University of Illinois at Urbana Champaign

Applied Parallel Programming

Team: wandering-gpu

Final Project

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Milestone 1

1 Kernel Statistics

Time(%)	Time	Calls	Avg	Min	Max	Name
40.10%	16.788ms	20	839.42us	1.1200us	16.155ms	[CUDA memcpy HtoD]
20.18%	8.4497ms	1	8.4497ms	8.4497ms	8.4497ms	void cudnn::detail::implicit_convolve_sgemm
11.81%	4.9434ms	1	4.9434ms	4.9434ms	4.9434ms	volta_cgemm_64x32_tn
7.05%	2.9497ms	2	1.4748ms	25.568us	2.9241ms	void op_generic_tensor_kernel
5.69%	2.3830ms	1	2.3830ms	2.3830ms	2.3830ms	void fft2d_c2r_32x32
5.59%	2.3404ms	1	2.3404ms	2.3404ms	2.3404ms	volta_sgemm_128x128_tn
4.55%	1.9059ms	1	1.9059ms	1.9059ms	1.9059ms	void cudnn::detail::pooling_fw_4d_kernel
4.18%	1.7480ms	1	1.7480ms	1.7480ms	1.7480ms	void fft2d_r2c_32x32

2 CUDA API Statistics

Time(%)	Time	Calls	Avg	Min	Max	Name
41.94%	2.94373s	22	133.81ms	13.721us	1.52482s	cudaStreamCreateWithFlags
34.43%	2.41664s	24	100.69ms	97.853us	2.41057s	cudaMemGetInfo
20.93%	1.46898s	19	77.315ms	817ns	393.98ms	cudaFree

3 Differences Between Kernels & API Calls

A CUDA kernel is an extended C function that, when called, are executed multiple times in parallel by different CUDA threads on the GPU. The CUDA APIs are programming interfaces that allow the programmer to use the CUDA device, i.e. the GPU. Kernel functions are written by the programmer and are meant to execute specific (mostly computation-intensive) tasks on the GPU, while API calls are provided by the CUDA library and are to manage the CUDA runtime environment and mostly prepare for the execution of kernels. While kernels are always executed by CUDA cores, CUDA APIs do not necessarily involve the execution of CUDA cores.

4 MXNet CPU Execution

```
Loading fashion-mnist data... done
Loading model... done
New Inference
EvalMetric: {'accuracy': 0.8236}
```

Run Time. 5.06s

5 MXNet GPU Execution

```
Loading fashion-mnist data... done
Loading model... done
New Inference
EvalMetric: {'accuracy': 0.8236}
```

Run Time: 4.40s

Milestone 2

Full CPU Time	11.32s
First Layer Time	2.405296s
Second Layer Time	7.342860

10000 images

Full CPU Time	0.250576s
First Layer Time	0.756567s
Second Layer Time	2.03s

1000 images

Full CPU Time	1.08s
First Layer Time	0.035050s
Second Layer Time	0.075312s

100 images

Table 1: CPU Run Time Statistics

Milestone 3

1 Execution Summary

First Layer Time	9.252ms
Second Layer Time	19.331ms

10000 images

First Layer Time	0.677ms
Second Layer Time	1.968ms

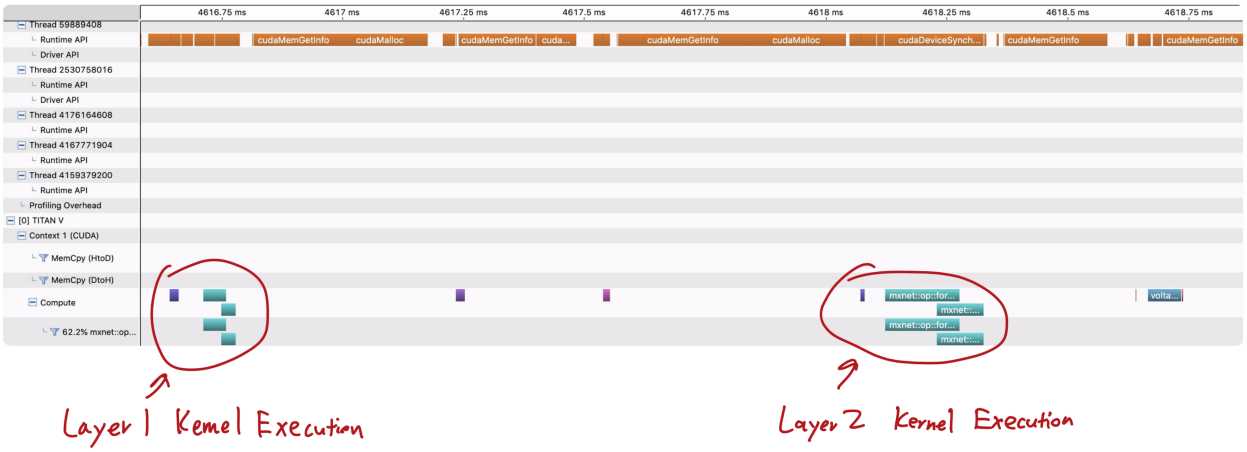
1000 images

First Layer Time	0.121ms
Second Layer Time	0.248ms

100 images

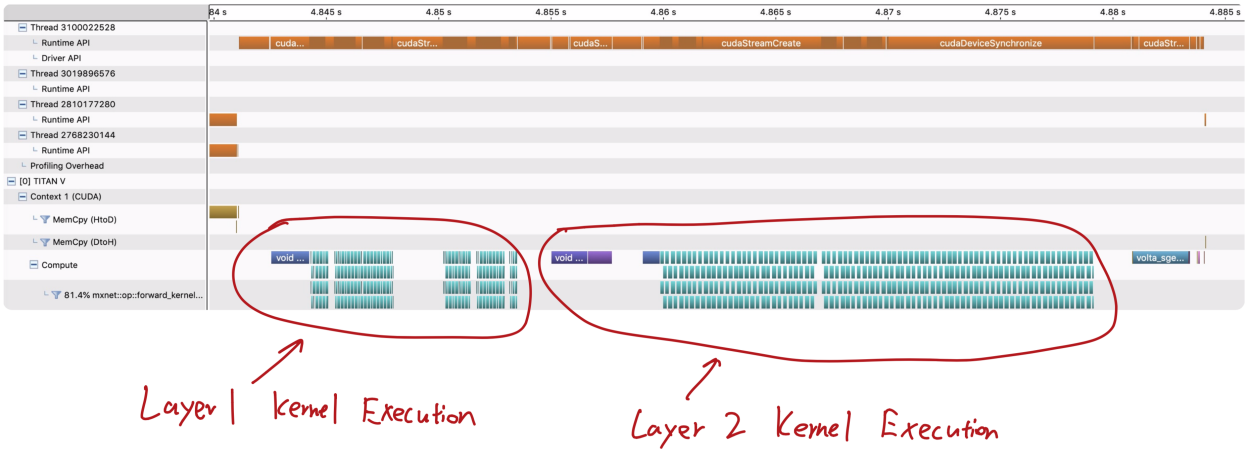
Table 2: GPU Run Time Statistics

2 Execution Timeline



(a) Dataset Size 100

(b) Dataset Size 1000



(c) Datset Size 10000

Figure 1: Kernel Execution Timelines generated by NVVP.