

HW4: Cuda Image Processing

Jonathan Land

Kernel launch configuration: For the Gaussian blur program (hw4_main.cu) I used my image reader to get the height and width via a struct, and then passed this in to read the image. The gridsize I used was $\text{weight} * \text{height} + \text{blockzise})/\text{blocksize}$. To be honest, I tried this first ($\text{weight} * \text{height} + \text{blockzise})$), and when this did not work, I tried $(\text{width} * \text{height} + \text{blockSize} - 1) / \text{blockSize};$) for my gridsize. This worked when I passed it in. For some of the methods, I tried different values based on where I thought my code was going wrong. Sometimes this worked; sometimes this did not. I struggled wth this assignment, to say the least. Since the configuration approach and weighted blur worked for the Gaussian blur method, I tried to use the same configuration on edge detection, but it did not work as I planned. Basically the program got the edges, but it did not get *all* the edges of the *whole* picture. It stops nearly half way. For the custom method, I used 8,8 threads per block and for number of blocks, I divided the width and height by 8. This sort of worked, and I was able to change the picture to produce the image I wanted. I used those numbers for really no reason at to be honest. I tried 16 and it produced the same things, so 8 seemed like a good number to use.

Choice method description: My method uses the edge detection algorithm described in class, and in the edge detection code submitted with the assignment, but it changes the colors of the pixels so that it prints other colors besides white when an edge is found.

