Karlsruher Institut für Technologie
Fakultät für Informatik

Lehrstuhl Algorithm Engineering
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HiWi-Tätigkeit

Mt-KaHyPar: Multi-Threaded Karlsruhe Graph and Hypergraph Partitioner

Description

Hypergraph partitioning is a classical NP-complete problem with the goal to partition a hypergraph into k blocks of roughly equal size (k is an input parameter), while minimizing the number of edges that cross multiple blocks (the *cut* of the partition). Hypergraph partitioning has a variety of applications including load balancing for distributed computing tasks, the design of microprocessor chips and the simulation of quantum circuits.

Mt-KaHyPar [1, 2] is a modern hypergraph partitioning framework that combines high solution quality with excellent scalability on shared-memory machines. It includes multiple configurations to enable different trade-offs between solution quality and running time. Furthermore, Mt-KaHyPar supports a variety of features that extend the standard partitioning problem and are important for applications, e.g., user-defined block weights and non-standard objective functions.

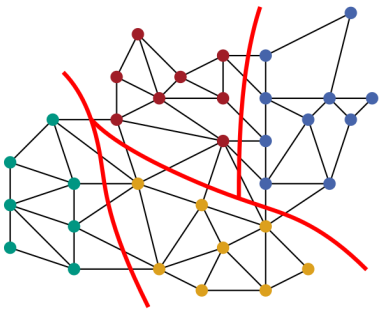
There are still many areas where additional features and improvements would make sense to allow broader use cases and better usability for Mt-KaHyPar. Implementing these improvements is the general goal of the HiWi position.

KaHyPar
KARLSRUHE HYPERGRAPH PARTITIONING

Tasks

Implement features and/or usability and performance improvements for MtKaHyPar. For example, this includes:

- Add support for new features such as guaranteed block connectivity
- Allow non-standard partitioning modes (e.g., when using the Steiner tree metric) to work with user-defined block weights and fixed vertices
- Identify and fix running time bottlenecks (e.g., due to bad scalability or expensive memory initialization)



Requirements

- Good C++ programming skills
- Interest in parallel programming and parallel algorithms
- Ability to work with a comparatively large and complex code base

References

[1] URL: `https://github.com/kahypar/mt-kahypar`.

[2] Lars Gottesbüren, Tobias Heuer, Nikolai Maas, Peter Sanders, and Sebastian Schlag. Scalable High-Quality Hypergraph Partitioning. 2023. `doi:10.1145/3626527`.

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