CS607: Contemporary Computing Platforms
Project 2

Submitted by:
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Requirements:

NVCC Version: 10.1.243
CUDA Version: 10.1

How to run the program:

➔ **Running on Goolge Colab**

- Open the python notebook 'google_colab_script.ipynb' in google colab and run the cell.
- Select and upload the sgmev.cu or ztmpv.cu file and uncomment the commands accordingly.

➔ **Running on Local Machine**

- Execute the sgmev.cu by the following command

```
$ nvcc sgmev.cu  -lcublas -lcurand -o output
$ ./output
```

- Execute the ztmpv.cu by the following command

```
$ nvcc ztmpv.cu  -lcublas -lcurand -o output
$ ./output
```

Changing Function Paramters:

➔ Each file sgmev.cu and ztmpv.cu contains function parameters as macros at the starting of the file. They can be changed accordingly. They have been well commented to describe them.

➔ As the matrix dimensions can be very large, matrices and vectors have been filled initially randomly. To fill manual entry one has to change the init_vals() function accordingly.

CuBLAS Routines Used:

➔ SGMEV: Level 3 function SGEMM (http://www.netlib.org/blas/sgemm.f)
➔ ZTMPV: Level 2 function STPMV (http://www.netlib.org/blas/stpmv.f)

Results

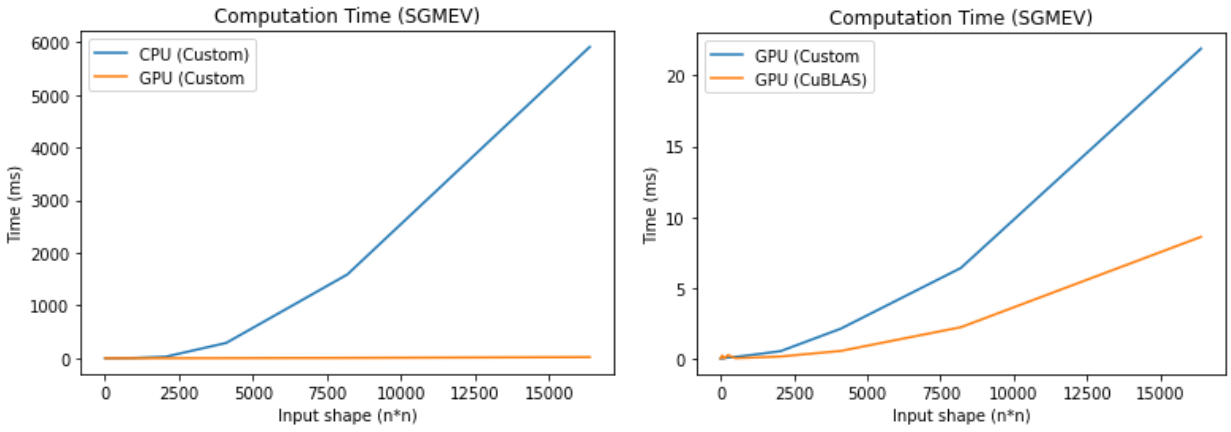
➔ **Routine 1: SGMEV**

y := alpha*op(A)*x + beta*y

Performance Comparison Table for SGMEV routine

Input Shape	**CPU Time** (in ms)	**GPU Time (Custom)** (in ms)	**GPU Time (CuBLAS)** (in ms)
4*4	0.002	0.030	0.043
8*8	0.002	0.031	0.042
16*16	0.003	0.031	0.044
32*32	0.006	0.034	0.186
64*64	0.016	0.041	0.241
128*128	0.057	0.059	0.042
256*256	0.328	0.103	0.277
512*512	1.643	0.150	0.056
1024*1024	6.442	0.277	0.093
2048*2048	28.883	0.554	0.178
4096*4096	290.499	2.136	0.568
8192*8192	1591.48	6.419	2.242
16384*16384	5912.3	21.896	8.618

Performance Graphs



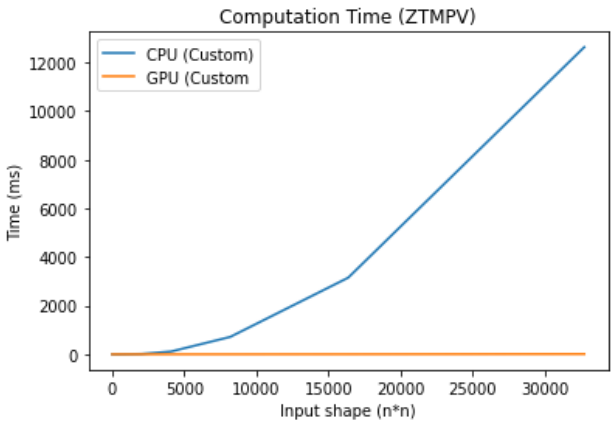
➔ **Routine 2: ZTMPV**

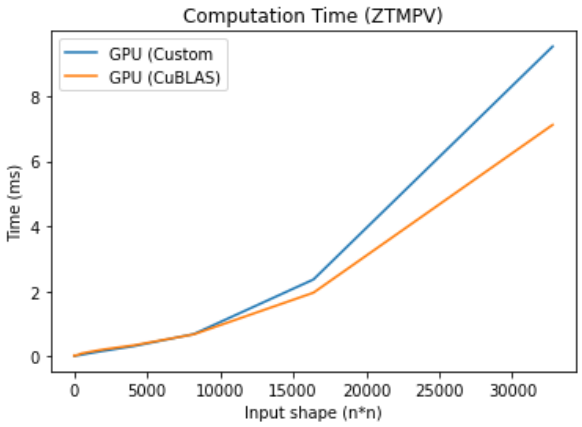
x := op(A)*x

Performance Comparison Table for ZTMPV routine

Input Shape	**CPU Time** (in ms)	**GPU Time (Custom)** (in ms)	**GPU Time (CuBLAS)** (in ms)
4*4	0.002	0.022	0.028
8*8	0.002	0.022	0.027
16*16	0.003	0.032	0.040
32*32	0.006	0.033	0.028
64*64	0.010	0.024	0.032
128*128	0.032	0.029	0.036
256*256	0.139	0.035	0.047
512*512	0.681	0.052	0.094
1024*1024	4.595	0.097	0.138
2048*2048	13.825	0.173	0.219
4096*4096	114.993	0.318	0.344
8192*8192	713.134	0.688	0.680
16384*16384	3149.2	2.364	1.958
32768*32768	12628.6	9.520	7.114

Performance Graphs





Screenshots of Execution on Google Colab