A Roadmap on Updates

Fernando Zacarias Flores
Benemérita Universidad Autónoma de Puebla, Mexico

Dionicio Zacarias Flores
Benemérita Universidad Autónoma de Puebla, Mexico

Rosalba Cuapa Canto
Benemérita Universidad Autónoma de Puebla, Mexico

Luis Miguel Guzmán Muñoz
Benemérita Universidad Autónoma de Puebla, Mexico

INTRODUCTION

Updates, is a central issue in relational databases and knowledge databases. In the last years, it has been well studied in the non-monotonic reasoning paradigm. Several semantics for logic program updates have been proposed (Brewka, Dix, & Knololige 1997), (De Schreye, Hermenegildo, & Pereira, 1999) (Katsumo & Mendelzon, 1991). However, recently a set of proposals has been characterized to propose mechanisms of updates based on logic and logic programming. All these mechanisms are built on semantics based on structural properties (Eiter, Fink, Sabattini & Thompits, 2000) (Leite, 2002) (Banti, Alferes & Brogi, 2003) (Zacarias, 2005). Furthermore, all these semantic ones coincide in considering the AGM proposal as the standard model in the update theory, for their wealth in properties. The AGM approach, introduced in (Alchourron, Gardenfors & Makinson, 1985) is the dominating paradigm in the area, but in the context of monotonic logic. All these proposals analyze and reinterpret the AGM postulates under the Answer Set Programming (ASP) such as (Eiter, Fink, Sabattini & Thompits, 2000). However, the majority of the adapted AGM and update postulates are violated by update programs, as shown in (De Schreye, Hermenegildo, & Pereira, 1999).

UPDATES

Update theory deals with knowledge base represented by a propositional theory. Besides, deals with incorporating new knowledge about a dynamic world. This dynamism is due to knowledge comes from the real world, what means that knowledge evolves over time. This exchange rate mainly deals with changes in the extensional part of knowledge bases. However, the problem of updating the intensional part of a knowledge base (rules and descriptions of actions) remains basically unexplored. However, the problem of updates has attracted the researchers’ attention in the last years who are dealing with such updates in the setting of logic programs. Though, some interesting proposals exist with foundation in Answer set programming (ASP), such as (Eiter, Fink, Sabattini & Thompits, 2000) (Leite, 2002) (Banti, Alferes & Brogi, 2003) (Osorio & Zacarias, 2003).

Answer set programming is a new paradigm used in the solution of the update issue. Particularly, this paradigm has taken bigger force around of update theory. A lot of theoretical work around updates under ASP has been developed by connoted researchers such as: Pereira, Alferes, Eiter, Osorio, Leite, Zacarias, and others. In the last years, a lot of theoretical work was devoted to explore the relationships between intuitionistic logic and ASP (Pearce, 1999) (Lifschitz, Pearce & Valverde, 2001). These results have recently provided a characterization of ASP by intuitionistic logic as follows: a literal is entailed by a program in the answer set semantics if and only if it belongs to every intuitionistically complete and consistent extension of the program formed by adding only negated literals (Pearce, 1999). The idea of these completions using in general intermediate logics is due to Pearce (Lifschitz, Pearce & Valverde, 2001). This logical approach provides the foundations to define the notion of non-monotonic inference of any propositional theory (using the standard connectives) in terms of a mono-
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tonic logic (namely intuitionistic logic), see (Lifschitz, 

STARTING WITH AGM

We start with an analysis on the AGM postulates and 
then we examine them with respect to update sequences. 
All these proposals are based on oneself principle of 
causal rejection principle. As is well known, if new 
knowledge of the world is somehow obtained, and it 
does not have conflicts with the previous knowledge 
then this new knowledge only expands knowledge. If 
by the contrary, new knowledge is inconsistent with 
the previous knowledge, and we want knowledge to be 
always consistent in all moment, we should solve this 
problem somehow. We point out that new information 
is incorporated into the current knowledge base subject 
to a causal rejection principle, which enforces that, in 
case of conflicts between rules, more recent rules are 
preferred and older rules are overridden.

