Historical Developments in the Field of AI Planning and Search

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1 Stanford Research Institute Problem Solver (STRIPS)

STRIPS marked a first milestone in AI planning as the first major planning system[3]. It was initially implemented in LISP and was used also for robot research at Stanford Research Institute[1].

STRIPS models the world using a language of statements that correspond to first-order predicate calculus[1]. Such representation marked one of the contributios of STRIPS: a well defined and useful language for representing planning problems[3].

As for the search strategy, STRIPS used "existing therorem -proving programs to answer questions about the model"[1, p. 191]. They based their search strategy on General Problem Solver (GPS) and QA3 theorem proving system[1, 3].

Over the STRIPS work, Bylander demostrated that a STRIPS planning problem belongs to PSPACE-complete[3]. Also, other modeling languages surged, that augmented STRIPS, like Action Description Language (ADL) and Problem Doman Description Language (PDDL)[3].

2 Subplan interleaving

Early planners usually used an approach named linear planning: there the subplans for each goal are just concatenated. Such approach can't handle some problems, like the Sussman anomaly[3].

WARPLAN was one planner that introduces "goal regression planning", that reorders steps to avoid conflicts between subgoals, and allows to interleave subplans[3]. INTERPLAN was other planner that uses interleaving[3].

WARPLAN also was the first planner written in a logic programming language: Prolog. It was only 100 LOC, in contrast to existing planners[3].

3 SATplan

SATplan "rewords" the planning problem as a satisfiability problem. It converts the planning

problem to conjunctive normal form (CNF) and then tries to demostrate the axioms and goals at some future time horizon. If it wasn't able to demostrate it then it expands the horizon[3, 2].

Once converted to CNF then any SAT could be used to demostrate the theorem. Usually those SATs are based on DPLL algorithm or WalkSAT[3, 2].

Expressing this kind of problems as satisfiability problems makes them as a sort of dual problem of automatic theorem proving and also Prolog execution, which was used to implement WARPLAN.

References

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