

Explanations.

-“sinfo” used to see partition of system like CPU(n), Root and their information such as its timelimit, nodes, nodelist and state.


-“squeue” shows the schedule of jobs with their JobID, its partition, issuer, time it is taking, its node.

-“sbatch” is used to submit jobs on Cluster via SLURM such as given Sbatch script at the end of exercise sheet.

-“sshare -all” shows which type of account a user has and his/her usage information such as EffectvUsage. Also, computation share can be seen with this command.

Tasks related to this tutorial with screenshots.

Creating a conda environment and installing PyTorch library and dependencies.

 berk@master: ~

```
(berk_fruit) berk@master:~$ wget https://repo.anaconda.com/archive/Anaconda3-5.3.1-Linux-x86_64.sh
```

```
(berk_fruit) berk@master:~$ bash Anaconda3-5.3.1-Linux-x86_64.sh
```

```
(berk_fruit) berk@master:~$ conda -V  
conda 4.5.11
```

```
(berk_fruit) berk@master:~$ conda install pytorch torchvision cpuonly -c pytorch
```

```
(berk_fruit) berk@master:~$ conda create --name berk_fruit
```

Activating the environment

```
(berk_fruit) berk@master:~$ source activate berk_fruit
```

```
(berk_fruit) berk@master:~$ conda install pytorch torchvision torchaudio cudatoolkit=10.2 -c pytorch
```

Let's put a neural network example from PyTorch website in a `berk_example.py`

```
(berk_fruit) berk@master:~$ nano berk_example.py
```

```
berk@master: ~
GNU nano 4.8                                berk_example.py
-- coding: utf-8 --

import torch
import math

dtype = torch.float
device = torch.device("cpu")
# device = torch.device("cuda:0") # Uncomment this to run on GPU

# Create random input and output data
x = torch.linspace(-math.pi, math.pi, 2000, device=device, dtype=dtype)
y = torch.sin(x)

# Randomly initialize weights
a = torch.randn(1, device=device, dtype=dtype)
b = torch.randn(1, device=device, dtype=dtype)
c = torch.randn(1, device=device, dtype=dtype)
d = torch.randn(1, device=device, dtype=dtype)

learning_rate = 1e-6
for t in range(700000):
    # Forward pass: compute predicted y
    y_pred = a + b * x + c * x ** 2 + d * x ** 3

    # Compute and print loss
    loss = (y_pred - y).pow(2).sum().item()
    if t % 100 == 99:
        print(t, loss)

    # Backprop to compute gradients of a, b, c, d with respect to loss
    grad_y_pred = 2.0 * (y_pred - y)
    grad_a = grad_y_pred.sum()
    grad_b = (grad_y_pred * x).sum()
    grad_c = (grad_y_pred * x ** 2).sum()
    grad_d = (grad_y_pred * x ** 3).sum()

    # Update weights using gradient descent
    a -= learning_rate * grad_a
    b -= learning_rate * grad_b
    c -= learning_rate * grad_c
    d -= learning_rate * grad_d

print(f'Result: y = {a.item()} + {b.item()} x + {c.item()} x^2 + {d.item()} x^3')
```

Now modifying the sbatch script given in the exercise sheet

```
berk@master: ~
```

```
(berk_fruit) berk@master:~$ nano bashme.sh
```

```
berk@master: ~
GNU nano 4.8                                bashme.sh
#!/usr/bin/env bash
#SBATCH --job-name=TEST1
#SBATCH --output=TEST_%j.log
#SBATCH --partition=STUD
#SBATCH --gres=gpu:1

set -e
source /home/berk/anaconda3/bin/activate /home/berk/anaconda3/envs/berk_fruit
cd $PWD
srun /home/berk/anaconda3/envs/berk_fruit/bin/python3 berk_example.py
```

```
(berk_fruit) berk@master:~$ cat bashme.sh
#!/usr/bin/env bash
#SBATCH --job-name=TEST1
#SBATCH --output=TEST_%j.log
#SBATCH --partition=STUD
#SBATCH --gres=gpu:1

set -e
source /home/berk/anaconda3/bin/activate /home/berk/anaconda3/envs/berk_fruit
cd $PWD
srun /home/berk/anaconda3/envs/berk_fruit/bin/python3 berk_example.py
```

Submitting the job - Here we see TEST_327048.log

```
berk@master:~$ sbatch bashme.sh
Submitted batch job 327048
```

```
berk@master:~$ ls
anaconda3  Anaconda3-5.3.1-Linux-x86_64.sh  bashme.sh  berk_example.py  lab_doc.txt  TEST_327048.log
```

