85.9637725604698 secs

Epoch time : 165.59509752923623 secs

Number of workers 8

This is epoch4

Waiting time : 34.63451681099832 secs

Compute time : 96.25817398680374 secs

Epoch time : 130.92280558682978 secs

Number of workers 12

This is epoch0

Waiting time : 136.91606784192845 secs

Compute time : 62.61137820687145 secs

Epoch time : 199.53897623997182 secs

Number of workers 12

This is epoch1

Waiting time : 144.64400974055752 secs

Compute time : 62.116847429424524 secs

Epoch time : 206.77475334331393 secs

Number of workers 12

This is epoch2

Waiting time : 145.81470367126167 secs

Compute time : 61.74969713110477 secs

Epoch time : 207.5875221658498 secs

Number of workers 12

This is epoch3

Waiting time : 125.43090993724763 secs

Compute time : 67.15218567987904 secs

Epoch time : 192.58403025567532 secs

Number of workers 12

This is epoch4

Waiting time : 40.829161829315126 secs

Compute time : 89.94084487250075 secs

Epoch time : 130.77954472601414 secs

Number of workers 16

This is epoch0

Waiting time : 87.29225396970287 secs

Compute time : 71.0953484843485 secs

Epoch time : 158.39014262193814 secs

Number of workers 16

This is epoch1

Waiting time : 97.09684382472187 secs

Compute time : 69.41041457932442 secs

Epoch time : 166.54953348403797 secs

Number of workers 16

This is epoch2

Waiting time : 97.71101761329919 secs

Compute time : 71.12606338458136 secs

Epoch time : 168.85628614295274 secs

Number of workers 16

This is epoch3

Waiting time : 99.2604484972544 secs

Compute time : 70.05790488934144 secs

Epoch time : 169.35556225292385 secs

Number of workers 16

This is epoch4

Waiting time : 65.12115315487608 secs

Compute time : 86.30250580888242 secs

Epoch time : 151.4342846996151 secs

Number of workers 20

This is epoch0

Waiting time : 48.72505577048287 secs

Compute time : 86.67115376517177 secs

Epoch time : 135.41895600687712 secs

Number of workers 20

This is epoch1

Waiting time : 47.64103918103501 secs

Compute time : 86.47278310731053 secs

Epoch time : 134.1328736450523 secs

Number of workers 20

This is epoch2

Waiting time : 54.87268427526578 secs

Compute time : 86.46804299438372 secs

Epoch time : 141.34192721918225 secs

Number of workers 20

This is epoch3

Waiting time : 52.76160594262183 secs

Compute time : 90.13946936186403 secs

Epoch time : 142.91701677488163 secs

Number of workers 20

This is epoch4

Waiting time : 61.76518695149571 secs

Compute time : 85.60888508101925 secs

Epoch time : 147.4086578860879 secs

Number of workers 24

This is epoch0

Waiting time : 22.200478611979634 secs

Compute time : 115.45384214678779 secs

Epoch time : 137.7766142738983 secs

Number of workers 24

This is epoch1

Waiting time : 29.202822398860008 secs

Compute time : 110.49803918320686 secs

Epoch time : 139.70463202893734 secs

Number of workers 24

This is epoch2

Waiting time : 24.543701133690774 secs

Compute time : 133.25577826518565 secs

Epoch time : 157.8038281989284 secs

Number of workers 24

This is epoch3

Waiting time : 21.01554827950895 secs

Compute time : 109.97429646225646 secs

Epoch time : 131.11497587384656 secs

Number of workers 24

This is epoch4

Waiting time : 23.554985066875815 secs

Compute time : 122.37106967531145 secs

Epoch time : 145.92886216612533 secs

Number of workers 28

This is epoch0

Waiting time : 30.874863754492253 secs

Compute time : 103.09353293478489 secs

Epoch time : 134.33042321167886 secs

Number of workers 28

This is epoch1

Waiting time : 29.79168302938342 secs

Compute time : 116.15462890081108 secs

Epoch time : 146.09767881780863 secs

Number of workers 28

This is epoch2

Waiting time : 33.30633915076032 secs

Compute time : 129.3982645822689 secs

Epoch time : 162.70802652230486 secs

Number of workers 28

This is epoch3

Waiting time : 26.12819259800017 secs

Compute time : 112.73142029065639 secs

Epoch time : 138.86907289503142 secs

Number of workers 28

This is epoch4

Waiting time : 28.050842970144004 secs

Compute time : 97.9057036889717 secs

Epoch time : 126.05704603111371 secs

Number of workers 32

This is epoch0

Waiting time : 44.894418311305344 secs

Compute time : 93.77032909216359 secs

Epoch time : 138.6703636967577 secs

Number of workers 32

This is epoch1

Waiting time : 57.410582568496466 secs

Compute time : 83.84722373494878 secs

Epoch time : 141.2683215388097 secs

Number of workers 32

This is epoch2

Waiting time : 63.033128838054836 secs

Compute time : 84.5371521548368 secs

Epoch time : 147.60237356368452 secs

Number of workers 32

This is epoch3

Waiting time : 57.19432642683387 secs