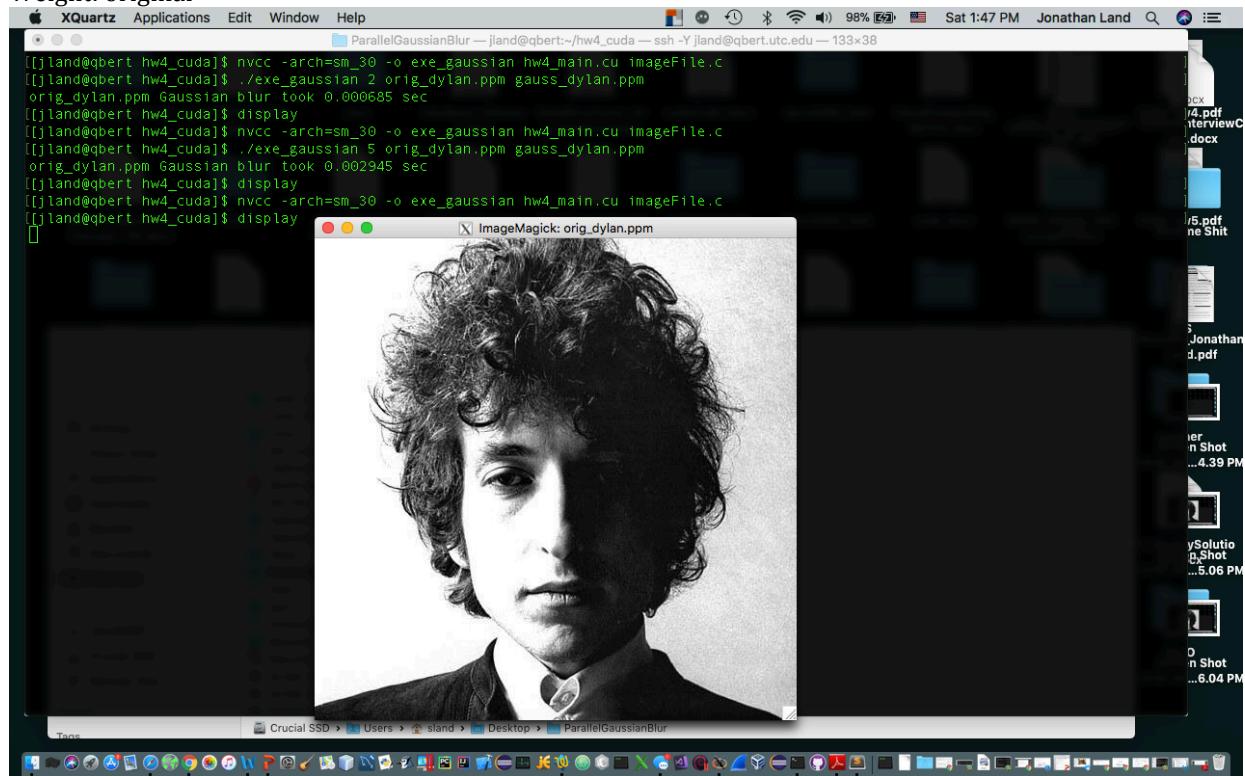
ppm Images used



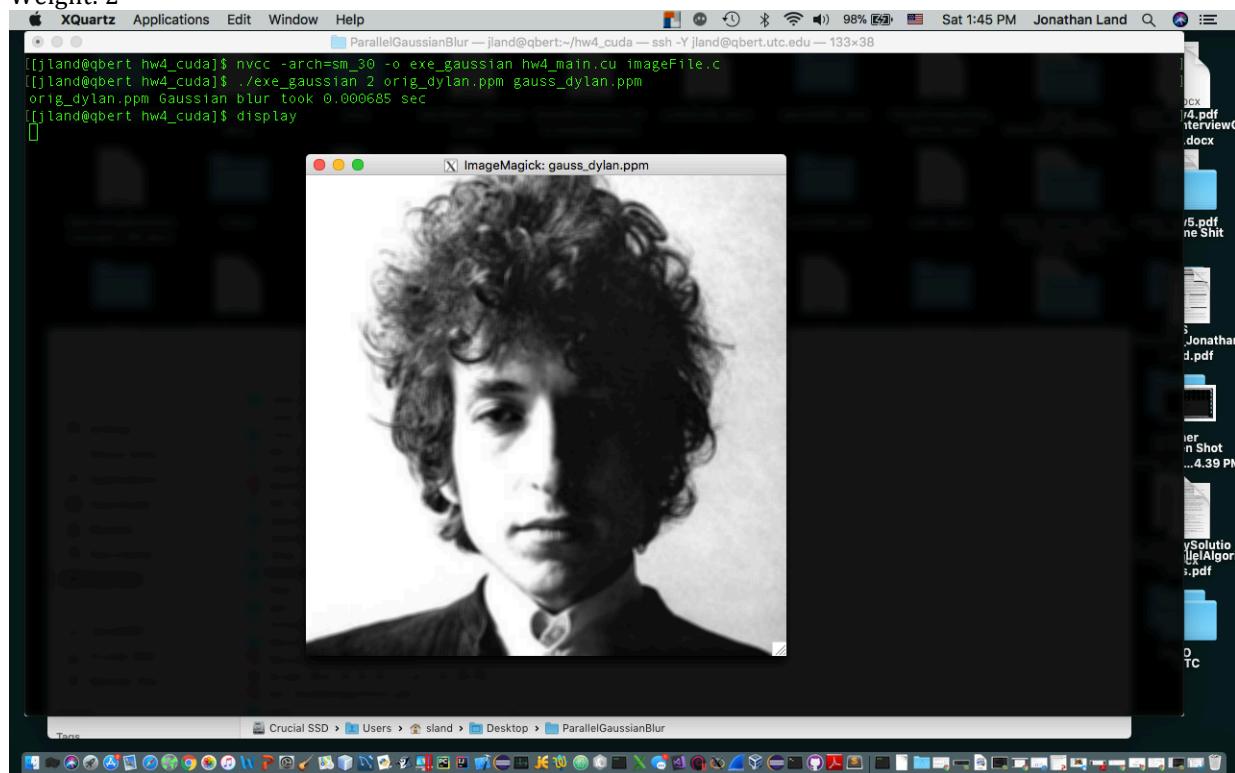


Weighted Gaussian blur and timings

Weight: original



Weight: 2



Weight: 5

A screenshot of a Mac OS X desktop. The top menu bar shows "XQuartz Applications Edit Window Help". A terminal window is open with the following command history:

```
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[jland@qbert hw4_cuda]$ display
```

A small window titled "ImageMagick: gauss_dylan.ppm" displays a blurred black and white portrait of Bob Dylan. The desktop background is dark, and the Dock at the bottom shows various application icons.

