

Parameterised and Fine-grained Subgraph Counting, modulo 2

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Abstract: Given a class of graphs \mathcal{C} , the problem $\text{ParitySub}(\mathcal{C})$ is defined as follows. The input is a graph H in \mathcal{C} together with an arbitrary graph G . The problem is to compute, modulo 2, the number of subgraphs of G that are isomorphic to H . The goal of this research is to determine for which classes \mathcal{C} the problem $\text{ParitySub}(\mathcal{C})$ is fixed-parameter tractable (FPT), i.e., solvable in time $f(|H|) \cdot |G|^{O(1)}$.

Curticapean, Dell, and Husfeldt (ESA 2021) conjectured that $\text{ParitySub}(\mathcal{C})$ is FPT if and only if the class of allowed patterns \mathcal{C} is matching splittable, which means that for some fixed B , every H in \mathcal{C} can be turned into a matching (a graph in which every vertex has degree at most 1) by removing at most B vertices.

Assuming the randomised Exponential Time Hypothesis, we prove their conjecture for (I) all hereditary pattern classes \mathcal{C} , and (II) all tree pattern classes, i.e., all classes \mathcal{C} such that every H in \mathcal{C} is a tree.

We also establish almost tight fine-grained upper and lower bounds for the case of hereditary patterns (I).

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