Research Review

STRIPS (Fikes and Nilsson 1971) is the first major automated planning system. It stands for Stanford Research Institute Problem Solver and it was developed by Richard Fikes and Nils Nilsson in 1971 at SRI International. STRIPS is the controlling component of the robot Shakey capable of:

- traveling to another location
- turning light switches on and off
- opening and closing doors
- climbing up and down from rigid objects
- moving objects

Additionally, the authors of STRIPS introduced a formal planning language that was used as input for the planner. One STRIPS instance consists of initial state, a specification of the goal states and actions. Each action has preconditions and postconditions.

The complexity of deciding whether any plan exists for a propositional STRIPS instance has been shown to be PSPACE-complete (Bylander 1994). Further restrictions can be enforced to make it an NP-complete problem.

The impact of STRIPS throughout the AI community was really substantial. Even recent games, like F.E.A.R (Orkin 2006), use very similar planning systems.

The approach used by STRIPS and similar systems (called linear programming) was found to be incomplete and it couldn't solve some very simple problems (Sussman 1975). A complete planner must allow for interleaving of actions from different sub-plans within a single sequence.

One solution to this problem was proposed by Waldinger (Waldinger 1981). Goal regression constructs totally ordered plan and then constructively modifies it to satisfy all sub-goals. This approach was implemented in the planning system WARPLAN. This planner was the first who was written in a logic programming language (Prolog).

Note that WARPLAN still produced its plans as a linear sequence of actions. Nonlinear planners like NOAH (Sacerdoti 1975) dealt with interactions between sub-goals in plans that are partially ordered.

SatPlan (Kautz, Selman, and others 1992) tries to cast the problem of planning as one of satisfiability. It converts the planning problem into a Boolean satisfiability problem. What is a satisfiability problem? Given a Boolean formula in conjunctive normal form (CNF), find an assignment of truth values to literals that makes it true. Intuitively, SatPlan constructs a propositional sentence that includes: initial state, set of actions and a goal. Then a SAT solver is called to create a model based on the sentence. It extracts variables that represent actions and creates a plan from them if a model can be constructed.

References

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