Weight: 10

```
[jland@qbert hw4_cuda]$ ls
anymethod2_dylan2.ppm      anymethod_yosemite.ppm      exe_anymethod      gauss_yosemite.ppm      imageFile.c      orig_yosemiete2.ppm
anymethod2_dylan.ppm        edgedetect_dylan2.ppm      exe_edgedetect      hw4_main_cu          imageFile.c      orig_yosemite.ppm
anymethod2_yosemite2.ppm    edgedetect_dylan.ppm       exe_gaussian        hw4_main_edgedetection2.cu  imageFile.h
anymethod_dylan.ppm         edgedetect_yosemite2.ppm  gauss_dylan.ppm     hw4_main_edgedetection.cu orig_dylan2.ppm
anymethod_dylan2.ppm        edgedetect_yosemite.ppm   gauss_yosemite2.ppm imagefile.c      orig_dylan.ppm

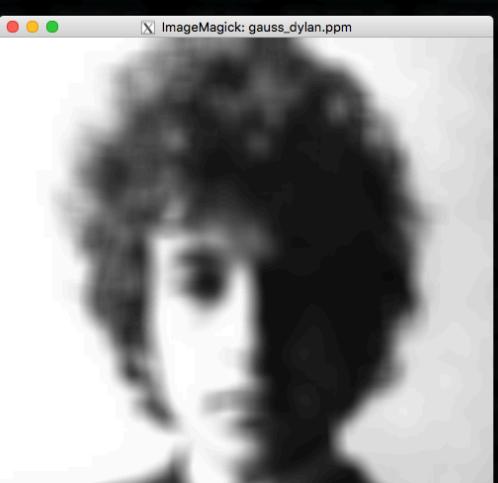
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 1 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000312 sec

[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000688 sec

[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002913 sec

[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 10 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.010255 sec

[jland@qbert hw4_cuda]$ display
[]
```



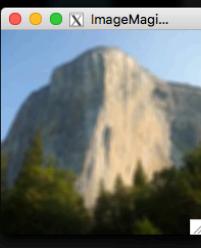
Weight: original

```
XQuartz Applications Edit Window Help ParallelGaussianBlur — jland@qbert:~/hw4_cuda — ssh -Y jland@qbert.utc.edu — 133x38
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000504 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000433 sec
[[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.001731 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000434 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ display
```



Weight: 2

```
XQuartz Applications Edit Window Help ParallelGaussianBlur — jland@qbert:~/hw4_cuda — ssh -Y jland@qbert.utc.edu — 133x38
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ display
[[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[[jland@qbert hw4_cuda]$ display
```



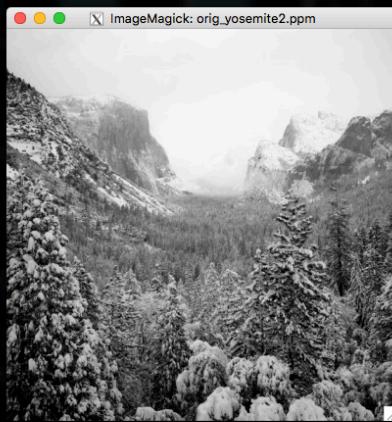
Weight 5:

```
XQuartz Applications Edit Window Help
ParallelGaussianBlur — jland@qbert:~/hw4_cuda — ssh -Y jland@qbert.utc.edu — 133x38
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000504 sec
[jland@qbert hw4_cuda]$ display
```



