Bachelor-/Masterthesis

Distributed Evolutionary Hypergraph Partitioning

Overview

Hypergraph partitioning (HGP) is an important problem with many application areas. Two prominent areas are VLSI design and scientific computing (e.g. the acceleration of sparse matrix-vector multiplications). While the former is an example of a field where small optimizations can lead to significant savings, the latter is an example where hypergraph-based modeling better captures the objectives of the application domain than graph-based approaches.

Most of the tools use the multilevel paradigm, which has three phases. The first of which recursively coarsens the hypergraph to obtain a hierarchy of smaller hypergraphs that reflect the basic structure of the input. After applying an initial partitioning algorithm to the smallest hypergraph in the second phase, coarsening is undone and, at each level, a local search method is used to improve the partition induced by the coarser level.

The main task of this thesis is to define and implement an evolutionary algorithm to tackle the problem. This includes the implementation of a number of heuristic algorithms to combine and mutate given input partitions. This strategy has already been proven to be successful for the graph partitioning problem, hence we have a high chance of a highly successful project. The implementation will be done within the hypergraph partitioning framework KaHyPar which already provides world class solution quality. One possibility is to modify the multilevel algorithm to only contract pairs of vertices that are in the same block. Hence, the better of the input partitions can be used as initial partition and the solution quality of the output partition will not be worse than the input. If the project turns out to be successful, it will be integrated into a coarse grained distributed evolutionary framework.

Requirements

- Interest in algorithms and data structures
- Excellent programming skills in C++
- Ability to think for yourself

INFO: More topics available such as matching or in partitioning/clustering.

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