Institut für Regelungstechnik
Leibniz Universität Hannover

Leibniz Universität Hannover

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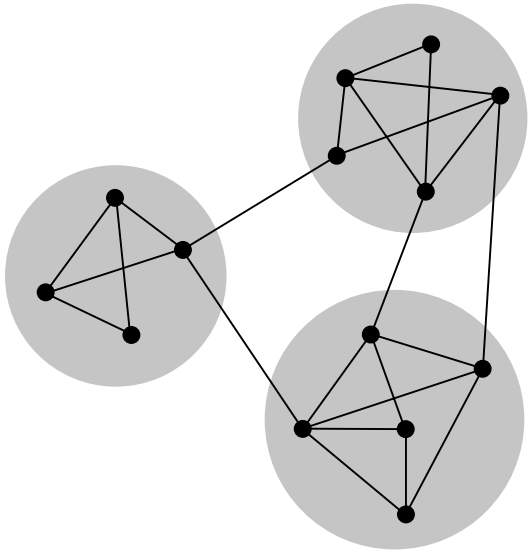
Bachelor-/Masterthesis

Multi-objective optimal graph partitioning

Graph partitioning is a fundamental problem in computer science and beyond, with applications in distributed systems, cybersecurity, social network analysis, and neuroscience. In many practical scenarios, partitioning decisions involve conflicting objectives. For example, separating components of a system may increase security (e.g., isolation of subsystems) while simultaneously degrading performance (e.g., increased communication overhead).
The goal of this thesis is to investigate multi-objective graph partitioning, where edges are associated with multiple attributes, such as performance loss and security gain incurred when cut. This includes the following work packages:

- Literature review: Study classical graph partitioning and minimum cut problems and extensions to multi-objective optimization, including approaches based on Pareto optimality and weighted objective formulations.
- Problem formulation: Formally define a multi-objective partitioning problem that captures the trade-off between performance and security. Explore scalarization techniques and Pareto-based formulations.
- Algorithm design: Implement and adapt suitable algorithms, such as multi-level partitioning methods, spectral approaches, or evolutionary algorithms.
- Evaluation: Conduct experiments on synthetic graphs to analyze the trade-offs between objectives and the structure/quality of the resulting partitions.

Requirements: Basic foundations in graph and/or optimization theory and programming experience (e.g., Python, Matlab). The thesis will be assigned mid-April.



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