Semestral Project Announcement

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Difference of galaxies

Our quest is to implement function which computes similarity of two galaxies

- they are not fixed in space, thus nearly the same galaxies may be rotated, shifted...
- we will compare distances of the same pairs of stars
- to emphasize larger differences, distance differences are squared before summed

Used formula:

$$\text{diff} = \sqrt{\frac{1}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (d_{ij}^{A} - d_{ij}^{B})^2}$$

Wher d_{ij}^{A} is Euclidean distance of i-th star to j-th star of galaxy A. Galaxies are defined by Cartesian coordinates of their stars.

Implementation

You will get a framework, which:

- creates input, copies it into GPU memory
- check result of CUDA implementation against non-optimized CPU code
- benchmarks your code

Your work

- you are expected to write CUDA code (kernel and code calling the kernel in file kernel.cu)

Project Rules

Rules for the implementation

- single-precision implementation is OK
- the input size can be changed to an arbitrary number
- performance will be evaluated on 2 000 stars or more
- implementation should run at compute capability 3.0 or greater
- the highest accepted error of the GPU implementation is 1 %
- this is an individual project – any form of cooperation is strictly prohibited

Stages of the Project

The project has three stages:

- the working parallel CUDA implementation: 25p, by Oct 29th (including)
- the efficient CUDA implementation (required speed will be announced): 25p, by Nov 26th (including)
- the most efficient implementation that you have: by Dec 6th

The First Stage

The working CUDA implementation

- performance doesn't matter (but your code must be parallelized)
- points will be assigned according to the correctness of your code
- deadline miss penalty: -2 points for each started day of delay
- also try to optimize the code (to save effort for the next deadline)

Compilation: `nvcc -O3 -use_fast_math -o framework framework.cu`