

Element-wise Matrix Add

As a step by step instruction has been presented in tutorial 2, here is a time for a stand-alone practice.

Accelerate the serial, element-wise square matrix addition code using cuda kernel.

In []:

```
%%file matrix_add.cu

#include <stdio.h>

cpu_add_matrix_elementwise (float* a, float* b, float* c, int N)
{
    int index;

    for (int i=0; i <N; ++i)
        for (int j=0; j <N; ++j)
        {
            index = i + j*N
            c[index] = a[index] + b[index];
        }
}

void print_matrix(float *Matrix, const int N)
{
    for (int i=0; i <N; ++i)
    {
        printf("\n");
        for (int j=0; j <N; ++j)
        {
            int index = i + j*N;
            printf(" %f ",Matrix[index]);
        }
    }
}

void CPU_version_wrapper(const int N)
{
    const int mem_size = N*N*sizeof(float);

    float* A = (float*)malloc(mem_size);
    float* B = (float*)malloc(mem_size);
    float* C = (float*)malloc(mem_size);

    // initialize data
    for (int i=0; i <N; ++i)
    {
        for (int j=0; j <N; ++j)
        {
            int index = i + j*N;
            A[index] = 2.*index;
            B[index] = 3.*index;
        }
    }

    // run calculations
    cpu_add_matrix_elementwise(A,B,C,N);
    print_matrix(C, N);

    // Free memory
    free(A); free(B); free(C);
}

int main(){
    const int N = 8;
    CPU_version_wrapper(N);
    printf("\n-----\n");
    //GPU_version_wrapper(N);
    printf("\n");
    return 0;
}
```

In []:

```
!echo "Check your GPU version"
!nvidia-smi
```

```
Check your GPU version
Wed Feb 23 17:54:03 2022

+-----+
| NVIDIA-SMI 460.32.03      Driver Version: 460.32.03      CUDA Version: 11.2      |
+-----+-----+-----+-----+
| GPU   Name           Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan   Temp   Perf    Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
|                                           MIG M.           |
+=====+=====+=====+=====+
|    0   Tesla T4               Off  | 00000000:00:04:0 Off  |            0         |
| N/A   49C    P8      10W /  70W |      0MiB / 15109MiB |      0%      Default  |
|                                           |                      | N/A         |
+-----+-----+-----+-----+

+-----+
| Processes:                                                       GPU Memory |
|  GPU   GI    CI          PID    Type   Process name                  Usage   |
|      ID    ID                                   |          |
+=====+=====+
|  No running processes found                                     |
+-----+
```

In []:

```
%%bash

CUDA_SUFF=35
nvcc -gencode arch=compute_${CUDA_SUFF},code=sm_${CUDA_SUFF} ./matrix_add.cu -o matrix_add
./matrix_add
```