Training error of the output .log (last part because cat TEST_327048.log is too long to show)

```
berk@master:~$ tail -f TEST_327048.log
699199 8.817167282104492
699299 8.817167282104492
699399 8.817167282104492
699499 8.817167282104492
699599 8.817167282104492
699699 8.817167282104492
699799 8.817167282104492
699899 8.817167282104492
699999 8.817167282104492
Result: y = 7.448800243281539e-09 + 0.8567265868186951 x + -1.1153709067457385e-08 x^2 + -0.09332836419343948 x^3
```

Checking the all queue

```
(berk_fruit) berk@master:~$ squeue
JOBID PARTITION NAME USER ST TIME NODES NODELIST(REASON)
308153 GPU TEST1 siu PD 0:00 1 (Job's account not permitted to use this partition (GPU allows staff not stud))
308155 GPU TEST1 siu PD 0:00 1 (Job's account not permitted to use this partition (GPU allows staff not stud))
319223 TEST GPU tens rscholz PD 0:00 1 (Resources)
323252 CPU3 index-68 hsjomaa PD 0:00 1 (Resources)
323253 CPU3 index-69 hsjomaa PD 0:00 1 (Priority)
323254 CPU3 index-70 hsjomaa PD 0:00 1 (Priority)
323255 CPU3 index-71 hsjomaa PD 0:00 1 (Priority)
323256 CPU3 index-72 hsjomaa PD 0:00 1 (Priority)
323257 CPU3 index-73 hsjomaa PD 0:00 1 (Priority)
323258 CPU3 index-74 hsjomaa PD 0:00 1 (Priority)
323259 CPU3 index-75 hsjomaa PD 0:00 1 (Priority)
323260 CPU3 index-76 hsjomaa PD 0:00 1 (Priority)
323261 CPU3 index-77 hsjomaa PD 0:00 1 (Priority)
323262 CPU3 index-78 hsjomaa PD 0:00 1 (Priority)
323263 CPU3 index-79 hsjomaa PD 0:00 1 (Priority)
323264 CPU3 index-80 hsjomaa PD 0:00 1 (Priority)
323265 CPU3 index-81 hsjomaa PD 0:00 1 (Priority)
323266 CPU3 index-82 hsjomaa PD 0:00 1 (Priority)
323267 CPU3 index-83 hsjomaa PD 0:00 1 (Priority)
323268 CPU3 index-84 hsjomaa PD 0:00 1 (Priority)
323269 CPU3 index-85 hsjomaa PD 0:00 1 (Priority)
```

Checking the queue for Student partition

```
berk@master:~$ squeue -p STUD
JOBID PARTITION NAME USER ST TIME NODES NODELIST(REASON)
307478 STUD sbatchme cuizon R 7-15:40:43 1 ngpu-019
307477 STUD sbatchme cuizon R 7-16:04:43 1 ngpu-019
307474 STUD sbatchme cuizon R 7-16:19:49 1 ngpu-019
307470 STUD sbatchme cuizon R 7-16:25:16 1 ngpu-019
307468 STUD sbatchme cuizon R 7-16:25:34 1 ngpu-019
307440 STUD sbatchme cuizon R 7-16:31:15 1 ngpu-019
327048 STUD TEST1 berk R 0:06 1 ngpu-019
```

Watch command to display running jobs in Student partition and my jobs

```
berk@master: ~  
Every 2.0s: squeue -p STUD
```

| JOBID | PARTITION | NAME | USER | ST | TIME | NODES | NODELIST (REASON) |
|--------|-----------|----------|--------|----|------------|-------|-------------------|
| 307478 | STUD | sbatchme | cuizon | R | 7-15:40:54 | 1 | ngpu-019 |
| 307477 | STUD | sbatchme | cuizon | R | 7-16:04:54 | 1 | ngpu-019 |
| 307474 | STUD | sbatchme | cuizon | R | 7-16:20:00 | 1 | ngpu-019 |
| 307470 | STUD | sbatchme | cuizon | R | 7-16:25:27 | 1 | ngpu-019 |
| 307468 | STUD | sbatchme | cuizon | R | 7-16:25:45 | 1 | ngpu-019 |
| 307440 | STUD | sbatchme | cuizon | R | 7-16:31:26 | 1 | ngpu-019 |
| 327048 | STUD | TEST1 | berk | R | 0:17 | 1 | ngpu-019 |

Display my running jobs – only to see jobs submitted by me (watch also possible and similar as we see above)

```
berk@master:~$ squeue -u berk
```

| JOBID | PARTITION | NAME | USER | ST | TIME | NODES | NODELIST (REASON) |
|--------|-----------|-------|------|----|------|-------|-------------------|
| 327048 | STUD | TEST1 | berk | R | 0:38 | 1 | ngpu-019 |

