Exercise Sheet 4 - OpenCL

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In this exercise, we will learn about OpenCL and parallel computation on the graphics card. (Hint: Look for the OpenCL Cheat-Sheet on the web. You can also find good sample code on the CONRAD website.)

Goals:

- Implement summation of Grid2Ds on GPU and CPU and compare the runtime

- Implement parallel-beam FBP on the GPU and compare the runtime with the CPU implementation

1. **OpenCLGrid:** Convert your Phantom from Exercise Sheet 1 to an OpenCLGrid2D. Add the phantom to itself for 1.000.000 times on GPU and CPU and measure the time difference. Hint: Have a look at the methods `add(..)` of the class OpenCLGrid2D to solve the task.

2. **OpenCL Kernels:** Implement an OpenCL kernel that adds two OpenCLGrid2Ds to each other. Test your code with two OpenCLGrid2Ds generated by two different phantoms, i.e. having objects located at different positions.

3. **OpenCL Back-Projection:** Implement a GPU Version of the parallel back-projection from Exercise Sheet 2. In addition to the function which was implemented for the Sheet 2, the GPU version should receive also the desired *worksize* as input. Try out different worksizes and see if this influences the performance of your function.

4. Use your code to reconstruct a real dataset and compare the runtime.

Think you are done? Checklist:

- ☐ Implemented host code

- ☐ Implemented backprojection kernel

- ☐ Compared runtimes of the backprojection using CPU vs. GPU

- ☐ What is visible in the real data?

- ☐ Validated by a supervisor