Planning Historical Developments

This is a short review of the planning and search developments STRIPS, ADL/PDDL, GRAPHPLAN. We are highlighting their structure and their impact in the artificial intelligence discipline.

STRIPS

In 1971 a Fikes and Nilsson presented the Stanford Research Institute Planning System developed for "Shakey" a small robot which performed simple operations like navigation and rearranging objects in a multiroom environment. [1]

In **STRIPS**, the world model is represented by a set of well-formed formulas (wffs) of the first-order predicate calculus. The solution of the planning problem is a sequence of operators; each operator corresponds to an action routine. An action can be described as a set of tree lists of wffs: Preconditions list, Additions lists, Deletions list. The preconditions represent the initial state. Additions are clauses not existing in the initial state but present in the current. Deletions are clauses removed from the initial state.[2]

The legacy of STRIPS was rather the representation language it used than its algorithmic approach; ADL encoded more realistic problems. PDDL also, standardized syntax for representing planning problems.[3]

ADL and PDDL

The Action Description Language (**ADL**) relaxed some of the STRIPS restrictions and made it possible to encode more realistic problems. ADL was introduced in 1986 by Pednault. In 2000 Nebel explores schemes for compiling ADL into STRIPS.

PDDL presented in 1998 by Malik Ghallab et al.[4]. Primarily inspired by STRIPS (as discussed above), **PDDL** stands for Planning Domain Definition Language and it was the first modeling language to be used widely for solving planning problems. It is also a computer-parsable language. It has remained the standard for the International Planning Competition since 1998. It has also been extended with the most recent version 3.0 that includes plan constraint and preferences[5]

The Components of PDDL are:

- Objects: Things in the world that interest us.
- Predicates: Properties of objects that we are interested in; can be true or false.
- Initial state: The state of the world that we start in.
- Goal specification: Things that we want to be true.
- Actions/Operators: Ways of changing the state of the world.[6]

The adoption of a common language accelerated the research in AI.

GRAPHPLAN

Graphplan is using graph algorithms on STRIPS-style domains. Given a problem, a compact structure (the Planning Graph) is explicitly constructed. Planning Graph encodes the planning problem in such a way that many useful constraints are included. The constraints are being propagated to reduce the needed volume of search.[7] Graphplan was presented by Avrim Blum and Merrick Furst, with subsequent extensions and improvements made by many researchers at many different institutions around the world.[8]

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[1] STRIPS, a retrospective, Richard E. Fikes and Nils J. Nilsson, Artificial Intelligence 59 (1993) 227-232
[2] STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving, Richard E. Fikes, Nils J. Nilsson
[3] Artificial Intelligence A Modern Approach, Stuart Russell, Peter Norvig, Prentice Hall (2010)
[4] PDDL The Planning Domain Denition Language https://courses.cs.washington.edu/courses/cse473/06sp/pddl.pdf
[5] Artificial Intelligence A Modern Approach, Stuart Russell, Peter Norvig, Prentice Hall (2010)
[6] http://www.cs.toronto.edu/~sheila/2542/s14/A1/introtopddl2.pdf
[7] Fast Planning Through Planning Graph Analysis, Avrim L. Blum, Merrick L. Furst
[8] The Graphplan Home Page, http://www.cs.cmu.edu/~avrim/graphplan.html