Ssh into ngpu-019 node to see if the job is running on GPU

```
berk@master:~$ ssh ngpu-019  
berk@ngpu-019's password:  
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-45-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
BIG MAMA - the ismll cluster  
  
Last login: Tue Feb  9 17:43:19 2021 from 10.1.1.252
```

```
berk@ngpu-019:~$ nvidia-smi
```

```
Tue Feb  9 18:53:34 2021
```

| | | | | | | | | | |
|---|-------------|---------------|---------------|---------------------------|------------------|--------|--------------------|------------|-----|
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| NVIDIA-SMI | | 450.51.05 | | Driver Version: 450.51.05 | | | CUDA Version: 11.0 | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| GPU | Name | Persistence-M | | | Bus-Id | Disp.A | Volatile | Uncorr. | ECC |
| Fan | Temp | Perf | Pwr:Usage/Cap | | Memory-Usage | | GPU-Util | Compute M. | |
| | | | | | | | MIG M. | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 0 | GeForce RTX | 207... | On | | 00000000:1A:00.0 | Off | | | N/A |
| 20% | 29C | P8 | 16W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 1 | GeForce RTX | 207... | On | | 00000000:1B:00.0 | Off | | | N/A |
| 20% | 32C | P8 | 16W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 2 | GeForce RTX | 207... | On | | 00000000:1C:00.0 | Off | | | N/A |
| 20% | 32C | P8 | 17W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 3 | GeForce RTX | 207... | On | | 00000000:1D:00.0 | Off | | | N/A |
| 20% | 34C | P8 | 10W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 4 | GeForce RTX | 207... | On | | 00000000:1E:00.0 | Off | | | N/A |
| 20% | 33C | P8 | 10W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 5 | GeForce RTX | 207... | On | | 00000000:3D:00.0 | Off | | | N/A |
| 20% | 29C | P8 | 10W / 215W | | 1MiB / 7982MiB | | 0% | Default | N/A |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |

| | | | | | | | | | |
|---|--------------------|----|------------|------------------|-----|----|---------|-----|--|
| 6 | GeForce RTX 207... | On | | 00000000:3E:00.0 | Off | | | N/A | |
| 20% | 34C | P8 | 22W / 215W | 1MiB / 7982MiB | | 0% | Default | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 7 | GeForce RTX 207... | On | | 00000000:3F:00.0 | Off | | | N/A | |
| 20% | 31C | P8 | 18W / 215W | 1MiB / 7982MiB | | 0% | Default | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 8 | GeForce RTX 207... | On | | 00000000:40:00.0 | Off | | | N/A | |
| 20% | 32C | P8 | 12W / 215W | 1MiB / 7982MiB | | 0% | Default | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| 9 | GeForce RTX 207... | On | | 00000000:41:00.0 | Off | | | N/A | |
| 20% | 35C | P8 | 20W / 215W | 1MiB / 7982MiB | | 0% | Default | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |

| | | | | | | | | | |
|---|----|----|-----|------|--------------|------------|--|--|--|
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |
| Processes: | | | | | | | | | |
| GPU | GI | CI | PID | Type | Process name | GPU Memory | | | |
| | ID | ID | | | | Usage | | | |
| ===== | | | | | | | | | |
| No running processes found | | | | | | | | | |
| +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+ | | | | | | | | | |

```
berk@ngpu-019:~$ Connection to ngpu-019 closed by remote host.
```

```
Connection to ngpu-019 closed.
```

