

# 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:

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

Where  $d_{ij}^A$  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 5.0 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 26th (including)
- the efficient CUDA implementation (75,000 mpairs/s on GTX 1070 using 50,000 stars): 25p, by Nov 23rd (including)
- the most efficient implementation that you have: by Dec 5th (including)

# 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`