An update theory is a knowledge base represented 
by a logic program. Then, let P be the program repre-
senting the current knowledge base, if it is updated by 
another program U, then P^U is a program updated of P if 
only if the models of P^U are the result of updating each 
of the models of P according to a given semantics S; 
to each of these models apply the update request U to 
obtain a new set of models M; P^U is any logic program 
whose models are exactly M.

The AGM approach proposes three basic operations 
on a belief set K: a) expansion K + \Phi, which is simply 
adding the new information \Phi \in \mathcal{L}_B to K. b) revision K * \Phi, which is sensibly revising K in the light of \Phi (in 
particular, when K contradicts \Phi); and c) contraction 
K — \Phi, which is removing \Phi from K.

On the other hand, AGM proposes a set of postulates, 
K*1 — K*8, that any revision operator * mapping a 
belief set K \subseteq \mathcal{L}_B and a sentence \Phi \in \mathcal{L}_B into the revised 
belief set K * \Phi should satisfy. We assume that K is 
represented by an epistemic state E, then the postulates 
K*1 — K*8 can be reformulated as in (Eiter, Fink, 
Sabattini & Thompits, 2000) as follows:

(K1) E * \Phi represents a belief set.
(K2) \Phi \in \text{Bel}(E * \Phi).
(K3) \text{Bel}(E * \Phi) \subseteq \text{Bel}(E + \Phi).
(K4) \neg \Phi \in \text{Bel}(E) implies \text{Bel}(E + \Phi) \subseteq \text{Bel}(E * \Phi).
(K5) \bot \in \text{Bel}(E * \Phi) only if \Phi is unsatisfiable.

(K6) \Phi_1 \equiv \Phi_2 implies \text{Bel}(E * \Phi_1) = \text{Bel}(E * \Phi_2).
(K7) \text{Bel}(E * (\Phi \land \gamma)) \subseteq \text{Bel}((E * \Phi) + \gamma).
(K8) \neg \gamma \notin \text{Bel}(E * \Phi) implies \text{Bel}((E * \Phi) + \gamma) \subseteq \text{Bel}(E 
* (\Phi \land \gamma)).

Katsuno and Mendelzon (1991) proposed a set of 
postulates where a change \Phi to a belief base B are 
propositional sentences over a finitary language. Some 
of the outstanding differences between the postulates 
of the AGM and those of Katsuno and Mendelzon are 
that revision should yield the same result as expansion 
E + \Phi, providing \Phi is compatible with E, which 
is not desirable for update in general. The postulate 8 
says that if E can be decomposed into a disjunction 
of states (e.g., models), then each case can be updated 
separately and the overall result is formed by taking 
the disjunction of the emerging states.

Darwiche and Pearl (1997) have proposed postu-
lates for iterated revision. This set of postulates is very 
simple and the majority of the adapted AGM and update 
postulates are violated by update programs. Another 
set of postulates for iterated revision, corresponding 
to a sequence E of observations, has been formulated 
by Lehmann (1995). Notice that in general the postu-
lates proposed for iterated revision fail, and, with the 
exception of some postulates, each change is given by 
a single rule. Though, is that the two views described 
above amount to the same at a technical level.

All these approaches on the update issue consider 
it as a process of belief revision. However, following 
Gardenfors and Makinson (1991; 1994), belief revi-
sion can be related to non-monotonic reasoning by 
interpreting it as an abstract consequence relation on 
sentences, where the epistemic state is fixed. In the 
same way as Eiter we can interpret update programs 
as abstract consequence relation on logic programs. 
In spite of this, we should consider these proposals since 
for example Makinson (1993) considered a set of (de-
sirable) properties for non-monotonic reasoning, and 
analyzed the behavior of some reasoning formalisms 
with respect to these properties.

Continuing with our research, immediately we 
comment in a general way the proposal of Alferes et. 
a., (2000). They introduced the concept of dynamic 
logic programs as a generalization of both the idea of 
updating interpretations through revision programs and 
of updating programs as defined by Alferes and Pereira 
(1997) and by Leite and Pereira (1997). Syntactically, 
dynamic logic programs are based on generalized logic