NYU Greene cluster setup

- Greene cluster info: https://sites.google.com/nyu.edu/nyu-hpc/hpc-systems/greene/getting-started?authuser=0
- Login into Greene cluster login node:
  - ssh username@access.cims.nyu.edu
  - ssh greene.hpc.nyu.edu
  - ssh burst
  - squeue # check if one of the following partition is used by others.
  - Launch an interactive job using slurm (it's fine to hop onto the 2-gpu partition if it's not being used, the starting of an interactive job may take a couple of minutes)
    - srun --account=csci_ga_3033_085-2023sp --partition=n1s8-v100-1 --gres=gpu:1 --pty /bin/bash
    - srun --account=csci_ga_3033_085-2023sp --partition=n1s16-v100-2 --gres=gpu:2 -- pty /bin/bash
    - srun --account=csci_ga_3033_085-2023sp --partition=c12m85-a100-1 --gres=gpu:1 -- pty /bin/bash
    - srun --account=csci_ga_3033_085-2023sp --partition=c24m170-a100-2 --gres=gpu:2 - -pty /bin/bash
- **Do the homework in a singularity container HPC setup:**
  - **/share/apps/pytorch/1.13.0/./run-pytorch.bash**

Finish up the exercise

- Check the environment:
  - python -c 'import torch; print(torch.__version__); print(torch.cuda.is_available());’
- Code play:
  - git clone https://github.com/pytorch/examples
  - cd examples/mnist
  - vi main.py
  - python3 main.py --help
  - python3 main.py --batch-size 64 --epochs 1 --dry-run
    - Train Epoch: 1 [0/60000 (0%)] Loss: 2.299825
    - HAO 1
    - HAO 2
- Instruction counting (example here):
  - ncu --profile-from-start off --metrics smsp__sass_thread_inst_executed_op_fadd_pred_on --target-processes all python3 ./main.py --batch-size 64 --epochs 1 --dry-run

```
Singularity> pwd
/home/hy2467/work/examples/mnist
Singularity> git diff
diff --git a/mnist/main.py b/mnist/main.py
index 29d81d6..50734ce 100644
--- a/mnist/main.py
+++ b/mnist/main.py
@@ -6,6 +6,7 @@ import torch.nn.functional as F
 import torch.optim as optim
 from torchvision import datasets, transforms
 from torch.optim.lr_scheduler import StepLR
+import torch.cuda.profiler as ncu


 class Net(nn.Module):
@@ -21,7 +22,14 @@ class Net(nn.Module):
     def forward(self, x):
         x = self.conv1(x)
         x = F.relu(x)
+        if START_TRACE:
+            print("HAO 1")
+            ncu.start()
         x = self.conv2(x)
+        if START_TRACE:
+            print("HAO 2")
+            ncu.stop()
+            quit()
         x = F.relu(x)
         x = F.max_pool2d(x, 2)
         x = self.dropout1(x)
@@ -131,9 +139,12 @@ def main():
     model = Net().to(device)
     optimizer = optim.Adadelta(model.parameters(), lr=args.lr)

+    global START_TRACE
+    START_TRACE=False
     scheduler = StepLR(optimizer, step_size=1, gamma=args.gamma)
     for epoch in range(1, args.epochs + 1):
         train(args, model, device, train_loader, optimizer, epoch)
+        START_TRACE=True
         test(model, device, test_loader)
         scheduler.step()
```

Example NCU output

```
ncu --profile-from-start off --metrics smsp__sass_thread_inst_executed_op_fadd_pred_on  --target-processes all python3 ./main.py --batch-size 64 --epochs 1 --dry-run
==PROF== Connected to process 202870 (/ext3/miniconda3/bin/python3.9)
Train Epoch: 1 [0/60000 (0%)]   Loss: 2.299825
==PROF== Target process 204133 terminated before first instrumented API call.
HAO 1
==PROF== Profiling "computeOffsetsKernel" - 1: 0%....50%....100% - 1 pass
==PROF== Profiling "volta_scudnn_128x64_relu_xreg..." - 2: 0%....50%....100% - 1 pass
==PROF== Profiling "elementwise_kernel" - 3: 0%....50%....100% - 1 pass
HAO 2
==PROF== Target process 204765 terminated before first instrumented API call.
==PROF== Disconnected from process 202870
[202870] python3.9@127.0.0.1
  void cask_cudnn::computeOffsetsKernel<(bool)0, (bool)0>(cask_cudnn::ComputeOffsetsParams), 2023-Mar-24 11:41:52, Context 1, Stream 7
    Section: Command line profiler metrics
    ---------------------------------------------------------------------- -------------- ------------------------------
    smsp__sass_thread_inst_executed_op_fadd_pred_on.avg                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.max                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.min                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.sum                          inst                              0
    ---------------------------------------------------------------------- -------------- ------------------------------

  volta_scudnn_128x64_relu_xregs_large_nn_v1, 2023-Mar-24 11:41:52, Context 1, Stream 7
    Section: Command line profiler metrics
    ---------------------------------------------------------------------- -------------- ------------------------------
    smsp__sass_thread_inst_executed_op_fadd_pred_on.avg                          inst                         115200
    smsp__sass_thread_inst_executed_op_fadd_pred_on.max                          inst                         120832
    smsp__sass_thread_inst_executed_op_fadd_pred_on.min                          inst                         108544
    smsp__sass_thread_inst_executed_op_fadd_pred_on.sum                          inst                         xxxxxx
    ---------------------------------------------------------------------- -------------- ------------------------------

  void at::native::elementwise_kernel<(int)128, (int)2, void at::native::gpu_kernel_impl<at::native::CUDAFunctor_add<float>>(at::TensorIteratorBase &, const T1
&)::[lambda(int) (instance 1)]>(int, T3), 2023-Mar-24 11:41:52, Context 1, Stream 7
    Section: Command line profiler metrics
    ---------------------------------------------------------------------- -------------- ------------------------------
    smsp__sass_thread_inst_executed_op_fadd_pred_on.avg                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.max                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.min                          inst                              0
    smsp__sass_thread_inst_executed_op_fadd_pred_on.sum                          inst                              0
    ---------------------------------------------------------------------- -------------- ------------------------------
```