Compute time : 89.62054473115131 secs

Epoch time : 146.87662029778585 secs

Number of workers 32

This is epoch4

Waiting time : 68.17093027662486 secs

Compute time : 79.65672725159675 secs

Epoch time : 147.82872012909502 secs

Number of workers 36

This is epoch0

Waiting time : 41.244972974061966 secs

Compute time : 93.70879061240703 secs

Epoch time : 134.95658881682903 secs

Number of workers 36

This is epoch1

Waiting time : 45.59600055310875 secs

Compute time : 89.94007909670472 secs

Epoch time : 135.55688986182213 secs

Number of workers 36

This is epoch2

Waiting time : 53.780724117998034 secs

Compute time : 86.11133345169947 secs

Epoch time : 139.89328769827262 secs

Number of workers 36

This is epoch3

Waiting time : 55.74623293010518 secs

Compute time : 87.33781108446419 secs

Epoch time : 143.09557427093387 secs

Number of workers 36

This is epoch4

Waiting time : 47.86419050535187 secs

Compute time : 93.25864457711577 secs

Epoch time : 141.1514574722387 secs

**C4**

Difference:

* Increasing the number of workers significantly reduced the time for data loading. For example, compared to number of workers = 1, for number of workers = 24 the top activities are no longer data loading but “autograd” and “backward”. See the following log.

Results for workers = 1, top 10 longest function calls

Sun Oct 28 16:43:14 2018 lab2\_profiled\_1.prof

2114953 function calls (2086394 primitive calls) in 4125.757 seconds

Ordered by: cumulative time

List reduced from 6444 to 10 due to restriction <10>

ncalls tottime percall cumtime percall filename:lineno(function)

1296/1 0.055 0.000 4125.760 4125.760 {built-in method builtins.exec}

1 0.001 0.001 4125.760 4125.760 lab2.py:7(<module>)

1 0.404 0.404 4123.104 4123.104 lab2.py:168(main)

605 0.006 0.000 3912.388 6.467 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/utils/data/dataloader.py:311(\_\_next\_\_)

600 0.002 0.000 3912.260 6.520 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/utils/data/dataloader.py:302(\_get\_batch)

600 0.007 0.000 3912.257 6.520 /home/yl5090/.conda/envs/nlp/lib/python3.6/multiprocessing/queues.py:340(get)

4200 0.012 0.000 3911.653 0.931 /home/yl5090/.conda/envs/nlp/lib/python3.6/multiprocessing/connection.py:208(recv\_bytes)

4200 0.015 0.000 3911.637 0.931 /home/yl5090/.conda/envs/nlp/lib/python3.6/multiprocessing/connection.py:406(\_recv\_bytes)

8400 0.032 0.000 3911.615 0.466 /home/yl5090/.conda/envs/nlp/lib/python3.6/multiprocessing/connection.py:374(\_recv)

8402 3911.576 0.466 3911.576 0.466 {built-in method posix.read}

Results for workers = 24, top 10 longest function calls

Sun Oct 28 16:43:15 2018 lab2\_profiled\_24.prof

2159362 function calls (2130803 primitive calls) in 836.401 seconds

Ordered by: cumulative time

List reduced from 6444 to 10 due to restriction <10>

ncalls tottime percall cumtime percall filename:lineno(function)

1296/1 0.056 0.000 836.403 836.403 {built-in method builtins.exec}

1 0.008 0.008 836.400 836.400 lab2.py:7(<module>)

1 0.681 0.681 833.915 833.915 lab2.py:168(main)

600 0.058 0.000 356.320 0.594 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/tensor.py:65(backward)

600 0.024 0.000 356.263 0.594 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/autograd/\_\_init\_\_.py:38(backward)

600 355.907 0.593 355.907 0.593 {method 'run\_backward' of 'torch.\_C.\_EngineBase' objects}

10800/1200 0.460 0.000 312.381 0.260 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/nn/modules/module.py:471(\_\_call\_\_)

600 0.060 0.000 311.938 0.520 lab2.py:103(forward)

2400 0.283 0.000 311.810 0.130 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/nn/modules/container.py:89(forward)

1200 0.026 0.000 179.078 0.149 /home/yl5090/.conda/envs/nlp/lib/python3.6/site-packages/torch/nn/modules/conv.py:299(forward)

**C5**

1. Average epoch time for number of workers = 1 and optimizer = SGD. Batch size = 150 to fit in memory on Prince for GPU. For CPU the batch size is 250.

|  |  |  |
| --- | --- | --- |
| Epoch | CPU | GPU |
| 0 | 391.02 | 436.51 |
| 1 | 391.12 | 399.69 |
| 2 | 462.37 | 421.83 |
| 3 | 379.23 | 829.06 |
| 4 | 407.82 | 593.26 |
| Mean | 406.31 | 536.07 |

1. As below: Batch size = 150 to fit in memory on Prince.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Optimization | Mean epoch time (seconds) | Mean loss | Mean precision@1 | Mean precision@3 |
| Adadelta | 92.05 | 0.29 | 0.92 | 0.62 |
| Adagrad | 88.04 | 0.21 | 0.94 | 0.67 |
| Adam | 85.35 | 0.24 | 0.93 | 0.65 |
| SGD | 85.39 | 0.26 | 0.93 | 0.64 |
| sgd-nesterov | 88.04 | 0.26 | 0.93 | 0.64 |