

## Can Berk - 306919

### Lab 11 - Mini Cluster Exercise

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

+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+									
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 shs: 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  217M 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.
```