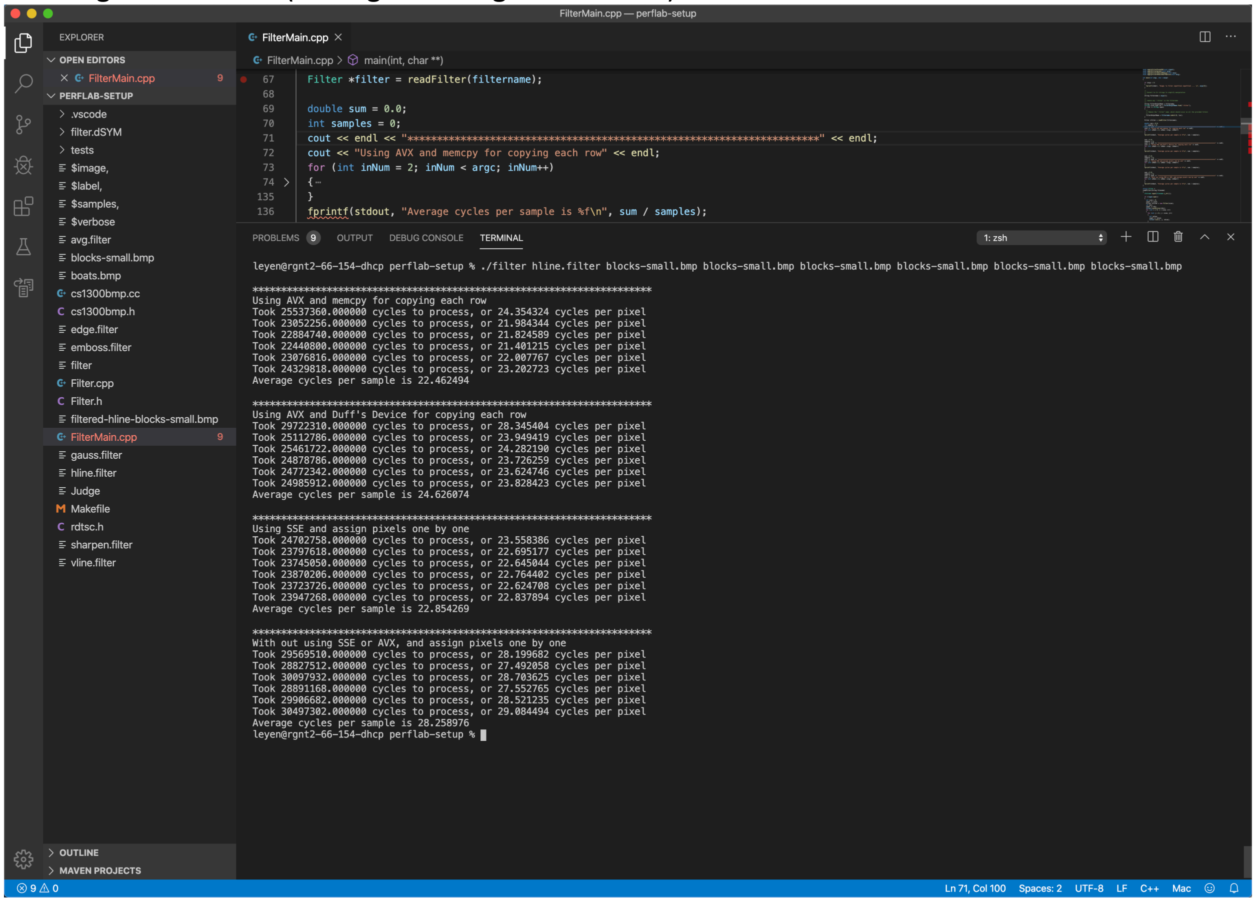
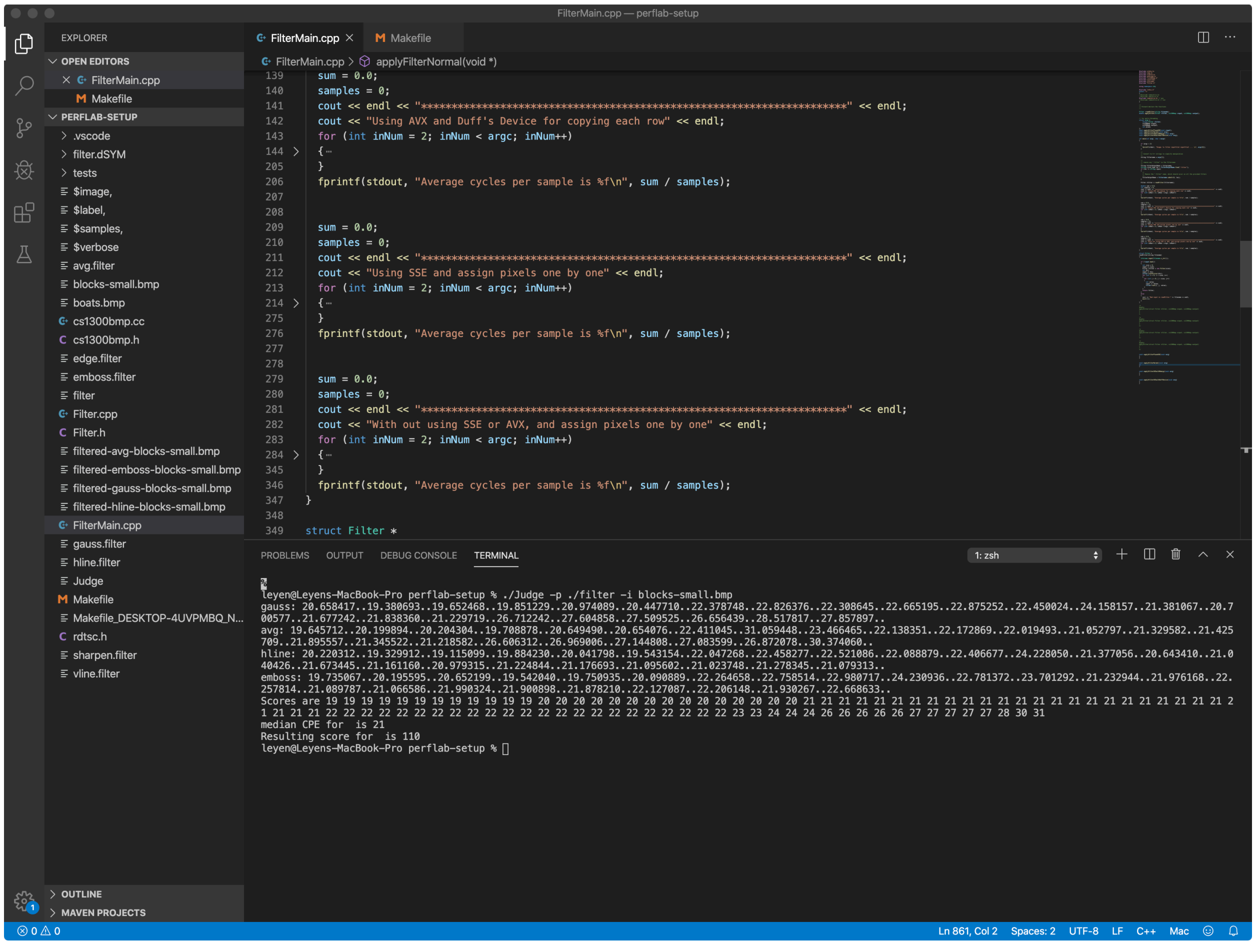
Running on i7-8750H (average of using all methods)



```cpp
Filter *filter = readFilter(filtername);

double sum = 0.0;
int samples = 0;
cout << endl << "**********************************************************************" << endl;
cout << "Using AVX and memcpy for copying each row" << endl;
for (int inNum = 2; inNum < argc; inNum++)
{…
}
fprintf(stdout, "Average cycles per sample is %f\n", sum / samples);
```

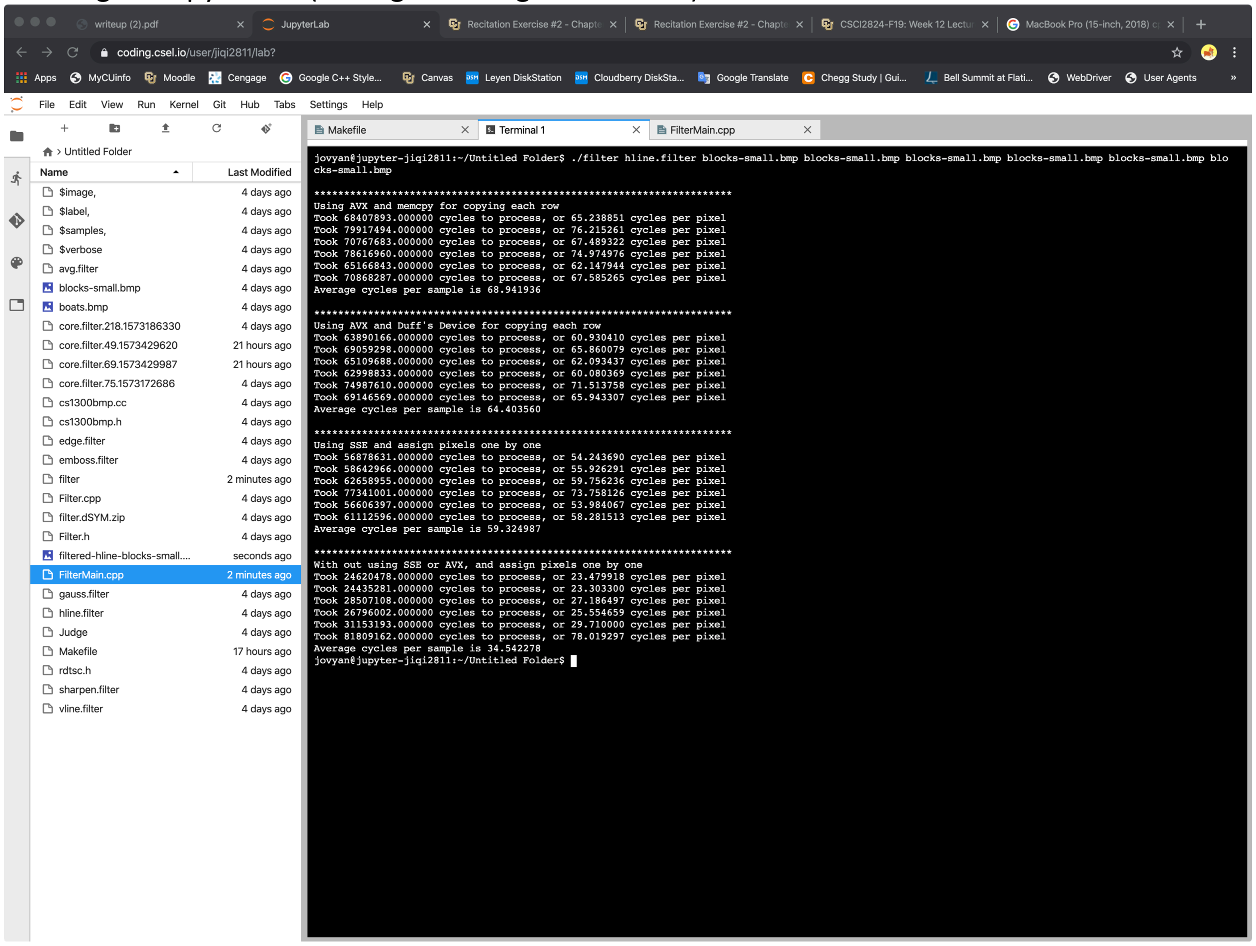
```
leyen@rgnt2-66-154-dhcp perflab-setup % ./filter hline.filter blocks-small.bmp blocks-small.bmp blocks-small.bmp blocks-small.bmp blocks-small.bmp blocks-small.bmp

**********************************************************************
Using AVX and memcpy for copying each row
Took 25537360.000000 cycles to process, or 24.354324 cycles per pixel
Took 23052256.000000 cycles to process, or 21.984344 cycles per pixel
Took 22884740.000000 cycles to process, or 21.824589 cycles per pixel