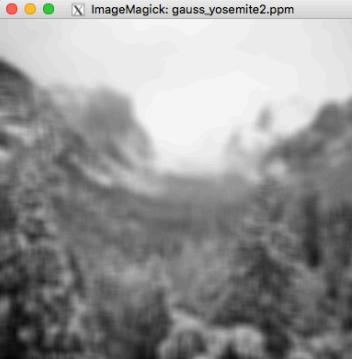
Weight: 2

```
XQuartz Applications Edit Window Help
ParallelGaussianBlur — jland@qbert:~/hw4_cuda — ssh -Y jland@qbert.utc.edu — 139x38
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000504 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000433 sec
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.001731 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000434 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ display
```



Weight: 5

```
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000504 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000433 sec
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.001731 sec
[jland@qbert hw4_cuda]$ display
```



Edge detection



The photo is in the bottom corner of the right side. I was able to figure out how to do some of this method, but struggled to complete it. This one changes the hair color for some reason, but I think I got close to getting the algorithm correct, if you see the code.

```

[jland@qbert ~]$ ls
cudaprograms hw4      hw4_main_anyMethod.cu      hw4test      hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE     hw4_cuda  hw4_main_edgedetection.cu  hw4_testmethods intel          output.ppm    PosixProgram
[jland@qbert ~]$ mv hw4_main_anyMethod.cu hw4_cuda/
[jland@qbert ~]$ mv hw4_main_edgedetection.cu hw4_cuda/
[jland@qbert ~]$ ls
cudaprograms hw4      hw4test      hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE     hw4_cuda  hw4_main_testmethods intel          output.ppm    PosixProgram
[jland@qbert ~]$ cd hw4_cuda
[jland@qbert hw4_cuda]$ ls
anymethod2_dylan2.ppm edgedetect_dylan2.ppm  exe_edgedetection gaussTest3_yos.ppm   imageFile.c
anymethod2_dylan.ppm  edgedetect_dylan.ppm   exe_gaussian   gauss_yosemite2.ppm imageFile.c
anymethod2_yosemite2.ppm edgedetect_yosemite2.ppm gauss_dylan.ppm gauss_yosemite.ppm imageFile.h
anymethod_dylan2.ppm  edgedetect_yosemite.ppm gaussTest1_dylan.ppm gaussTest1_yos.ppm  orig_dylan2.ppm
anymethod_dylan.ppm   edgeTest_dylan.ppm    gaussTest1_yos.ppm hw4_main_anyMethod.cu orig_dylan.ppm
anymethod_yosemite.ppm exe_anymethod      gaussTest2_dylan.ppm hw4_main_edgedetection2.cu orig_yosemite2.ppm
anyTest_dylan.ppm     exe_anyMethod       gaussTest2_yos.ppm hw4_main_edgedetection.cu orig_yosemite.ppm
anyTest_yosemite.ppm  exe_edgedetect     gaussTest3_dylan.ppm imagefile.c
[[jland@qbert hw4_cuda]$ hw4_main_anyMethod.cu
-bash: hw4_main_anyMethod.cu: command not found
[jland@qbert hw4_cuda]$ vi hw4_main_anyMethod.cu
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_dylan2.ppm anymethodTest1_dylan.ppm
orig_dylan2.ppm Any method took 0.000112 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm anymethodTest1_yosemiten.ppm
orig_yosemite.ppm Any method took 0.000113 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm anymethodTest1_yosemite.ppm
orig_yosemite.ppm Any method took 0.000100 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ vi hw4_main_edgedetection.cu
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetection hw4_main_edgedetection.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_edgedetection orig_dylan2.ppm edgedetectionTest1_dylan.ppm
orig_dylan2.ppm Edge detection took 0.000189 sec
[jland@qbert hw4_cuda]$ display

