Appendix A - Partial Stable Models

The semantics of a logic program is given by the set of its partial stable models (PSMs) (corresponding to complete extensions of AFs (Caminada et al. 2015)). We summarize the basic concepts underlying the notion of PSMs (Saccà 1997).

A (normal) logic program (LP) is a set of rules of the form $A \leftarrow B_1 \wedge \cdots \wedge B_n$, with $n \geq 0$, where A is an atom, called head, and $B_1 \wedge \cdots \wedge B_n$ is a conjunction of literals, called body. We consider programs without function symbols. Given a program P, $ground(P)$ denotes the set of all ground instances of the rules in P. The Herbrand Base of a program P, i.e., the set of all ground atoms which can be constructed using predicate and constant symbols occurring in P, is denoted by B_P, whereas $\neg B_P$ denotes the set $\{\neg A \mid A \in B_P\}$. Analogously, for any set $S \subseteq B_P \cup \neg B_P$, $\neg S$ denotes the set $\{\neg A \mid A \in S\}$, where $\neg\neg A = A$. Given $I \subseteq B_P \cup \neg B_P$, $pos(I)$ (resp., $neg(I)$) stands for $I \cap B_P$ (resp., $\neg I \cap B_P$). I is *consistent* if $pos(I) \cap \neg neg(I) = \emptyset$, otherwise I is *inconsistent*.

Given a program P, $I \subseteq B_P \cup \neg B_P$ is an *interpretation* of P if I is consistent. Also, I is *total* if $pos(I) \cup neg(I) = B_P$, *partial* otherwise. A partial interpretation M of a program P is a *partial model* of P if for each $\neg A \in M$ every rule in $ground(P)$ having as head A contains at least one body literal B such that $\neg B \in M$. Given a program P and a partial model M, the positive instantiation of P w.r.t. M, denoted by P^M, is obtained from $ground(P)$ by deleting: (a) each rule containing a negative literal $\neg A$ such that $A \in pos(M)$; (b) each rule containing a literal B such that neither B nor $\neg B$ is in M; (c) all the negative literals in the remaining rules. M is a partial stable model of P iff M is the minimal model of P^M. Alternatively, P_M could be built by replacing every negated body literal in $ground(P)$ by its truth value.

The set of partial stable models of a logic program P, denoted by $\mathcal{PS}(P)$, define a meet semilattice. The *well-founded* model (denoted by $\mathcal{WF}(P)$) and the *maximal-stable* models $\mathcal{MS}(P)$, are defined by considering $\subseteq$-minimal and $\subseteq$-maximal elements. The set of (total) *stable* models (denoted by $\mathcal{TS}(P)$) is obtained by considering the maximal-stable models which are total.

The semantics of a logic program is given by the set of its partial stable models or by one of the restricted sets above recalled.

References

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