Automated Planning Research Review

1.STRIPS Language [1]

The STRIPS stand for Stanford Research Institute Problem Solver. It is a representation language of classical planners, expressive enough to describe a wide variety of problems, but restrictive enough to allow efficient algorithms to operate over it. There are 3 main representations: states, goals and actions.

The STRIPS describes states as a conjunction of positive literals. Literals in first-order state descriptions must be ground and function-free, using closed-world assumption.

The STRIPS describes goals as partially specified state. A propositional state satisfies a goal if the state contains all the atoms in goal.

The STRIPS describes actions in terms of their preconditions and effects. Preconditions is a conjunction of function-free positive literals stating what must be true in a state before the action can be executed. The effect is a conjunction of function-free literals describing how the state changes when the action is executed.

2. Planning Graph Data Structure

As total-order and partial-order planning cannot guarantee accuracy, a new data structure, planning graph, was developed to give better heuristic estimates.

A planning graph consists of a sequence of levels that correspond to time steps in the plan, where level 0 is the initial state. Each level contains a set of literals and a set of actions. The literals of current level are true, if the previous level actions are true; The actions of current level are true, if the literals hold.

The benefit of the planning graph structure is that it offered the min number of steps need for literal to be true, which is efficient.

3. GRAPHPLAN Algorithm [2]

As we mentioned, the planning graph is an efficient data structure to give better heuristic estimates in automated planning problems. However, to extract the solution from the graph, we need to use a specialized algorithm such as GRAPHPLAN.

The graph plan algorithm had two main steps:

1st Check whether all the goal literals are present in the current level, with no mutex links between any pair of them.

2nd If previous return true, a solution exists. Otherwise, add actions for current level and the state literals for the next level.

The graph plan would keep execute terminate when a solution found or no solution exists.

References

[1] Richard E. Fikes, Nils J. Nilsson (Winter 1971). "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving".

[2] Stuart J. Russell, Peter Norvig (2010), Artificial Intelligence: A Modern Approach (3rd Edition).