Project 3 AI-Planning research review

Planning research is a central part of the AI. It arose from investigation into state-space search, theorem proving and control theory,

1st major planning system is STRIPS[1] [2]which is originated from General Problem Solver, GPS[3]. STRIPS is designed as the planning component of the software of the Shakey Robot project in SRI[4].

REPRESENTATION

The representation language beneath the STRIPS is Action Description Language, ADL[5], which is able to encode more realistic problems by relaxed some of the STRIPS restrictions. Later, it evolved to Problem Domain Description Lanugage, PDDL[6],

IDEA

Planner in early 1970's focused on totally ordered sequence. Problem decomposition was achieved by computing a subplan for each subgoal and then stringing the subplans together in some order. This approach, called **Linear Planning,** soon discovered incomplete mainly due to the subgoals conflict.

Then comes the **Partial Ordered Planning**[7] to detect the conflicts and to protect the achieved conditions from interference[8]

Partial Orderd Planning dominated the research for 20 years since 1975-77. Some approaches emerged in between, mainly on heuristics and state space planning,

APPROACHES

The **GraphPlan**[9] comes out to guide the search in many different ways with orders of magitude faster than Partial Order Planning.

The most recent approach is the **Binary Decision Diagrams**

Boolean Satisfiablity(SAT) approach performs well in some context when Graph Plan prevails. The SATPlan will convert the planning problem into **Boolean Satisfiability Problem**.

Overall, constraint-based approach like GraphPlan and SATPlan are best for NP-hard domain, while search-based approach outperform other in domain where feasible solution can be found without backtracking. GraphPlan and SATPlan have trouble in domains with many objects due to the accompanied overhead of actions creation, in some case, such action creation can be delay till needed.

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1   Fikes and Nilsson, 1971
2   Fikes and Nilsson, 1993
3   Newell and Simon, 1961
4   N.J. Nilsson, Shakey the Robot, SRI Tech, Note 323, Menlo Park, CA, 1984
5   Pednault, 1986
6   Ghallab et al., 1998
7   Tate, 1975a
8   Sussman, 1975
9   Avrim Blum and Merrick Furst 1995, 1997