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NetIds: mepauls2, jayati, sal3
Team name: team_name
School: On-campus

Kernels (>90% of program time):*Here we assume GPU activity = memory transfer + kernel operations (gpu hardware usage)*

32.06% 35.969ms   20 1.7984ms 1.1200us 33.609ms **[CUDA memcpy HtoD]**

17.88% 20.062ms   1 20.062ms 20.062ms 20.062ms **volta_scudnn_128x64_relu_interior_nn_v1**

17.16% 19.252ms   4 4.8129ms 4.8122ms 4.8133ms **volta_gcgemm_64x32_nt**

8.53% 9.5671ms   4 2.3918ms 2.0052ms 3.1255ms **void fft2d_c2r_32x32<float, bool=0, bool=0, unsigned int=0, bool=0, bool=0>(float*, float2 const *, int, int, int, int, int, int, int, int, int, float, float, cudnn::reduced_divisor, bool, float*, float*, int2, int, int)**

7.80% 8.7556ms   1 8.7556ms 8.7556ms 8.7556ms **volta_sgemm_128x128_tn**

6.42% 7.2052ms   2 3.6026ms 25.536us 7.1797ms **void op_generic_tensor_kernel<int=2, float, float, float, int=256, cudnnGenericOp_t=7, cudnnNanPropagation_t=0, cudnnDimOrder_t=0, int=1>(cudnnTensorStruct, float*, cudnnTensorStruct, float const *, cudnnTensorStruct, float const *, float, float, float, float, dimArray, reducedDivisorArray)**

5.70% 6.3895ms   4 1.5974ms 1.2742ms 2.0207ms **void fft2d_r2c_32x32<float, bool=0, unsigned int=0, bool=0>(float2*, float const *, int, int, int, int, int, int, int, int, int, cudnn::reduced_divisor, bool, int2, int, int)**

3.88% 4.3527ms   1 4.3527ms 4.3527ms 4.3527ms **void cudnn::detail::pooling_fw_4d_kernel<float, float, cudnn::detail::maxpooling_func<float, cudnnNanPropagation_t=0>, int=0, bool=0>(cudnnTensorStruct, float const *, cudnn::detail::pooling_fw_4d_kernel<float, float, cudnn::detail::maxpooling_func<float, cudnnNanPropagation_t=0>, int=0, bool=0>, cudnnTensorStruct*, cudnnPoolingStruct, float, cudnnPoolingStruct, int, cudnn::reduced_divisor, float)**

CUDA API Calls (>90% program time):

1. cudaStreamCreateWithFlags
   41.41%(time%) 3.08766s(time) 22(calls) 140.35ms(avg) 14.396us(min) 1.61488s(max)
2. cudaMemGetInfo

    33.15%(time%) 2.47141s(time) 24(calls) 102.98ms(avg) 55.402us(min) 2.46633s(max)

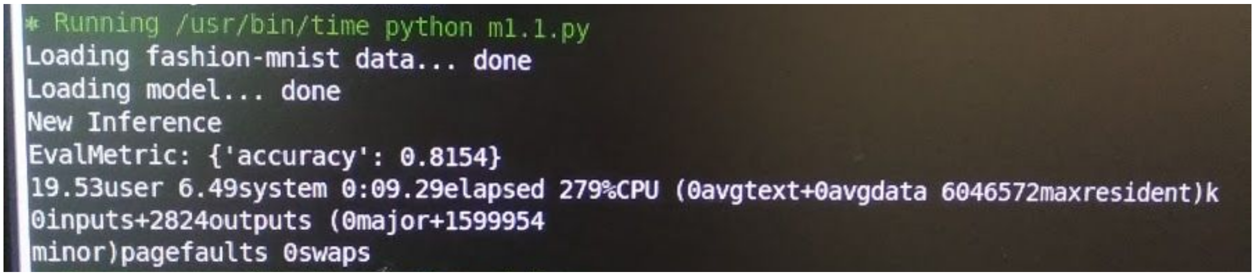
3. cudaFree
   21.17%(time%) 1.57836s(time) 19(calls) 83.072ms(avg) 1.2440us(min) 421.47ms(max)

Kernel launch vs. API call:

CUDA API calls are instructions (cudaMemcpy, cudaGetDevice, etc.) that are executed by the host (CPU) to initiate memory transfer, execution or to communicate with the GPU and are executed once.

GPU kernels are C functions that when called, are executed N times in parallel by N different CUDA threads, as opposed to only once like regular C functions. (N is defined by the grid).

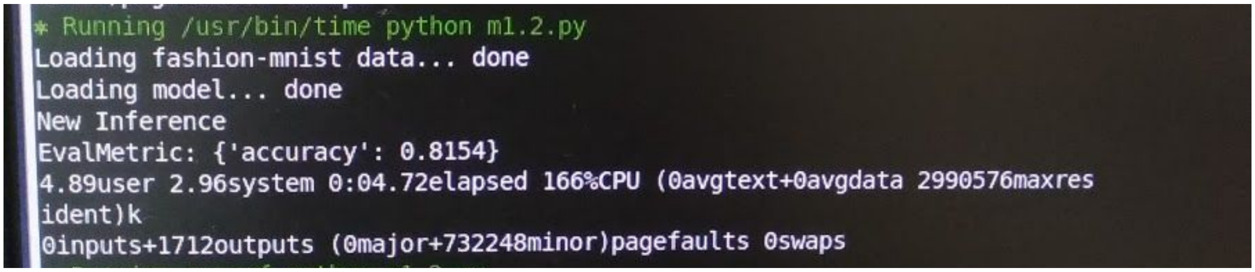
Rai running MXNet on the CPU:



```
* Running /usr/bin/time python m1.1.py
Loading fashion-mnist data... done
Loading model... done
New Inference
EvalMetric: {'accuracy': 0.8154}
19.53user 6.49system 0:09.29elapsed 279%CPU (0avgtext+0avgdata 6046572maxresident)k
0inputs+2824outputs (0major+1599954
minor)pagefaults 0swaps
```

Program run time:
User: 19.53 seconds
System: 6.49 seconds
Elapsed: 0:09.29

Rai running MXNet on the GPU:



```
* Running /usr/bin/time python m1.2.py
Loading fashion-mnist data... done
Loading model... done
New Inference
EvalMetric: {'accuracy': 0.8154}
4.89user 2.96system 0:04.72elapsed 166%CPU (0avgtext+0avgdata 2990576maxres
ident)k
0inputs+1712outputs (0major+732248minor)pagefaults 0swaps
```

Program run time:
User: 4.89 seconds
System: 2.96 seconds
Elapsed: 0:04.72

Whole program execution time:

New Inference:10000
User: 88.36 seconds
System: 10.38 seconds
Elapsed: 1:16.79 seconds
Op Time: 11.134082 seconds
Op Time: 61.390580 seconds
Correctness: 0.7653 Model: ece408

New Inference:1000
User: 18.35 seconds
System: 2.70 seconds
Elapsed: 0:11.22
Op Time: 1.317549
Op Time: 6.760934
Correctness: 0.767 Model: ece408

New Inference:100
User: 8.61
System: 2.60
Elapsed: 0:03.16
Op Time: 0.119225
Op Time: 0.676391
Correctness: 0.76 Model: ece408