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CSCE 435
HW 6

Explanation of Changes

There were a couple changes I made to the code to enable much faster execution in parallel on the GPU. There were two strategies I employed, one of which turned out to be far faster than the other.

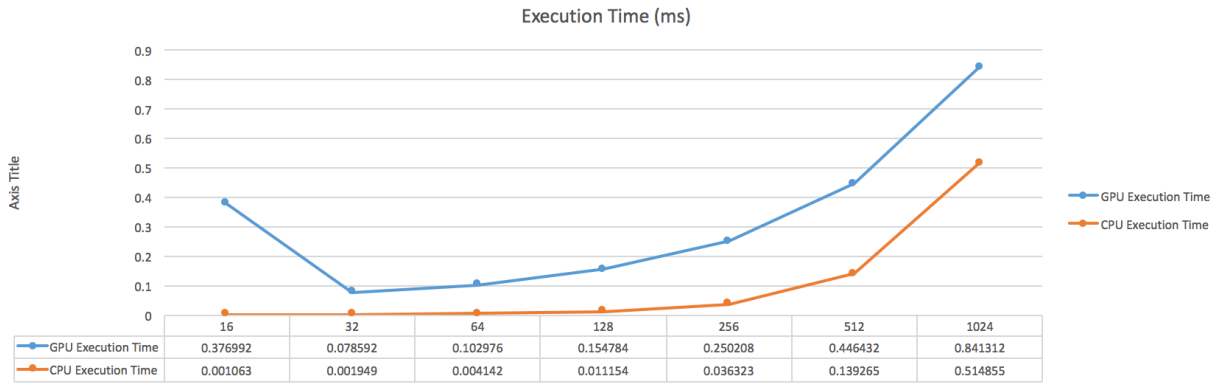
The first strategy was to create a grid of blocks, where each thread defined exactly one pair of points. Each thread would calculate the distance between two points, then atomically update the value D with the min of its calculated distance and the value of D. While this way is massively parallel, the need to synchronize access to D for every single pair of points made it very slow.

The second strategy was to remove just the outer loop of the brute-force algorithm in minimum_distance_host, and replace it with parallelism employed through the GPU. That is, every value of i will be taken by one thread on the GPU, which will calculate the minimum distance from the point at i to all other points j, and will only update the value D after it has completely finished.

The i value of each thread is calculated by threadIdx + (blockIdx*blockDim). I used a function for a atomic min that works with float values from http://stackoverflow.com/questions/17399119/cant-we-use-atomic-operations-for-floating-point-variables-in-cuda to synchronize the reading and writing of D to ensure that it maintains the correct values across all threads.

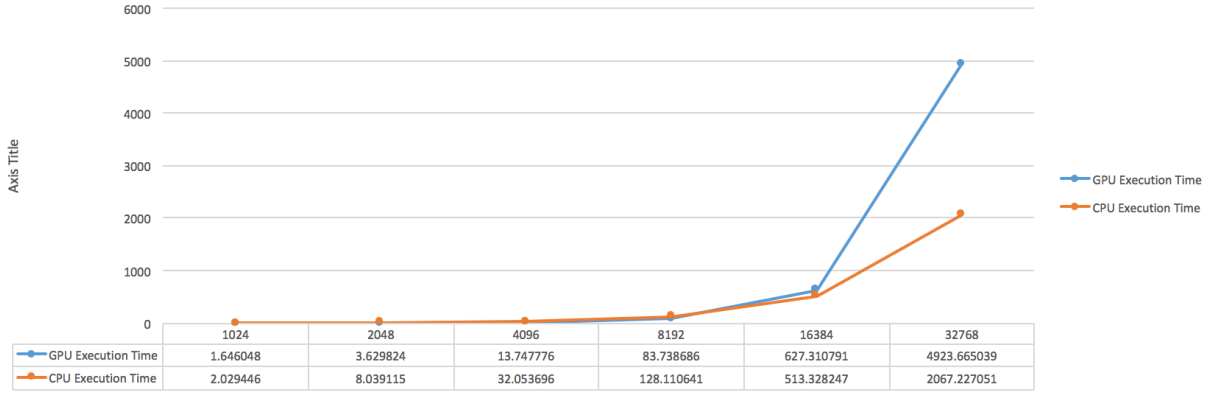
Graphs

Execution Time (ms) n=4-10



	16	32	64	128	256	512	1024
GPU Execution Time	0.376992	0.078592	0.102976	0.154784	0.250208	0.446432	0.841312
CPU Execution Time	0.001063	0.001949	0.004142	0.011154	0.036323	0.139265	0.514855

Execution Time (ms) n=11-16



	1024	2048	4096	8192	16384	32768
GPU Execution Time	1.646048	3.629824	13.747776	83.738686	627.310791	4923.665039
CPU Execution Time	2.029446	8.039115	32.053696	128.110641	513.328247	2067.227051

Data transfer time (ms)