Research Review

STRIPS

Stanford Research Institute Problem Solver(STRIPS) is an automated planning technique created by Richard E.Fikes and Nils J.Nilsson at 1971[1]. It is used by robot research at SRI and initially implemented with LISP. And it represents the world model by a set of well-form formulas (wffs) of the first-order predicate calculus.

The problem space of STRIPS is defined by:
1. Initial condition
2. A set of operators with preconditions and effects
3. Goal condition

In order to solve a world model with large amount of operators, instead of applying breadth-first search to find the goal, STRIPS employed the General Problem Solver (GPS) strategy to find the operation sequence from initial condition to goal condition.

The action representation of STRIPS is more influential than the planning technique. The same name is commonly used to refer the action language of this planner.

Graphplan

Graphplan is an automated planning technique created by Avirm L. Blum and Merrick L. Furst at 1995[2]. It always returns the shortest plan if possible. And Planning Graph Analysis is used to guide the planner.

Planning Graph encodes the planning problem with levels in STRIPS-like domains. In these domains, operators have preconditions, add-effects and delete-effects. The first level is the initial condition and the last level is the goal condition. Also, mutually exclusive relations are maintained at each level. It is constructed in polynomial time with polynomial size.

After the graph is generated, Graphplan performs backward search to obtain the operation sequence.

Blackbox

Blackbox is an automated planning technique created by Henry Kautz and Bart Selman at 1998[3]. It combines the propositional structure of Graphplan and the search algorithms of Satplan.

Following is the workflow of Blackbox:
1. Converts a planning problem to a plan graph
2. Converts the plan graph to a CNF wff
3. Solves the wff by SAT engines

Blackbox is flexible to specify a schedule for different engines. For example, it can run Walksat for 2 minutes and satz for another 5 minutes if no solution is found. Also, it outperforms both Graphplan and Satplan alone[4].

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[1] STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving - http://ai.stanford.edu/~nilsson/OnlinePubs-Nils/PublishedPapers/strips.pdf

[2] Fast Planning Through Planning Graph Analysis - https://www.cs.cmu.edu/~avrim/Papers/graphplan.pdf

[3]BLACKBOX: A New Approach to the Application of Theorem Proving to Problem Solving - http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.21.1189&rep=rep1&type=ps

[4] Unifying SAT-based and Graph-based Planning - https://www.cs.rochester.edu/u/kautz/papers/ijcai99blackbox.pdf