Took 22440800.000000 cycles to process, or 21.401215 cycles per pixel
Took 23076816.000000 cycles to process, or 22.007767 cycles per pixel
Took 24329818.000000 cycles to process, or 23.202723 cycles per pixel
Average cycles per sample is 22.462494

**********************************************************************
Using AVX and Duff's Device for copying each row
Took 29722310.000000 cycles to process, or 28.345404 cycles per pixel
Took 25112786.000000 cycles to process, or 23.949419 cycles per pixel
Took 25461722.000000 cycles to process, or 24.282190 cycles per pixel
Took 24878786.000000 cycles to process, or 23.726259 cycles per pixel
Took 24772342.000000 cycles to process, or 23.624746 cycles per pixel
Took 24985912.000000 cycles to process, or 23.828423 cycles per pixel
Average cycles per sample is 24.626074

**********************************************************************
Using SSE and assign pixels one by one
Took 24702758.000000 cycles to process, or 23.558386 cycles per pixel
Took 23797618.000000 cycles to process, or 22.695177 cycles per pixel
Took 23745050.000000 cycles to process, or 22.645044 cycles per pixel
Took 23870206.000000 cycles to process, or 22.764402 cycles per pixel
Took 23723726.000000 cycles to process, or 22.624708 cycles per pixel
Took 23947268.000000 cycles to process, or 22.837894 cycles per pixel
Average cycles per sample is 22.854269

**********************************************************************
With out using SSE or AVX, and assign pixels one by one
Took 29569510.000000 cycles to process, or 28.199682 cycles per pixel
Took 28827512.000000 cycles to process, or 27.492058 cycles per pixel
Took 30097932.000000 cycles to process, or 28.703625 cycles per pixel
Took 28891168.000000 cycles to process, or 27.552765 cycles per pixel
Took 29906682.000000 cycles to process, or 28.521235 cycles per pixel
Took 30497302.000000 cycles to process, or 29.084494 cycles per pixel
Average cycles per sample is 28.258976
leyen@rgnt2-66-154-dhcp perflab-setup %
```



```cpp
    sum = 0.0;
    samples = 0;
    cout << endl << "**********************************************************************" << endl;
