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## Project 1: Seam Carving

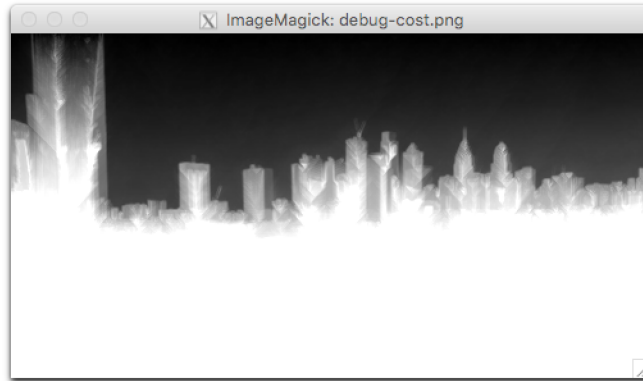
By using the Sobel function, we can get the image energy using some calculation. I got the same output result for the image energy as the example.

```
alan90011 — ssh -X ayt32@tux.cs.drexel.edu — 111x57
Removing seam 280 / 300
399 104
Removing seam 281 / 300
399 318
Removing seam 282 / 300
399 104
Removing seam 283 / 300
399 110
Removing seam 284 / 300
399 170
Removing seam 285 / 300
399 155
Removing seam 286 / 300
399 104
Removing seam 287 / 300
399 274
Removing seam 288 / 300
399 232
Removing seam 289 / 300
399 260
Removing seam 290 / 300
399 118
Removing seam 291 / 300
399 229
Removing seam 292 / 300
399 228
Removing seam 293 / 300
399 222
Removing seam 294 / 300
399 305
Removing seam 295 / 300
399 289
Removing seam 296 / 300
399 222
Removing seam 297 / 300
399 57
Removing seam 298 / 300
399 151
Removing seam 299 / 300
399 151
ayt32@tux1 hw1> cd output
ayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result2.jpg
^Cayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result3.jpg
ayt32@tux1 output> display result1.jpg
ayt32@tux1 output> display result2.jpg
ayt32@tux1 output> display result3.jpg
ayt32@tux1 output> cd ..
ayt32@tux1 hw1> ls
debug-cost.png  debug-first-seam-gone.png  expected-debug-output  images
debug-energy.png  example-output              hw1.py                 output
ayt32@tux1 hw1> display debug-cost.png
ayt32@tux1 hw1> display debug-energy.png
```



Passing the energy matrix to compute the seam cost gave me the the same result as the example as well.

```
alan90011 — ssh -X ayt32@tux.cs.drexel.edu — 111x57
399 238
Removing seam 280 / 300
399 104
Removing seam 281 / 300
399 318
Removing seam 282 / 300
399 104
Removing seam 283 / 300
399 110
Removing seam 284 / 300
399 170
Removing seam 285 / 300
399 155
Removing seam 286 / 300
399 104
Removing seam 287 / 300
399 274
Removing seam 288 / 300
399 232
Removing seam 289 / 300
399 260
Removing seam 290 / 300
399 118
Removing seam 291 / 300
399 229
Removing seam 292 / 300
399 228
Removing seam 293 / 300
399 222
Removing seam 294 / 300
399 305
Removing seam 295 / 300
399 289
Removing seam 296 / 300
399 222
Removing seam 297 / 300
399 57
Removing seam 298 / 300
399 151
Removing seam 299 / 300
399 151
ayt32@tux1 hw1> cd output
ayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result2.jpg
^Cayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result3.jpg
ayt32@tux1 output> display result1.jpg
ayt32@tux1 output> display result2.jpg
ayt32@tux1 output> display result3.jpg
ayt32@tux1 output> cd ..
ayt32@tux1 hw1> ls
debug-cost.png debug-first-seam-gone.png expected-debug-output images
debug-energy.png example-output hw1.py output
ayt32@tux1 hw1> display debug-cost.png
```



