1 Background

Deciding consistency for a given set of constraints is a fundamental reasoning task in qualitative spatial and temporal reasoning. Recently, a new dtree-based approach has been proposed which exploits the structure of constraint graphs that leads to efficient solutions for a set of NP-hard spatial and temporal problems [1, 2]. It relies on iteratively partitioning a given qualitative constraint network into multiple overlapping sub-networks. Existing decomposition schemes are based on hypergraph partitioning techniques, which are non-optimal approximations first applied to VLSI circuits. It remains an open question whether a new partition scheme can deliver significantly better results.
2 Project Description

The project is about investigating a new partition scheme for iteratively decomposing constraint networks in qualitative spatial and temporal reasoning. You will implement a program that take a constraint graph as input, partition it into smaller sub-graphs, and delegate the solution finding to an existing solver. You will evaluate different partition schemes and how they perform with existing benchmark problems.

3 Tasks

- Survey the existing literature in graph-decomposition;
- Implement a graph-decomposition scheme and integrate into an existing solver;
- Evaluate the performance of the scheme with existing benchmarks.

4 Benefits

- Learn about qualitative spatial and temporal reasoning;
- Analyze a practical problem with many potential applications;
- Develop and watch your own solution working.

5 Skills

- Good analytical and implementation skills;
- Basic knowledge of logic;
- Experience with C++;
- Knowledge with graph theory would be an advantage

References