    cout << "Using AVX and Duff's Device for copying each row" << endl;
    for (int inNum = 2; inNum < argc; inNum++)
    {…
    }
    fprintf(stdout, "Average cycles per sample is %f\n", sum / samples);


    sum = 0.0;
    samples = 0;
    cout << endl << "**********************************************************************" << endl;
    cout << "Using SSE and assign pixels one by one" << endl;
    for (int inNum = 2; inNum < argc; inNum++)
    {…
    }
    fprintf(stdout, "Average cycles per sample is %f\n", sum / samples);


    sum = 0.0;
    samples = 0;
    cout << endl << "**********************************************************************" << endl;
    cout << "With out using SSE or AVX, and assign pixels one by one" << endl;
    for (int inNum = 2; inNum < argc; inNum++)
    {…
    }
    fprintf(stdout, "Average cycles per sample is %f\n", sum / samples);
  }

  struct Filter *
```

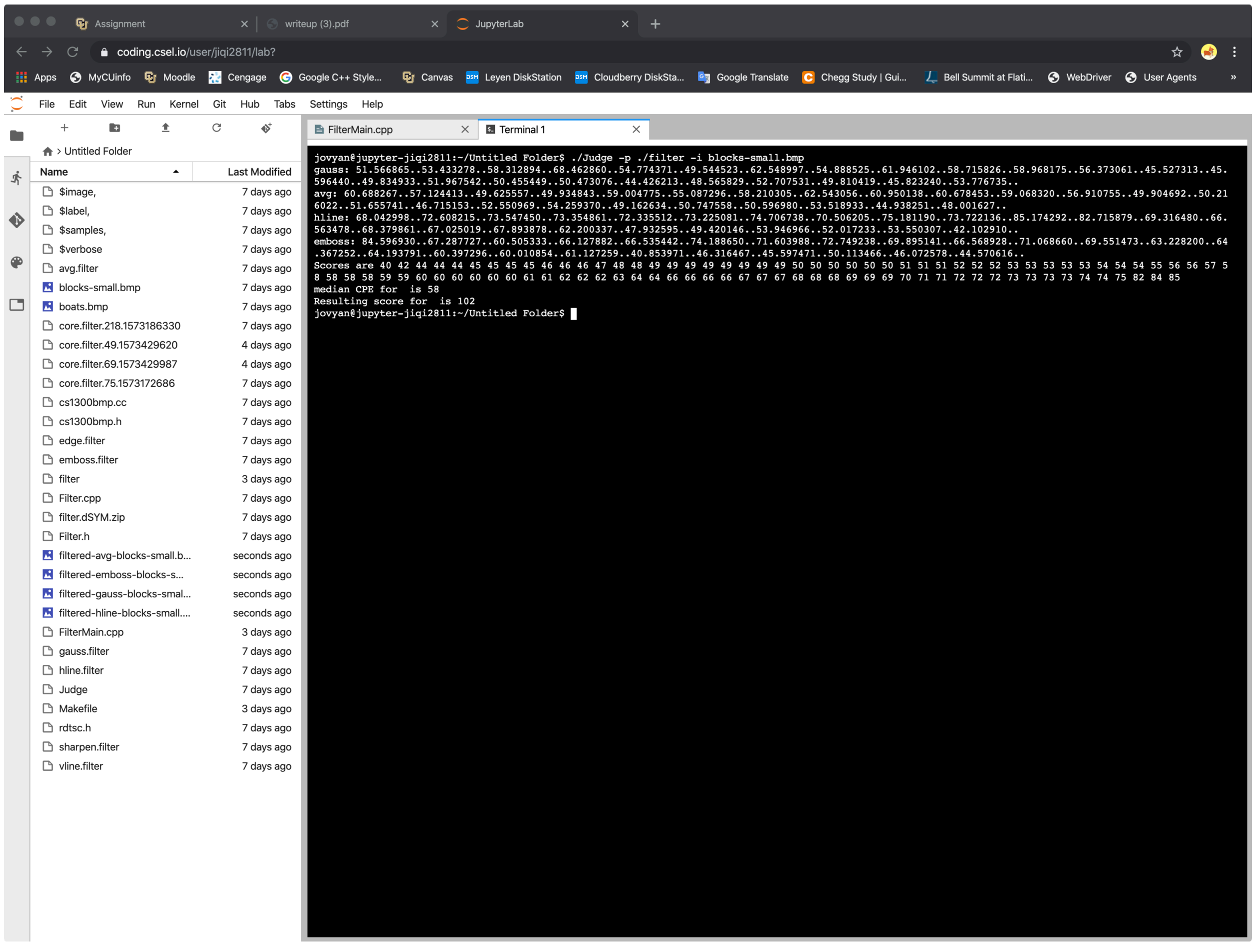
```
%
leyen@Leyens-MacBook-Pro perflab-setup % ./Judge -p ./filter -i blocks-small.bmp
gauss: 20.658417..19.380693..19.652468..19.851229..20.974089..20.447710..22.378748..22.826376..22.308645..22.665195..22.875252..22.450024..24.158157..21.381067..20.7
00577..21.677242..21.838360..21.229719..26.712242..27.604858..27.509525..26.656439..28.517817..27.857897..
avg: 19.645712..20.199894..20.204304..19.708878..20.649490..20.654076..22.411045..31.059448..23.466465..22.138351..22.172869..22.019493..21.052797..21.329582..21.425
709..21.895557..21.345522..21.218582..26.606312..26.969006..27.144808..27.083599..26.872078..30.374060..
hline: 20.220312..19.329912..19.115099..19.884230..20.041798..19.543154..22.047268..22.458277..22.521086..22.088879..22.406677..24.228050..21.377056..20.643410..21.0
40426..21.673445..21.161160..20.979315..21.224844..21.176693..21.095602..21.023748..21.278345..21.079313..
emboss: 19.735067..20.195595..20.652199..19.542040..19.750935..20.090889..22.264658..22.758514..22.980717..24.230936..22.781372..23.701292..21.232944..21.976168..22.
257814..21.089787..21.066586..21.990324..21.900898..21.878210..22.127087..22.206148..21.930267..22.668633..