Everything in the code should be working and output the same images result as the sample output. At first, my seam carving was a little off, but after discussing with the professor, we found out in my `gradient_magnitude` function, if I convert to float before the Sobel it will have slightly different energy cost. But it may also be more optimized for seam carving. The followings are my result outputs using the same input command given in the assignment.

```
Removing seam 276 / 300
399 104
Removing seam 277 / 300
399 123
Removing seam 278 / 300
399 281
Removing seam 279 / 300
399 238
Removing seam 280 / 300
399 104
Removing seam 281 / 300
399 318
Removing seam 282 / 300
399 104
Removing seam 283 / 300
399 110
Removing seam 284 / 300
399 170
Removing seam 285 / 300
399 155
Removing seam 286 / 300
399 104
Removing seam 287 / 300
399 274
Removing seam 288 / 300
399 232
Removing seam 289 / 300
399 260
Removing seam 290 / 300
399 118
Removing seam 291 / 300
399 229
Removing seam 292 / 300
399 228
Removing seam 293 / 300
399 222
Removing seam 294 / 300
399 305
Removing seam 295 / 300
399 289
Removing seam 296 / 300
399 222
Removing seam 297 / 300
399 57
Removing seam 298 / 300
399 151
Removing seam 299 / 300
399 151
```

```
ayt32@tux1 hw1> cd output
```

```
ayt32@tux1 output> ls
```

```
result1.jpg result2.jpg result3.jpg
```

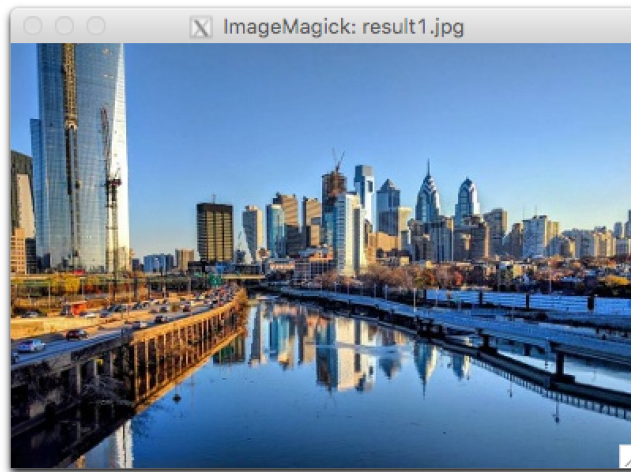
```
ayt32@tux1 output> display result2.jpg
```

```
^Cayt32@tux1 output> ls
```

```
result1.jpg result2.jpg result3.jpg
```

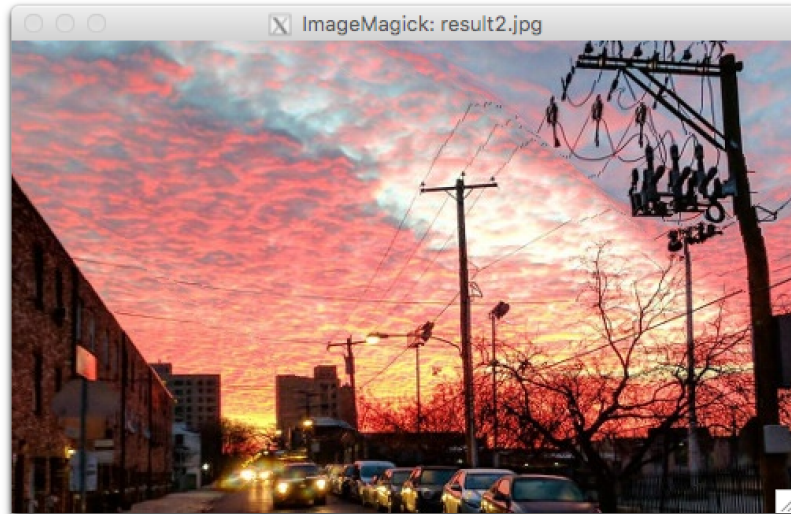
```
ayt32@tux1 output> display result3.jpg
```