```

Any /custom operation

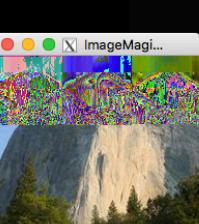
```

Warning: No xauth data; using fake authentication data for X11 forwarding.
Last login: Sat Apr 14 19:52:33 2018 from jlandmbp.wireless.utm.edu
#####
##### Welcome to qbert; if you use this cluster for published research, please use
##### the following excerpt to cite this cluster:
##### This material is based upon work supported by the National Science Foundation
##### under Major Research Instrumentation (MRI) Grant No. 1229213. Any opinions,
##### findings, and conclusions or recommendations expressed in this material are
##### those of the authors and do not necessarily reflect the views of the National
##### Science Foundation
#####
[jland@qbert ~]$ ls
cudaprograms hw4      hw4_main_anyMethod.cu      hw4test      hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE     hw4_cuda  hw4_main_edgedetection.cu  hw4_testmethods intel          output.ppm    PosixProgram
[jland@qbert ~]$ mv hw4_main_anyMethod.cu hw4_cuda/
[jland@qbert ~]$ mv hw4_main_edgedetection.cu hw4_cuda/
[jland@qbert ~]$ ls
cudaprograms hw4      hw4test      hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE     hw4_cuda  hw4_main_testmethods intel          output.ppm    PosixProgram
[jland@qbert ~]$ cd hw4_cuda
[jland@qbert hw4_cuda]$ ls
anymethod2_dylan2.ppm edgedetect_dylan2.ppm  exe_edgedetection gaussTest3_yos.ppm   imageFile.c
anymethod2_dylan.ppm  edgedetect_dylan.ppm   exe_gaussian   gauss_yosemite2.ppm imageFile.c
anymethod2_yosemite2.ppm edgedetect_yosemite2.ppm gauss_dylan.ppm gauss_yosemite.ppm imageFile.h
anymethod_dylan2.ppm  edgedetect_yosemite.ppm gaussTest1_dylan.ppm gaussTest1_yos.ppm  orig_dylan2.ppm
anymethod_dylan.ppm   edgeTest_dylan.ppm    gaussTest1_yos.ppm hw4_main_anyMethod.cu orig_dylan.ppm
anymethod_yosemite.ppm exe_anymethod      gaussTest2_dylan.ppm hw4_main_edgedetection2.cu orig_yosemite2.ppm
anyTest_dylan.ppm     exe_anyMethod       gaussTest2_yos.ppm hw4_main_edgedetection.cu orig_yosemite.ppm
anyTest_yosemite.ppm  exe_edgedetect     gaussTest3_dylan.ppm imagefile.c
[[jland@qbert hw4_cuda]$ hw4_main_anyMethod.cu
-bash: hw4_main_anyMethod.cu: command not found
[jland@qbert hw4_cuda]$ vi hw4_main_anyMethod.cu
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_dylan2.ppm anymethodTest1_dylan.ppm
orig_dylan2.ppm Any method took 0.000112 sec
[jland@qbert hw4_cuda]$ display

```

Yosemite (change colors)

```
findings, and conclusions or recommendations expressed in this material are
those of the authors and do not necessarily reflect the views of the National
Science Foundation
#####
[jland@qbert ~]$ ls
cudaprograms hw4      hw4_main_anyMethod.cu      hw4test          hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE      hw4_cuda  hw4_main_edgedetection.cu  hw4_testmethods intel           output.ppm    PosixProgram
[jland@qbert ~]$ mv hw4_main_anyMethod.cu hw4_cuda/
[jland@qbert ~]$ mv hw4_main_edgedetection.cu hw4_cuda/
[jland@qbert ~]$ ls
cudaprograms hw4      hw4test          hw4_testmethods2 nvvp_workspace ParallelGaussianBlur-master
HW3_CODE      hw4_cuda  hw4_testmethods intel           output.ppm    PosixProgram
[jland@qbert ~]$ cd hw4_cuda
[jland@qbert hw4_cuda]$ ls
anymethod2_dylan2.ppm   edgedetect_dylan2.ppm   exe_edgedetection gaussTest3_yos.ppm   imageFile.c
anymethod2_dylan.ppm    edgedetect_dylan.ppm   exe_gaussian     gauss_yosemite2.ppm imageFile.c
anymethod2_yosemite2.ppm edgedetect_yosemite2.ppm gauss_dylan.ppm  gauss_yosemite.ppm imageFile.h
anymethod_dylan2.ppm    edgedetect_yosemite.ppm gaussTest1_dylan.ppm hw4_main_anyMethod.cu orig_dylan2.ppm
anymethod_dylan.ppm     edgeTest_dylan.ppm    gaussTest1_yos.ppm hw4_main_cu        orig_dylan.ppm
anymethod_yosemite.ppm  exe_anymethod       gaussTest2_dylan.ppm hw4_main_edgedetection2.cu orig_yosemite2.ppm
anyTest_dylan.ppm        exe_anyMethod       gaussTest2_yos.ppm hw4_main_edgedetection.cu orig_yosemite.ppm
anyTest_yosemite.ppm    exe_edgedetect      gaussTest3_dylan.ppm imagefile.c
[jland@qbert hw4_cuda]$ hw4_main_anyMethod.cu
-bash: hw4_main_anyMethod.cu: command not found
[jland@qbert hw4_cuda]$ vi hw4_main_anyMethod.cu
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_dylan2.ppm anymethodTest1_dylan.ppm
orig_dylan2.ppm Any method took 0.000112 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm anymethodTest1_yosemiten.ppm
orig_yosemite.ppm Any method took 0.000113 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm anymethodTest1_yosemite.ppm
orig_yosemite.ppm Any method took 0.000100 sec
[jland@qbert hw4_cuda]$ display
[