Scores are 19 19 19 19 19 19 19 19 19 19 19 19 20 20 20 20 20 20 20 20 20 20 20 20 20 20 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 2
1 21 21 21 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 23 23 24 24 24 26 26 26 26 26 27 27 27 27 27 28 30 31
median CPE for  is 21
Resulting score for  is 110
leyen@Leyens-MacBook-Pro perflab-setup % 
```

Running on JupyterLab (average of using all methods)



Name	Last Modified
$image,	4 days ago
$label,	4 days ago
$samples,	4 days ago
$verbose	4 days ago
avg.filter	4 days ago
blocks-small.bmp	4 days ago
boats.bmp	4 days ago
core.filter.218.1573186330	4 days ago
core.filter.49.1573429620	21 hours ago
core.filter.69.1573429987	21 hours ago
core.filter.75.1573172686	4 days ago
cs1300bmp.cc	4 days ago
cs1300bmp.h	4 days ago
edge.filter	4 days ago
emboss.filter	4 days ago
filter	2 minutes ago
Filter.cpp	4 days ago
filter.dSYM.zip	4 days ago
Filter.h	4 days ago
filtered-hline-blocks-small....	seconds ago
FilterMain.cpp	2 minutes ago
gauss.filter	4 days ago
hline.filter	4 days ago
Judge	4 days ago
Makefile	17 hours ago
rdtsc.h	4 days ago
sharpen.filter	4 days ago
vline.filter	4 days ago

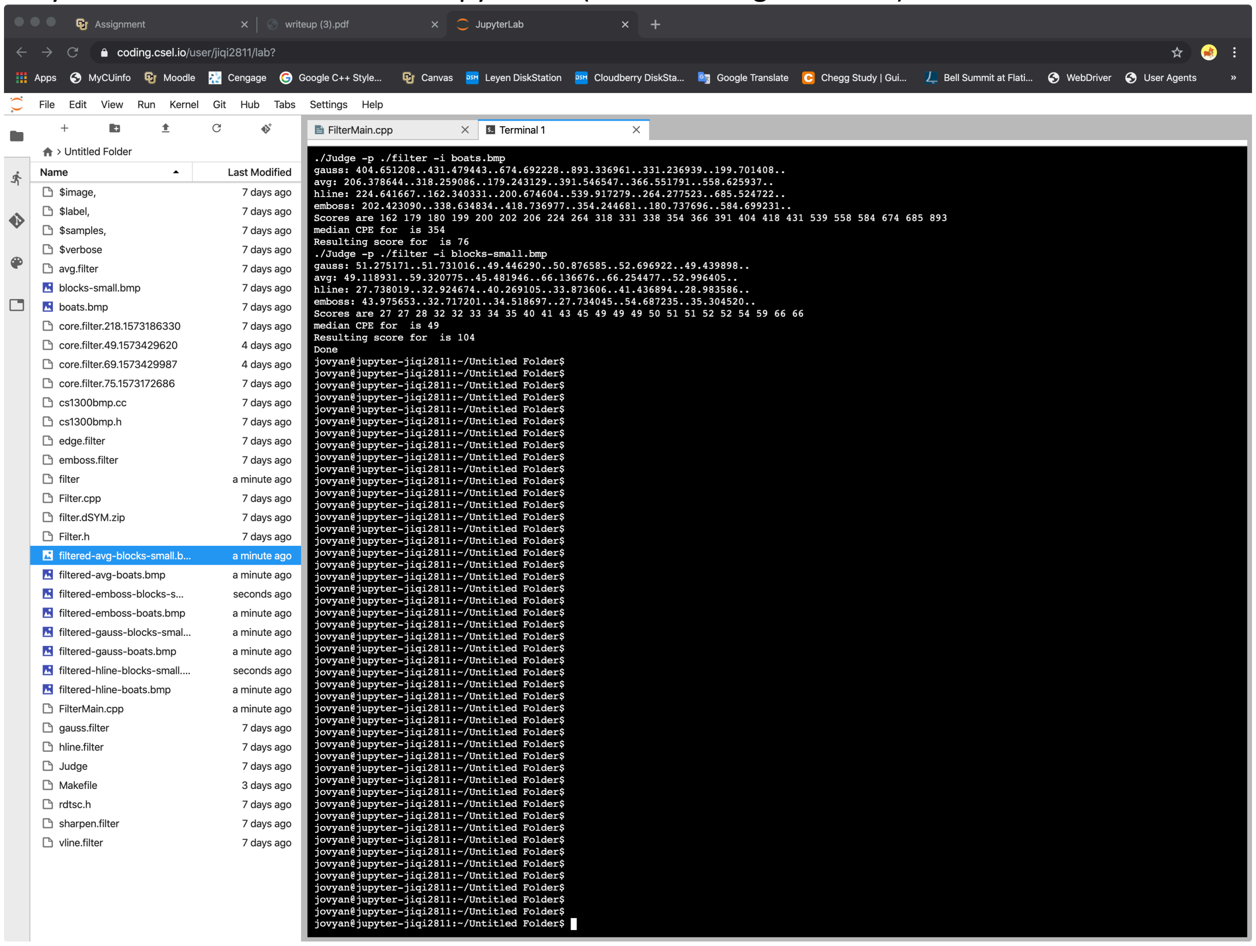
```
jovyan@jupyter-jiqi2811:~/Untitled Folder$ ./filter hline.filter blocks-small.bmp blocks-small.bmp blocks-small.bmp blocks-small.bmp blocks-small.bmp blo
cks-small.bmp

**********************************************************************
Using AVX and memcpy for copying each row
Took 68407893.000000 cycles to process, or 65.238851 cycles per pixel
Took 79917494.000000 cycles to process, or 76.215261 cycles per pixel
Took 70767683.000000 cycles to process, or 67.489322 cycles per pixel
Took 78616960.000000 cycles to process, or 74.974976 cycles per pixel
Took 65166843.000000 cycles to process, or 62.147944 cycles per pixel
Took 70868287.000000 cycles to process, or 67.585265 cycles per pixel
Average cycles per sample is 68.941936

**********************************************************************
Using AVX and Duff's Device for copying each row
Took 63890166.000000 cycles to process, or 60.930410 cycles per pixel
Took 69059298.000000 cycles to process, or 65.860079 cycles per pixel
Took 65109688.000000 cycles to process, or 62.093437 cycles per pixel
Took 62998833.000000 cycles to process, or 60.080369 cycles per pixel
Took 74987610.000000 cycles to process, or 71.513758 cycles per pixel
Took 69146569.000000 cycles to process, or 65.943307 cycles per pixel
Average cycles per sample is 64.403560

**********************************************************************
Using SSE and assign pixels one by one
Took 56878631.000000 cycles to process, or 54.243690 cycles per pixel
