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The complexity of reverse engineering problems for conjunctive queries. (English)

Zbl 1402.68040


Summary: Reverse engineering problems for conjunctive queries (CQs), such as query by example (QBE) or definability, take a set of user examples and convert them into an explanatory CQ. Despite their importance, the complexity of these problems is prohibitively high (coNEXPTIME-complete). We isolate their two main sources of complexity and propose relaxations of them that reduce the complexity while having meaningful theoretical interpretations. The first relaxation is based on the idea of using existential pebble games for approximating homomorphism tests. We show that this characterizes QBE/definability for CQs up to treewidth $k$, while reducing the complexity to EXPTIME. As a side result, we obtain that the complexity of the QBE/definability problems for CQs of treewidth $k$ is EXPTIME-complete for each $k \geq 1$. The second relaxation is based on the idea of “desynchronizing” direct products, which characterizes QBE/definability for unions of CQs and reduces the complexity to coNP. The combination of these two relaxations yields tractability for QBE and characterizes it in terms of unions of CQs of treewidth at most $k$. We also study the complexity of these problems for conjunctive regular path queries over graph databases, showing them to be no more difficult than for CQs.

For the entire collection see [Zbl 1360.68007].

MSC:

68P15 Database theory
68Q17 Computational difficulty of problems (lower bounds, completeness, difficulty of approximation, etc.)
68Q25 Analysis of algorithms and problem complexity

Keywords:
reverse engineering; conjunctive queries; query by example; definability; treewidth; complexity of pebble games

Full Text: DOI