

Historical Developments In AI Planning

STRIPS

STRIPS (Stanford Research Institute Problem Solver) was designed by Richard Fikes and Nils Nilsson in 1971. It introduced a simple syntax for defining the model of world for chosen problem, goal to reach, and possible actions that can change world state. Each action has a conditions necessary for this action, and changes to the world model that will occur after this action.

Problem solving start from initial world model. Then chain of actions is define. Each do small changes to world model making it closer and closer to goal. With last action our resulting world model will satisfy the conditions of our goal.

Graphplan

This approach was developed by Avriem Blum and Merrick Furst at Carnegie Mellon in 1997. Main idea is to build an n-level graph structure representing world model for current problem. Each level is a new world state or possible actions that can be used from this state.

Hypothetically, if we had enough computing powers, we would be able to build “complete” world model graph structure that can represent any possible world state and find a state that will satisfy our goal. Practically we could do this only for very simple problems. So we need to build graph as minimum as possible but in which structure we can find optimal solution for our problem.

We starting building graph from 1 level, that represents initial conditions. Than we extend graph structure to +2 levels (one level is action level, second is new state). If new state satisfy the conditions of our goal we stop, if not we build extend graph to additional +2 level again and again, till we we reach the goal.

One of the main feature of planning graphs is mutex - mutually exclusive relationships. Mutex is two actions or two states, that cannot coexist in one valid plan. This exclusiveness help graph to be more closer to problem and don't create unneeded sub-graph structures.

Heuristic search planning

It's based on using a custom heuristic search based on some knowledge to build a solution plan for current problem. Good heuristic can help find optimal (or at least good) solution rather quickly for a complex problems. Heuristics can be domain dependant and domain independent. Second type of heuristics can be used as some kind of "universal" way to solve planning problems of different domain, but also they wouldn't be as effective as more specific heuristics.

The main idea is to value amount of actions needed to change the world model from its current state till it satisfy goal condition. So basically, heuristic used to measure "distance" to the goal. This will help to select most useful action from each state to move world model closer and closer to goal.