Took 58642966.000000 cycles to process, or 55.926291 cycles per pixel
Took 62658955.000000 cycles to process, or 59.756236 cycles per pixel
Took 77341001.000000 cycles to process, or 73.758126 cycles per pixel
Took 56606397.000000 cycles to process, or 53.984067 cycles per pixel
Took 61112596.000000 cycles to process, or 58.281513 cycles per pixel
Average cycles per sample is 59.324987

**********************************************************************
With out using SSE or AVX, and assign pixels one by one
Took 24620478.000000 cycles to process, or 23.479918 cycles per pixel
Took 24435281.000000 cycles to process, or 23.303300 cycles per pixel
Took 28507108.000000 cycles to process, or 27.186497 cycles per pixel
Took 26796002.000000 cycles to process, or 25.554659 cycles per pixel
Took 31153193.000000 cycles to process, or 29.710000 cycles per pixel
Took 81809162.000000 cycles to process, or 78.019297 cycles per pixel
Average cycles per sample is 34.542278
jovyan@jupyter-jiqi2811:~/Untitled Folder$ 
```
]



Name	Last Modified
$image,	7 days ago
$label,	7 days ago
$samples,	7 days ago
$verbose	7 days ago
avg.filter	7 days ago
blocks-small.bmp	7 days ago
boats.bmp	7 days ago
core.filter.218.1573186330	7 days ago
core.filter.49.1573429620	4 days ago
core.filter.69.1573429987	4 days ago
core.filter.75.1573172686	7 days ago
cs1300bmp.cc	7 days ago
cs1300bmp.h	7 days ago
edge.filter	7 days ago
emboss.filter	7 days ago
filter	3 days ago
Filter.cpp	7 days ago
filter.dSYM.zip	7 days ago
Filter.h	7 days ago
filtered-avg-blocks-small.b...	seconds ago
filtered-emboss-blocks-s...	seconds ago
filtered-gauss-blocks-smal...	seconds ago
filtered-hline-blocks-small....	seconds ago
FilterMain.cpp	3 days ago
gauss.filter	7 days ago
hline.filter	7 days ago
Judge	7 days ago
Makefile	3 days ago
rdtsc.h	7 days ago
sharpen.filter	7 days ago
vline.filter	7 days ago

```
jovyan@jupyter-jiqi2811:~/Untitled Folder$ ./Judge -p ./filter -i blocks-small.bmp
gauss: 51.566865..53.433278..58.312894..68.462860..54.774371..49.544523..62.548997..54.888525..61.946102..58.715826..58.968175..56.373061..45.527313..45.
596440..49.834933..51.967542..50.455449..50.473076..44.426213..48.565829..52.707531..49.810419..45.823240..53.776735..
avg: 60.688267..57.124413..49.625557..49.934843..59.004775..55.087296..58.210305..62.543056..60.950138..60.678453..59.068320..56.910755..49.904692..50.21
6022..51.655741..46.715153..52.550969..54.259370..49.162634..50.747558..50.596980..53.518933..44.938251..48.001627..
hline: 68.042998..72.608215..73.547450..73.354861..72.335512..73.225081..74.706738..70.506205..75.181190..73.722136..85.174292..82.715879..69.316480..66.
