How You Ask Matters: A Simple Expert Questioning Approach for Efficient Ontology Fault Localization

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Abstract. When ontologies reach a certain size and complexity, faults such as inconsistencies or wrong entailments are hardly avoidable. Locating the faulty axioms that cause these faults is a hard and time-consuming task as, in real-world ontologies, there is often a large number of competing possible fault locations. Model-based diagnosis is a paradigm that allows to reason about these different fault hypotheses based on the faulty ontology and a set of specifications about the intended (correct) ontology. In literature, several model-based approaches for ontology fault localization have been proposed. To relieve the user (domain expert) as much as possible of the mentally tough debugging task, these methods often guide the user towards the actual fault in a semi-automatic way. This is accomplished by an interactive dialog where the expert consecutively answers system-generated questions about the intended ontology in order to reduce the possible fault locations. To suggest as few and as informative questions as possible, these interactive methods draw on various algorithmic optimizations as well as heuristics. However, these computations are often based on certain assumptions about the interacting user and the metric to be optimized.

In this work, we critically discuss these optimization criteria and suppositions about the user and argue that these might not always be fully realistic. As a result, we suggest an alternative, arguably more reasonable metric to measure the expert's effort and show that existing approaches do not achieve optimal efficiency in terms of this metric. Moreover, we detect that the efficiency of existing approaches depends largely on the (answering) behavior of the interacting expert. As a remedy, we suggest a new (and simpler) notion of expert question that does not rely on any assumptions about the user's way of answering and implies equal fault localization costs for different expert types. In experiments conducted on faulty real-world ontologies the novel querying method leads to fewer expert consultations in 66 % of the cases and reduces the computation time for the best next question by at least 80 % in all trials.

Keywords. Interactive Ontology Debugging, Model-Based Diagnosis, Query-Based Debugging, Fault Localization, Sequential Diagnosis, Expert Questions, Ontology Quality Assurance

References

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