

Fast Vertex Merging for Cluster Editing

1. Introduction

Fixed-parameter tractable (FPT) algorithms for cluster editing find solutions quickly when the number of edits is small.

The fastest theoretical algorithm uses vertex merging, and vertex merging has also been used successfully in practice.

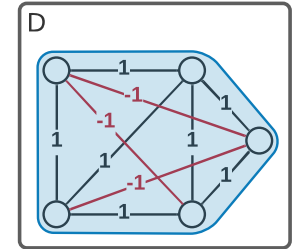
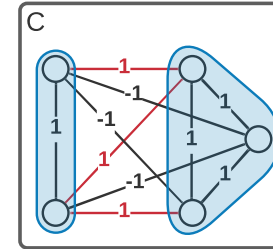
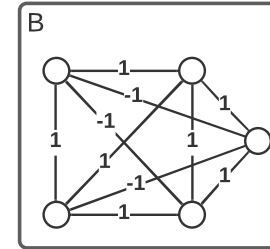
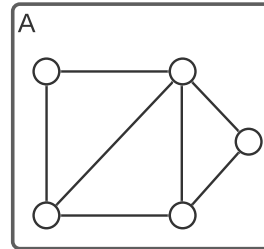
FPT algorithms use lower bounds to skip branches that cannot give a better solution.

Thus, there is the need for a fast data-structure for vertex merging that provides a good lower bound.

2. Weighted Graphs for Vertex Merging

The unweighted graph used for unweighted cluster editing A can be converted to a weighted graph suitable for vertex merging B.

A weighted cluster editing solution minimizes the total cost of negative edges in cluster and positive edges between cluster. Two examples C D.

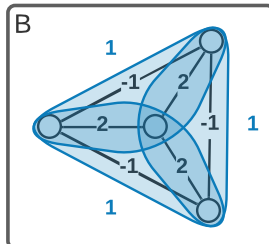
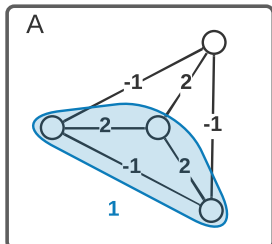


3. Better Lower Bound

Conflict triples are sets of three vertices that do not allow a cost free solution.

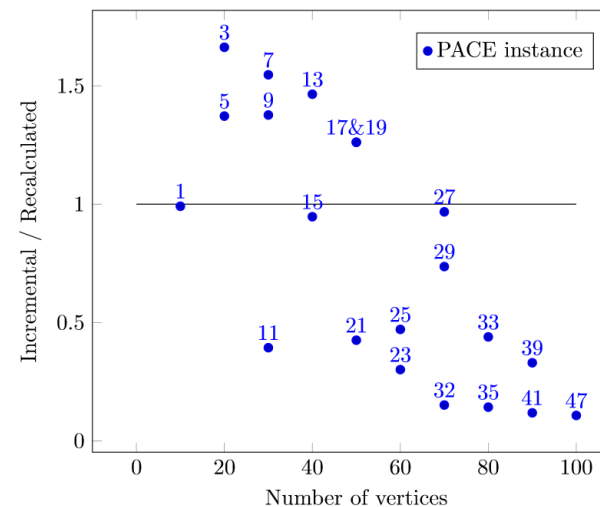
A: Edge-disjoint conflict triples give a lower bound for weighted and unweighted graphs.

B: Cost-disjoint conflict triples can reuse edges and give a better bound on weighted graphs.



4. Results

Incremental lower bound calculation is faster for instances with more vertices. Incremental is also faster for instances with high edge density.



FPT is faster than MaxSAT on easy graphs and slower on hard graphs. It's not clear why there is a big jump in solving time.