```

Timings

Guasian blur

```
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.000685 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_dylan.ppm gauss_dylan.ppm
orig_dylan.ppm Gaussian blur took 0.002945 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_gaussian hw4_main.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000194 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite.ppm gauss_yosemite.ppm
orig_yosemite.ppm Gaussian blur took 0.000504 sec
[jland@qbert hw4_cuda]$ display
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.000433 sec
[jland@qbert hw4_cuda]$ ./exe_gaussian 5 orig_yosemite2.ppm gauss_yosemite2.ppm
orig_yosemite2.ppm Gaussian blur took 0.001731 sec
[jland@qbert hw4_cuda]$ display
```

```
[jland@qbert hw4_cuda]$ ./exe_gaussian 2 orig_yosemite2.ppm gauss_yosemite2.ppm  
orig_yosemite2.ppm Gaussian blur took 0.000434 sec
```

Edge Detection

```
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetect  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetect orig_yosemite.ppm edgedetect_yosemite.ppm  
orig_yosemite.ppm Edge detection took 0.000099 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetect  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetect orig_yosemite2.ppm  
edgedetect_yosemite2.ppm  
orig_yosemite2.ppm Edge detection took 0.000083 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetect  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetect orig_dylan.ppm edgedetect_dylan.ppm  
orig_dylan.ppm Edge detection took 0.000084 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetection  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetection orig_dylan2.ppm  
edgedetectionTest1_dylan.ppm  
orig_dylan2.ppm Edge detection took 0.000189 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetection  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetection orig_yosemite.ppm  
edgedetectionTest1_yosemite.ppm  
orig_yosemite.ppm Edge detection took 0.000184 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_edgedetection  
hw4_main_edgedetection.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_edgedetection orig_yosemite2.ppm  
edgedetectionTest_yosemite.ppm  
orig_yosemite2.ppm Edge detection took 0.000009 sec
```

Any

```
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod  
hw4_main_anyMethod.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_dylan2.ppm  
anymethodTest1_dylan.ppm  
orig_dylan2.ppm Any method took 0.000112 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod  
hw4_main_anyMethod.cu imageFile.c  
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm  
anymethodTest1_yosemiten.ppm  
orig_yosemite.ppm Any method took 0.000113 sec  
[jland@qbert hw4_cuda]$ display  
[jland@qbert hw4_cuda]$ nvcc -arch=sm_30 -o exe_anymethod
```

```
hw4_main_anyMethod.cu imageFile.c
[jland@qbert hw4_cuda]$ ./exe_anymethod orig_yosemite.ppm
anymethodTest1_yosemite.ppm
orig_yosemite.ppm Any method took 0.000100 sec
```