Cpu와 Gpu 연산 속도 비교

1. Mul cpu, gpu

```
Dot Product of matrix A(m x n) and matrix B(n x k)
please type in m n and k
3 3
3
matrix A :
1        2        3
4        5        6
7        8        9

matrix B :
1        -2       3
3        5        2
-1       3        -4

transpose
mul_cpu[0][0] : 4 , mul_gpu[0][0] : 4
mul_cpu[0][1] : 17 , mul_gpu[0][1] : 17
mul_cpu[0][2] : -5 , mul_gpu[0][2] : -5

mul_cpu[1][0] : 13 , mul_gpu[1][0] : 13
mul_cpu[1][1] : 35 , mul_gpu[1][1] : 35
mul_cpu[1][2] : -2 , mul_gpu[1][2] : -2

mul_cpu[2][0] : 22 , mul_gpu[2][0] : 22
mul_cpu[2][1] : 53 , mul_gpu[2][1] : 53
mul_cpu[2][2] : 1 , mul_gpu[2][2] : 1

Time elapsed on matrix multiplication of 3x3 . 3x3 on GPU: 0.387744 ms.

Time elapsed on matrix multiplication of 3x3 . 3x3 on CPU: 0.002688 ms.
```

2. Div cpu, gpu

```
Dot Product of matrix A(m x n) and matrix B(n x k)
please type in m n and k
3
3
3
matrix A :
1        2        3
4        5        6
7        8        9

matrix B :
1        -2       3
3        5        2
-1       3        -4

transpose
div_cpu[0][0] : 6 , div_gpu[0][0] : 6
div_cpu[0][1] : 19 , div_gpu[0][1] : 19
div_cpu[0][2] : -7 , div_gpu[0][2] : -7

div_cpu[1][0] : 12 , div_gpu[1][0] : 12
div_cpu[1][1] : 49 , div_gpu[1][1] : 49
div_cpu[1][2] : -13 , div_gpu[1][2] : -13

div_cpu[2][0] : 18 , div_gpu[2][0] : 18
div_cpu[2][1] : 79 , div_gpu[2][1] : 79
div_cpu[2][2] : -19 , div_gpu[2][2] : -19

Time elapsed on matrix multiplication of 3x3 . 3x3 on GPU: 0.399072 ms.

Time elapsed on matrix multiplication of 3x3 . 3x3 on CPU: 0.002656 ms.

incorrect results ... suggest to change the BLOCK_SIZE !!
```

3. convolution

kernel size	3x3		5x5	
input size	CPU	gpu	CPU	gpu
8x8	0.054432ms	0.351360ms	0.025664ms	0.349184ms
512x512	823.728455ms	0.892768ms	1047.462769ms	0.70752ms

8*8 , 5*5

8*8 , 5*5

```
please type in input : m , filter : n
8
5
input matrix :
0.461156 [0]      0.761052 [1]      0.704735 [2]      0.398521 [3]      0.593859 [4]      0.983687 [5]      0.756583 [6]      0.287489 [7]
0.189493 [8]      0.688716 [9]      0.527694 [10]     0.105131 [11]     0.552677 [12]     0.046759 [13]     0.037438 [14]     0.972445 [15]
0.817028 [16]     0.338865 [17]     0.661534 [18]     0.995617 [19]     0.231935 [20]     0.307128 [21]     0.135914 [22]     0.008638 [23]
0.683012 [24]     0.260610 [25]     0.220827 [26]     0.151386 [27]     0.197416 [28]     0.094867 [29]     0.832794 [30]     0.658572 [31]
0.855919 [32]     0.537529 [33]     0.057093 [34]     0.449778 [35]     0.521216 [36]     0.813676 [37]     0.737267 [38]     0.710709 [39]
0.502392 [40]     0.264961 [41]     0.815840 [42]     0.055068 [43]     0.311720 [44]     0.853278 [45]     0.027514 [46]     0.128748 [47]
0.192143 [48]     0.689048 [49]     0.124365 [50]     0.424078 [51]     0.996176 [52]     0.260279 [53]     0.432716 [54]     0.679188 [55]
0.520889 [56]     0.653544 [57]     0.830575 [58]     0.718305 [59]     0.748411 [60]     0.663369 [61]     0.376877 [62]     0.604330 [63]

filter matrix :
0.200898 [0]      0.433969 [1]      0.054107 [2]      0.722114 [3]      0.247645 [4]
0.791374 [5]      0.432824 [6]      0.750037 [7]      0.056335 [8]      0.248663 [9]
0.805105 [10]     0.368056 [11]     0.101941 [12]     0.832619 [13]     0.496804 [14]
0.294084 [15]     0.521667 [16]     0.621169 [17]     0.718162 [18]     0.517844 [19]
0.881448 [20]     0.150879 [21]     0.197032 [22]     0.402337 [23]     0.804423 [24]

cpu_matrix_convolution
===========cpu convolution matrix===========
5.809212        4.923330        5.287128        5.294955
4.950894        5.134673        4.846055        5.070051
5.789652        4.963806        4.654154        4.599612
5.240188        5.603030        5.534059        5.611770
cudaEventElapsedTime
===========gpu convolution matrix===========
5.809212        4.923329        5.287128        5.294955
4.950894        5.134673        4.846055        5.070051
5.789652        4.963805        4.654154        4.599612
5.240188        5.603030        5.534059        5.611770
cpu[0][0] : 5.809212 == gpu[0][0] : 5.809212 , i*k+j = [0]
cpu[0][1] : 4.923330 == gpu[0][1] : 4.923329 , i*k+j = [1]
cpu[0][2] : 5.287128 == gpu[0][2] : 5.287128 , i*k+j = [2]
cpu[0][3] : 5.294955 == gpu[0][3] : 5.294955 , i*k+j = [3]

cpu[1][0] : 4.950894 == gpu[1][0] : 4.950894 , i*k+j = [4]
cpu[1][1] : 5.134673 == gpu[1][1] : 5.134673 , i*k+j = [5]
cpu[1][2] : 4.846055 == gpu[1][2] : 4.846055 , i*k+j = [6]
cpu[1][3] : 5.070051 == gpu[1][3] : 5.070051 , i*k+j = [7]

cpu[2][0] : 5.789652 == gpu[2][0] : 5.789652 , i*k+j = [8]
cpu[2][1] : 4.963806 == gpu[2][1] : 4.963805 , i*k+j = [9]
cpu[2][2] : 4.654154 == gpu[2][2] : 4.654154 , i*k+j = [10]
cpu[2][3] : 4.599612 == gpu[2][3] : 4.599612 , i*k+j = [11]

cpu[3][0] : 5.240188 == gpu[3][0] : 5.240188 , i*k+j = [12]
cpu[3][1] : 5.603030 == gpu[3][1] : 5.603030 , i*k+j = [13]
cpu[3][2] : 5.534059 == gpu[3][2] : 5.534059 , i*k+j = [14]
cpu[3][3] : 5.611770 == gpu[3][3] : 5.611770 , i*k+j = [15]

Time elapsed on matrix convolution of 8x5 . 5x4 on GPU: 0.349184 ms.

Time elapsed on matrix convolution of 8x5 . 5x4 on CPU: 0.025664 ms.
```