Diploma/Master Thesis Topics in the Field of Database Query Processing and Optimization on GPUs

Offered and supervised by Sebastian Breß:

1. **Survey of GPU Coprocessing Techniques in Databases**

   Current research targets the acceleration of database systems using graphics processing units (GPUs). The goal of the thesis would be to investigate the state of the art of GPU coprocessing and provide an overview of existing approaches, e.g., during query processing like relational operations, compression techniques, or query optimization like selectivity estimation and cost computation.

2. **Design and Implementation of a parallel Join on GPUs**

   Joins are expensive operations which often process large datasets and can dominate query execution time. With General Purpose Computation on Graphics Processing Units (GPGPU), it is possible to accelerate join operations using the GPU as coprocessor. The goal of the thesis would be to investigate the state of the art for parallel join algorithms and implement and evaluate an efficient join algorithm for the GPU in a research prototype using C/C++.

3. **Extension of a Self-Tuning Decision Model for optimal CPU/GPU Query Processing**

   Graphics processing units (GPUs) can accelerate database operations, but a GPU algorithm is not necessarily faster than its CPU counterpart, because of properties of the GPU. Hence, it is necessary to decide on the fastest algorithm/processing device to achieve optimal query performance and/or utilization of available resources. Since analytical cost models for GPU algorithms are hard to create and to maintain, our model uses a learning based approach. The goal of the thesis would be to extend our decision model by new learning methods. First, the state of the art of learning based execution time estimation has to be investigated and second the most suitable approach has to be implemented and evaluated in a research prototype using C/C++.

**Other Topics:** I want to encourage students to propose their own topics in the field of database query optimization, GPU Coprocessing, Column-oriented databases, and related areas!