Dynamic Parameterized Problems and Algorithms

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Abstract

Fixed-parameter algorithms and kernelization are two powerful methods to solve NP-hard problems. Yet, so far those algorithms have been largely restricted to static inputs.

In this talk we survey fixed-parameter algorithms and kernelizations for fundamental NP-hard problems with dynamic inputs. We discuss a variety of parameterized graph and hitting set problems which are known to have $f(k) \cdot n^{1+o(1)}$-time algorithms on inputs of size n, and we consider the question of whether there is a data structure that supports small updates (such as edge/vertex/set/element insertions and deletions) with an update time of $g(k) \cdot n^{o(1)}$; such an update time would be essentially optimal. Update and query times independent of n are particularly desirable.

We complement our positive results by several conditional and unconditional lower bounds. The conditional lower bounds assume popular hardness hypotheses, whereas the unconditional lower bounds hold in the cell probe model.

Keywords. Dynamic algorithms, fixed-parameter algorithms, sublinear algorithms.

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