563478..68.379861..67.025019..67.893878..62.200337..47.932595..49.420146..53.946966..52.017233..53.550307..42.102910..
emboss: 84.596930..67.287727..60.505333..66.127882..66.535442..74.188650..71.603988..72.749238..69.895141..66.568928..71.068660..69.551473..63.228200..64
.367252..64.193791..60.397296..60.010854..61.127259..40.853971..46.316467..45.597471..50.113466..46.072578..44.570616..
Scores are 40 42 44 44 44 45 45 45 45 46 46 46 47 48 48 49 49 49 49 49 49 49 49 50 50 50 50 50 50 51 51 51 52 52 52 53 53 53 53 53 54 54 54 55 56 56 57 5
8 58 58 58 59 59 60 60 60 60 60 60 61 61 62 62 62 63 64 64 66 66 66 66 67 67 67 68 68 68 69 69 69 70 71 71 72 72 72 73 73 73 73 74 74 75 82 84 85
median CPE for  is 58
Resulting score for  is 102
jovyan@jupyter-jiqi2811:~/Untitled Folder$ 
```

Only use the normal function on JupyterLab (without using avx & sse)



Name	Last Modified
$image,	7 days ago
$label,	7 days ago
$samples,	7 days ago
$verbose	7 days ago
avg.filter	7 days ago
blocks-small.bmp	7 days ago
boats.bmp	7 days ago
core.filter.218.1573186330	7 days ago
core.filter.49.1573429620	4 days ago
core.filter.69.1573429987	4 days ago
core.filter.75.1573172686	7 days ago
cs1300bmp.cc	7 days ago
cs1300bmp.h	7 days ago
edge.filter	7 days ago
emboss.filter	7 days ago
filter	a minute ago
Filter.cpp	7 days ago
filter.dSYM.zip	7 days ago
Filter.h	7 days ago
filtered-avg-blocks-small.b...	a minute ago
filtered-avg-boats.bmp	a minute ago
filtered-emboss-blocks-s...	seconds ago
filtered-emboss-boats.bmp	a minute ago
filtered-gauss-blocks-smal...	a minute ago
filtered-gauss-boats.bmp	a minute ago
filtered-hline-blocks-small....	seconds ago
filtered-hline-boats.bmp	a minute ago
FilterMain.cpp	a minute ago
gauss.filter	7 days ago
hline.filter	7 days ago
Judge	7 days ago
Makefile	3 days ago
rdtsc.h	7 days ago
sharpen.filter	7 days ago
vline.filter	7 days ago

```
./Judge -p ./filter -i boats.bmp
gauss: 404.651208..431.479443..674.692228..893.336961..331.236939..199.701408..
avg: 206.378644..318.259086..179.243129..391.546547..366.551791..558.625937..
hline: 224.641667..162.340331..200.674604..539.917279..264.277523..685.524722..
emboss: 202.423090..338.634834..418.736977..354.244681..180.737696..584.699231..
Scores are 162 179 180 199 200 202 206 224 264 318 331 338 354 366 391 404 418 431 539 558 584 674 685 893
median CPE for  is 354
Resulting score for  is 76
./Judge -p ./filter -i blocks-small.bmp
gauss: 51.275171..51.731016..49.446290..50.876585..52.696922..49.439898..
avg: 49.118931..59.320775..45.481946..66.136676..66.254477..52.996405..
hline: 27.738019..32.924674..40.269105..33.873606..41.436894..28.983586..
emboss: 43.975653..32.717201..34.518697..27.734045..54.687235..35.304520..
Scores are 27 27 28 32 32 33 34 35 40 41 43 45 49 49 49 50 51 51 52 52 54 59 66 66
median CPE for  is 49
Resulting score for  is 104
Done
jovyan@jupyter-jiqi2811:~/Untitled Folder$
jovyan@jupyter-jiqi2811:~/Untitled Folder$
jovyan@jupyter-jiqi2811:~/Untitled Folder$
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jovyan@jupyter-jiqi2811:~/Untitled Folder$
jovyan@jupyter-jiqi2811:~/Untitled Folder$ 
```