Htop shows:

```
berk@master:~$ htop
```

```
berk@master:~$ htop
Tasks: 118, 181 sh: 1 running
Load average: 0.13 0.28 0.32
Uptime: 125 days(1), 03:59:32
Mem[11.71G/31.1G]
Swap[1.14G/8.00G]

PID USER     PRI  NI  VIRT  RES  SHR  S CPU% MEM%   TIME+  Command
461 influxdb 20   0  227G  427M  40076 S 11.3  4.3    134h /usr/bin/influxd -config /etc/influxdb/influxdb.conf
1462 influxdb 20   0  227G  427M  40076 S 2.2  1.3   10h29:06 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
1506 influxdb 20   0  227G  427M  40076 S 0.4  1.3   10h00:03 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
3618429 influxdb 20   0  227G  427M  40076 S 2.6  1.3   6h11:03 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
829 slurm 20   0  3108M  739M  4976 S 1.3  2.3  27h21:21 /usr/local/sbin/slurmd
3023254 root 20   0  843M  6720  3308 S 0.0  0.0   6h39:22 /usr/sbin/collectd
1019 influxdb 20   0  227G  427M  40076 S 3.1  1.3   10h43:37 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
3838854 munge 20   0  231M  10160  7652 S 0.4  0.0   19:33:10 /usr/sbin/munged
654 systemd-n 20   0  26876  4368  4128 S 0.0  0.0   7:22:62 /lib/systemd/systemd-networkd
1386 mysql 20   0  2319M  150M  4272 S 0.0  0.5   12:02:79 /usr/sbin/mysqld
859641 berk 20   0  20152 11012  8548 R 0.4  0.0   0:00:19 htop
1796 influxdb 20   0  227G  427M  40076 S 2.6  1.3   10h22:32 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
740 influxdb 20   0  227G  427M  40076 S 0.4  1.3   9h57:49 /usr/bin/influxd -config /etc/influxdb/influxdb.conf
3838856 munge 20   0  217M  10160  7652 S 0.0  0.0   7:34:72 /usr/sbin/munged
3023267 root 20   0  843M  6720  3308 S 0.0  0.0   2h31:11 /usr/sbin/collectd
820 mysql 20   0  2319M  150M  4272 S 0.0  0.5   3h34:47 /usr/sbin/mysqld
969011 ahmedrash 20   0  6889  3816  2624 S 0.0  0.0   1:54:07 watch squeue -u ahmedrash
3023276 root 20   0  843M  6720  3308 S 0.0  0.0   36:50:08 /usr/sbin/collectd
3838857 munge 20   0  217M  10160  7652 S 0.0  0.0   7:34:77 /usr/sbin/munged
888 slurm 20   0  3108M  739M  4976 S 0.0  2.3   1h29:56 /usr/local/sbin/slurmd
47697 mofassir 20   0  6436  2664  2216 S 0.0  0.0   1h32:23 watch -n1 squeue | grep mofassir
1731 grafana 20   0  1676M  44536 16252 S 0.0  0.1   1h01:42 /usr/sbin/grafana-server --config=/etc/grafana/grafana.ini --pidfile=/var/run/grafana/grafana-server.pid --packaging=deb ctf
2036 grafana 20   0  1676M  44536 16252 S 0.0  0.1   6:58:34 /usr/sbin/grafana-server --config=/etc/grafana/grafana.ini --pidfile=/var/run/grafana/grafana-server.pid --packaging=deb ctf
1393 mysql 20   0  2319M  150M  4272 S 0.0  0.5   11:55:68 /usr/sbin/mysqld
514183 hajomaa 20   0  8600  3752  2484 S 0.0  0.0   0:15:92 watch squeue -t running -p GPU
704558 rscholz 20   0  31544  7072  4848 S 0.0  0.0   0:00:11 sshd: rscholz@pts/37
3023275 root 20   0  843M  6720  3308 S 0.0  0.0   36:43:26 /usr/sbin/collectd
1 root 20   0  167M  10212  4096 S 0.0  0.0   6:40:36 /sbin/init maybe-ubiquity
396 root 19  -1  162M  69820  69880 S 0.0  0.2   57:15:81 /lib/systemd/systemd-journald
432 root 20   0  22376  4192  3140 S 0.0  0.0   0:32:38 /lib/systemd/systemd-udev
574 root  RT  0  273M  17936  8188 S 0.0  0.1   0:57:45 /sbin/multipathd -d -s
575 root  RT  0  273M  17936  8188 S 0.0  0.1   0:00:00 /sbin/multipathd -d -s
576 root  RT  0  273M  17936  8188 S 0.0  0.1   0:08:94 /sbin/multipathd -d -s
577 root  RT  0  273M  17936  8188 S 0.0  0.1   6:21:28 /sbin/multipathd -d -s
578 root  RT  0  273M  17936  8188 S 0.0  0.1   0:00:00 /sbin/multipathd -d -s
579 root  RT  0  273M  17936  8188 S 0.0  0.1   0:00:00 /sbin/multipathd -d -s
572 root  RT  0  273M  17936  8188 S 0.0  0.1   14:14:30 /sbin/multipathd -d -s
615 rpc 20   0  7096  2312  2312 S 0.0  0.0   0:12:18 /sbin/rpcbind -f -w
650 systemd-t 20   0  90396  3512  3460 S 0.0  0.0   0:00:00 /lib/systemd/systemd-timesyncd
616 systemd-t 20   0  90396  3512  3460 S 0.0  0.0   0:14:47 /lib/systemd/systemd-timesyncd
```

Explanation: IT monitors the systems resource usage through users by frequently updating. We can see command by a user and how much time it is taking, CPU usage etc.

Copy a data from my local computer to the master with “scp” command

```
user@DESKTOP-U52L9RM MINGW64 ~/Documents
$ scp lab_doc.txt berk@master.ism11.de:/home/berk/lab_doc.txt
berk@master.ism11.de's password:
lab_doc.txt
```

```
berk@master: ~
berk@master:~$ ls
anaconda3  Anaconda3-5.3.1-Linux-x86_64.sh  bashme.sh  berk_example.py  lab_doc.txt  TEST_327048.log
berk@master:~$ nano lab_doc.txt
```

```
berk@master: ~
GNU nano 4.8 lab_doc.txt
This is document to check for lab exercise.
```