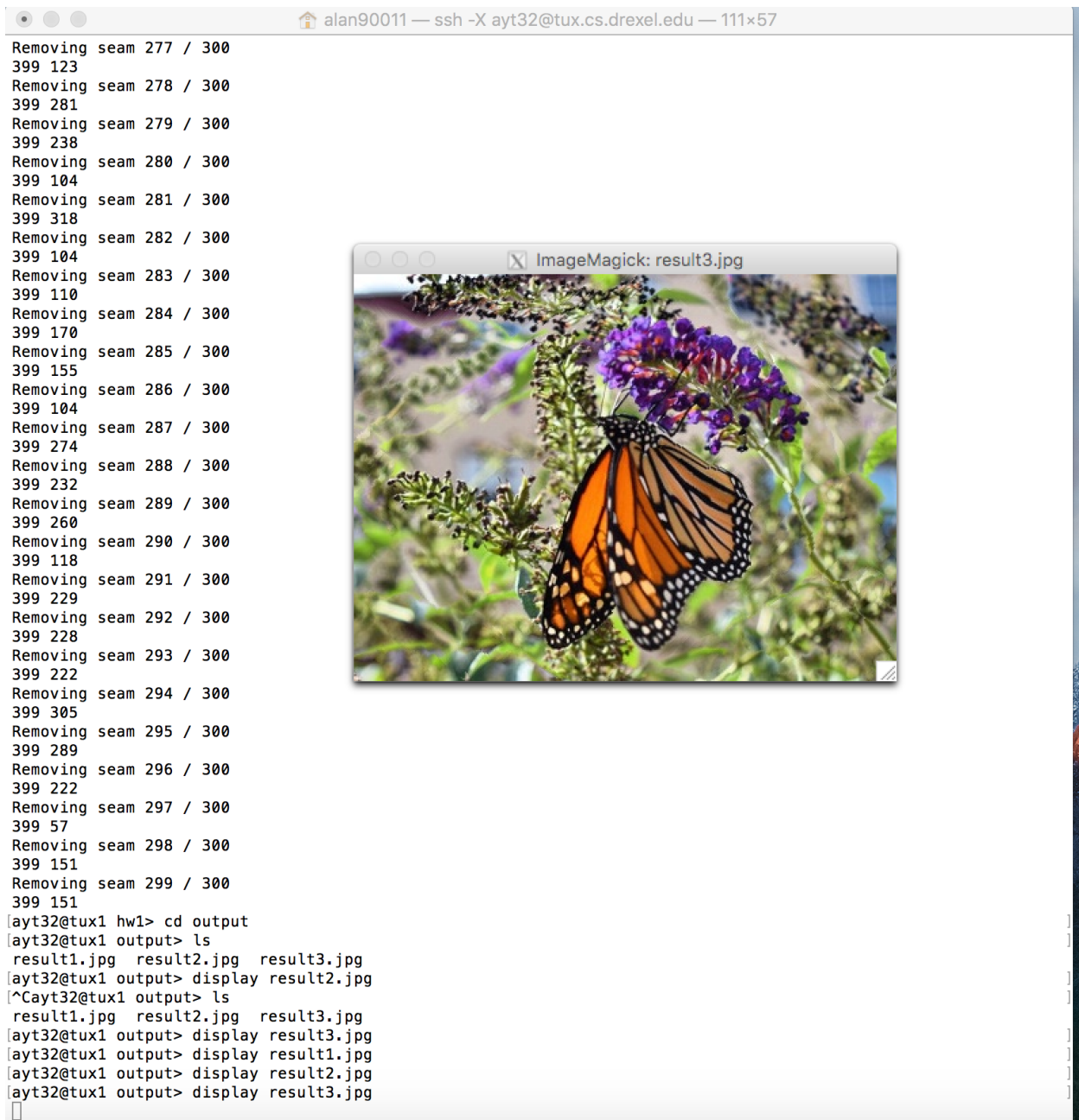
```
ayt32@tux1 output> display result1.jpg
```



```
399 104
Removing seam 277 / 300
399 123
Removing seam 278 / 300
399 281
Removing seam 279 / 300
399 238
Removing seam 280 / 300
399 104
Removing seam 281 / 300
399 318
Removing seam 282 / 300
399 104
Removing seam 283 / 300
399 110
Removing seam 284 / 300
399 170
Removing seam 285 / 300
399 155
Removing seam 286 / 300
399 104
Removing seam 287 / 300
399 274
Removing seam 288 / 300
399 232
Removing seam 289 / 300
399 260
Removing seam 290 / 300
399 118
Removing seam 291 / 300
399 229
Removing seam 292 / 300
399 228
Removing seam 293 / 300
399 222
Removing seam 294 / 300
399 305
Removing seam 295 / 300
399 289
Removing seam 296 / 300
399 222
Removing seam 297 / 300
399 57
Removing seam 298 / 300
399 151
Removing seam 299 / 300
399 151
```

```
ayt32@tux1 hw1> cd output
ayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result2.jpg
^Cayt32@tux1 output> ls
result1.jpg result2.jpg result3.jpg
ayt32@tux1 output> display result3.jpg
ayt32@tux1 output> display result1.jpg
ayt32@tux1 output> display result2.jpg
```





I used some of the online references. Here are some citations

Work reference citations:

OpenCV with Python By Example Page 272

<http://www.cs.middlebury.edu/~dsilver/vision/seam-carving/>