

ELEC 4511/5511 Hardware/Software Interface

OpenCL Image Filters

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Topics Covered:

- Shared memory utilization: allocation and shared access
- 2-D task description of blocks
- Reformulation of computation for data-level parallelism

[Item 1] - For the assignment, submit the .cl file and...

It's attached to submission.

Note: All times are in [ms]

[Item 2] - Provide the execution time for the Sobel filter:

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.879	2.913	3.313993174
dublin.bmp	3.344	58.133	17.38427033

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Sobel_dublin.bmp --filter sobel -cl filter_kernel.cl
Processing sobel : images/dublin.bmp -> images/Sobel_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 58.133000 ms

Finished with OPENCL Kernel
Computation Time: 3.344000 ms

[charles.bollig@ucdeneleccalc-01 OpenCL]$ █

[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Sobel_lena.bmp --filter sobel -cl filter_kernel.cl
Processing sobel : images/lena.bmp -> images/Sobel_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 2.913000 ms

Finished with OPENCL Kernel
Computation Time: 0.879000 ms

[charles.bollig@ucdeneleccalc-01 OpenCL]$ █
```

[Item 3] – Implement the Average Filter

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.343	1.889	5.50728863
dublin.bmp	2.515	38.6	15.34791252

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Average_dublin.bmp --filter average -cl filter_kernel.cl
Processing average : images/dublin.bmp -> images/Average_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 38.608000 ms

Finished with OPENCL Kernel
Computation Time: 2.515000 ms
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Average_lena.bmp --filter average -cl filter_kernel.cl
Processing average : images/lena.bmp -> images/Average_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 1.889000 ms

Finished with OPENCL Kernel
Computation Time: 0.343000 ms
```

[Item 4] – Implement the Boost Filter

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.358	1.919	5.360335196
dublin.bmp	2.66	41.601	15.63947368

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Boost_dublin.bmp --filter boost -cl filter_kernel.cl
Processing boost : images/dublin.bmp -> images/Boost_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 41.601000 ms

Finished with OPENCL Kernel
Computation Time: 2.660000 ms
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Boost_lena.bmp --filter boost -cl filter_kernel.cl
Processing boost : images/lena.bmp -> images/Boost_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 1.919000 ms

Finished with OPENCL Kernel
Computation Time: 0.358000 ms
```

Graduate Students-

[Item 5] - Provide the execution time for the 5x5 Sobel filter:

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.361	6.421	17.7867036
dublin.bmp	3.87	109.995	28.42248062

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Sobel5x5_dublin.bmp --filter sobel5x5 -cl filter_kernel.cl
Processing sobel5x5 : images/dublin.bmp -> images/Sobel5x5_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 109.995000 ms

Finished with OPENCL Kernel
Computation Time: 3.870000 ms
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Sobel5x5_lena.bmp --filter sobel5x5 -cl filter_kernel.cl
Processing sobel5x5 : images/lena.bmp -> images/Sobel5x5_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 6.421000 ms

Finished with OPENCL Kernel
Computation Time: 0.361000 ms
```

[Item 6] – Implement the 5x5 Average Filter

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.6	3.412	5.686666667
dublin.bmp	7.124	66.262	9.301235261

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Average5x5_dublin.bmp --filter average5x5 -cl filter_kernel.cl
Processing average5x5 : images/dublin.bmp -> images/Average5x5_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 66.262000 ms

Finished with OPENCL Kernel
Computation Time: 7.124000 ms

[charles.bollig@ucdeneleccalc-01 OpenCL]$ █
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Average5x5_lena.bmp --filter average5x5 -cl filter_kernel.cl
Processing average5x5 : images/lena.bmp -> images/Average5x5_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 3.412000 ms

Finished with OPENCL Kernel
Computation Time: 0.600000 ms

[charles.bollig@ucdeneleccalc-01 OpenCL]$ █
```

[Item 7] – Implement the 5x5 Boost Filter

Input Size	OPENCL Execution Time	CPU Execution Time	Speedup (x times)
lena.bmp	0.578	3.428	5.930795848
dublin.bmp	6.74	71.467	10.60341246

```
[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/dublin.bmp --out images/Boost5x5_dublin.bmp --filter boost5x5 -cl filter_kernel.cl
Processing boost5x5 : images/dublin.bmp -> images/Boost5x5_dublin.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 1533 by 1024 = 1569792 , imagesize = 1572864
Finished with CPU Kernel
Computation Time: 71.467000 ms

Finished with OPENCL Kernel
Computation Time: 6.740000 ms

[charles.bollig@ucdeneleccalc-01 OpenCL]$ ./filterCL --file images/lena.bmp --out images/Boost5x5_lena.bmp --filter boost5x5 -cl filter_kernel.cl
Processing boost5x5 : images/lena.bmp -> images/Boost5x5_lena.bmp
OpenCL file : filter_kernel.cl
Parameters : Radius 1 BoostThreshold 1
Image details: 256 by 256 = 65536 , imagesize = 65536
Finished with CPU Kernel
Computation Time: 3.428000 ms

Finished with OPENCL Kernel
Computation Time: 0.578000 ms
```