RESEARCH REVIEW

Development of Planning Languages [1]:

The first major planning system, STRIPS (Fikes and Nilsson, 1971), invented the first planning languages which is close to what we called “classical” language. Action Description Language, or ADL (Pednault, 1986), relaxed some of the STRIPS restrictions and made it possible to encode more realistic problems. Problem Domain Description Language (PDDL) (Ghallab et al., 1998), was introduced as a computer-parable, standardized syntax for representing planning problems and has been used as the standard language for the International Planning Competition since 1998 with several extensions.

Development of Algorithms [2]:

The first general of planning methods is Linear Planning named by Sacerdoti (1975), which considered totally ordered action sequences. However, it doesn’t allow for interleaving of actions.

Goal-regression planning (Waldinger,1975; Warren’s 1974) reorders the steps to avoid conflict between sub goals make up for the defects of Linear Planning.

Partial-order planning include the detection of conflicts (Tate, 1975a) and the protection of achieved conditions from interference (Sussman, 1975) dominated the next 20 years of research.

Nguyen and Kambhampati (2001) developed REPOP planner with accurate heuristics derived from a planning graph, which scales up much better than GRAPHPLAN in parallelizable domains and is competitive with the fastest state-space planners.

Then there is a resurgence of interest in state-space planning with different heuristic methods from late 1990s to 2000s, like ignore-delete-list heuristic and FASTDOWNWARD.

Closely after state-space planning with heuristics, Graphic Planning with heuristics is also revitalized.

Most recently, there has been interest in the representation of plans as binary decision diagrams, compact data structures BINARY DECISION for Boolean expressions widely studied in the hardware verification community (Clarke and Grumberg, 1987; McMillan, 1993).

FASTDOWNWARD [3]:

Fast Downward is a classical planning system based on heuristic search. Fast Downward is a progression planner, searching the space of world states of a planning task in the forward direction. The input of Fast Downward is first translated into an alternative representation called multi-valued planning tasks, which makes many of the implicit constraints of a propositional planning task explicit. Fast Downward uses hierarchical decompositions of planning tasks for computing its heuristic function, called the causal graph heuristic, which is very different from traditional HSP-like heuristics based on ignoring negative interactions of operators.

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[1,2] Intelligence A, Approach A M. Stuart Russell and Peter Norvig[J]. 2010.

[3] Helmert M. The fast downward planning system[J]. Journal of Artificial Intelligence Research, 2006, 26: 191-246.