Karlsruhe Institute of Technology

Institute for Data Processing and Electronics
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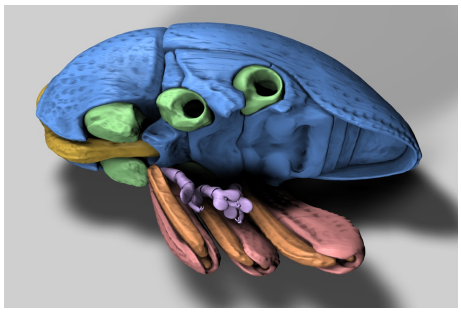
Optimizing imaging algorithms to the latest parallel CPU and GPU architectures

Master Thesis

Parallel computing has become increasingly important in the last several years. The standard servers include nowadays up to 64 computing cores. Modern GPUs are able to execute thousands of floating point operations in parallel and have become a valuable tool in multiple scientific field that require high computational throughput. It becomes more and more important to parallelize existing image processing algorithms and tune the implementations to the recent hardware architectures. It is crucial to take into the consideration the details of hardware architectures. The computational units may employ different types of cache hierarchies to accelerate memory access, the new processors often introduce new sets of instructions accelerating specific operations.

Imaging station equipped with 2 Xeon CPUs totaling to 16 computational cores and 4 GPUs.

The student will select an algorithm from one of the ongoing projects and perform optimization and tuning for the used hardware. Available options include differential phase contrast imaging done in cooperation with ANKA synchrotron, digital image correlation and tracking done in collaboration with University of Pennsylvania, X-Ray CT done in collaboration with Helmholtz Center in Dresden-Rosendorf.



Example of 3D X-Ray imaging. The functional groups of a flightless weevil are colored.

Required Skills: Good knowledge of C programming language, knowledge of OpenCL or/and CUDA is a plus

Experience Gained: *Parallel programming, GPU programming, Image processing*

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