

Belief Revision in Knowledge Bases

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Abstract

The need for more powerful knowledge representation techniques led to the development of logical knowledge bases, where knowledge is expressed using logical propositions. Such knowledge bases allow the existence of information not explicitly stored in the base (implicit knowledge). However, implicit knowledge introduced several difficulties when it comes to updating the knowledge, as the new data may contradict either the knowledge base itself, or the implicit knowledge of the base. The problem of updating a knowledge base in the face of new, possibly contradictory, information is known as belief revision and is a crucial problem for several applications.

This work addresses this problem for propositional knowledge bases. A new and more powerful representation of propositional expressions is introduced, which allows the expression of knowledge as a 2-dimensional matrix of complex numbers. This representation allows the "quantification" of knowledge and provides a direct way of executing updates, as well as an easy method for seeking, rating and removing contradictions in the knowledge base. Executing queries under this new representation is a similar problem that is addressed, and which is directly related to the problem of belief revision.

Moreover, ways of parameterization of the updating and querying methods are proposed and it is observed that quite different techniques of updating belong in the class of algorithms occurring from the above parameterization. Despite this fact, algorithms belonging in this class have several desirable properties and allow the integration of different update operations, such as revision, update, contraction and erasure. Proposed algorithms from the literature can be set forth under the new framework for specific parameters and problems of classical propositional logic can be solved under this notion. Finally, some new problems opened by the introduction of the table representation are discussed and methods of further improvement of this technique in knowledge representation and updating are proposed.

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