The Reuse and Modification of Rulebases by Predicate Substitution*

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Abstract

We propose a method for reusing and modifying a deductive database. The need for such techniques occurs when new rulebased applications differ only slightly from existing ones or when an application is to be incrementally updated. Such techniques are particularly important when reprogramming is expensive or unreliable. In order to facilitate reuse we extend deductive database systems by the concept of predicate substitution. In this way, during query evaluation, not only variables, but also predicates can be substituted. Substitution increases the expressive power of Datalog. Not only does data complexity increase from $PTIME$ to $EXPTIME$, but substitution also allows large sets of Datalog rules to be succinctly expressed. The paper provides a proof and model theory for this language, including a fixpoint semantics.

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1 Introduction

This paper proposes a method for reusing and modifying a deductive database. The need for such techniques occurs when new rulebased applications differ only slightly from existing ones or when an application is to be incrementally updated. Such techniques are particularly important when reprogramming is expensive or unreliable. Unfortunately, these issues have not yet received significant attention in the deductive database literature. This paper attempts to address them.

We focus on a particular class of modifications which we call *predicate substitutions*. The idea is to reuse and modify a set of rules by substituting one predicate symbol for another. To this end, we introduce a modal-like notation $A(x)[P/Q]$ which we call a *predicate with substitution*. Intuitively, this expression means, "replace P by Q in the definition of A". To take the simplest example, suppose that A is defined by the following rules:

$$A(x) \leftarrow B(x, y), P(x), P(y).$$
$$A(x) \leftarrow C(x), P(x).$$