

Can state-of-the-art MaxSAT-based preprocessing and solving be effectively used for cluster editing?

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Problem Overview

Cluster Editing

Given a Graph, what is the minimum number of edge modifications to turn it into a disjoint union of cliques?

Unweighted Partial MaxSAT

Given two sets, hard clauses and soft clauses, what is an assignment of literals that satisfies all the hard clauses and minimizes the number of falsified soft clauses?

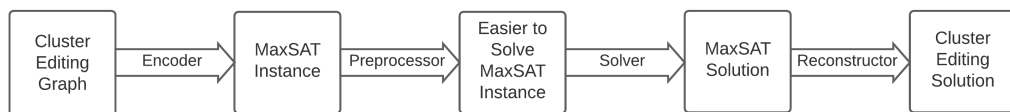


Figure 1: General Pipeline

Pipeline Specifics

Modelling [1]

- Transitive encoding (prevent conflict triples)
- Binary Encoding (assign vertices to cluster)
- Domain-specific Knowledge

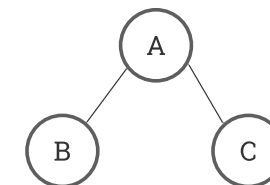


Figure 2: Conflict Triple

Preprocessor

- MaxPre [4]
- SAT Techniques
- (Weighted) MaxSAT Techniques

Solvers

- MaxHS (Implicit Hitting Set) [2]
- EvalMaxSAT (Core-Guided) [3]
- Both performed well in MaxSAT Evaluation 2020

Benchmarks

- Between 10 - 90 Vertices
- Between 11 - 1456 Edges
- Between 3-703 Solution Size
- Varying Structures
- Varying Densities

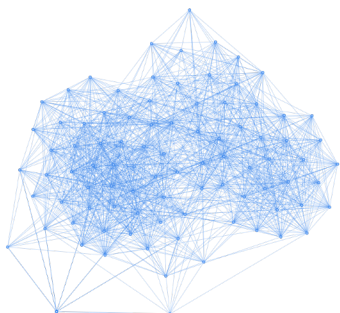
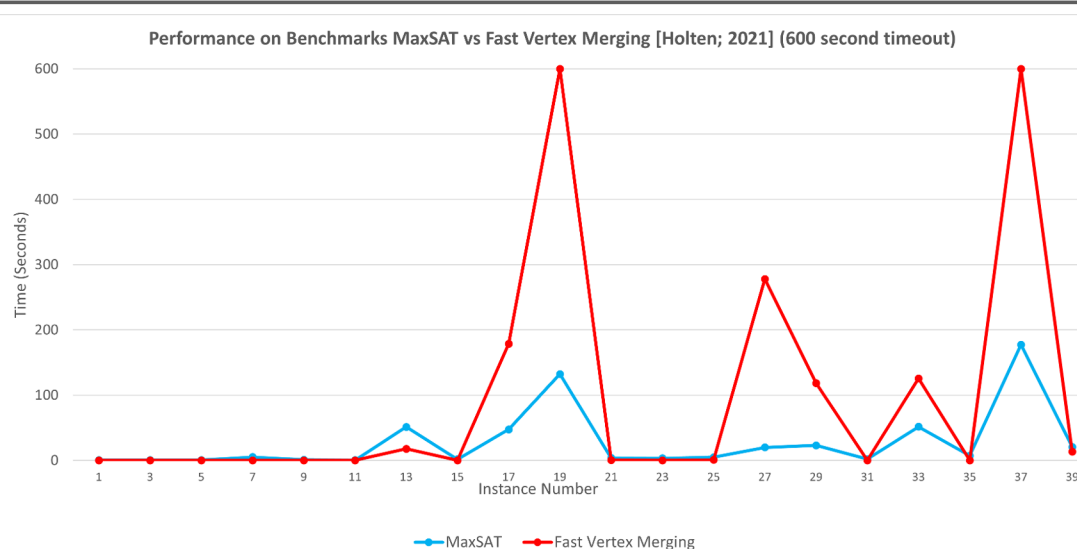


Figure 3: Instance exact037

Results



Conclusions

- Non-Obvious Interactions between modelling, preprocessing and solving
- Applicability depends on input instance
- Modelling is not very scalable (up to 500.000 clauses for 100 vertices)
- MaxHS + Preprocessed Transitive Encoding appears to be the most stable
- MaxSAT approaches are possible but might not be guided in the same way as theoretical approaches