RESEARCH REVIEW

IMPLEMENT A PLANNING SEARCH: AIR CARGO PLANNING

Planning as a method in artificial intelligence is based on finding an action sequence in order to reach a given goal by fulfilling sub-goals (actions) utilizing search and logic. In other words, it can be seen as development of an agent that can take decisions to achieve a target, similar to how intelligent creatures make choices.

Some developments in the domain have been discussed below.

STRIPS (Stanford Research Institute Problem Solver): Developed in 1971 by Fikes and Nilsson, STRIPS was designed to enable a robot named 'Shakey' to accomplish sophisticated goals such as manipulating an object in another room. To accomplish this goal, a sequence of actions had to be performed, for which the robot had to reasonably assemble a plan of simple individual actions and execute them until the goal was reached.

In STRIPS planning, there is complete knowledge about the initial state, and the actions are deterministic with only one outcome. Its solution is a linear plan with a sequence of actions. A STRIPS instance is composed of an initial state, the specification of the goal states – situations which the planner is trying to reach and a set of actions. For each action, the following are included: pre-conditions (what must be established before the action is performed); post-conditions (what is established after the action is performed). Then a problem consisting of initial state and goal condition is defined. STRIPS then searches all possible states, starting from the initial state, executing various actions, until it reaches the goal.

Partial-Order Planning: While STRIPS is a forward planner that enforces total ordering on actions at all stages of the planning process, the idea of a partial-order planner is to have a partial ordering between actions and only commit to an ordering between actions when forced. This is sometimes also called a non-linear planner, which is a misnomer because such planners often produce a linear plan.

Anthony Barret and Daniel Weld have argued in 1993, that partial-order planning is superior to total-order planning, as it is faster and thus more efficient. They tested this theory using Korf's taxonomy of sub-goal collections, in which they found that partial-order planning performs better because it produces more trivial serializable than total-order planning. One drawback of this type of planning system is that because the algorithm is more complex than others, it requires a lot more computational power for each node.

Graphplan: Graphplan is a general-purpose planner for STRIPS-style domains, based on the ideas used in graph algorithms. It gained popularity around 1995. Given a problem statement, Graphplan explicitly constructs and annotates a compact structure called a Planning Graph, in which a plan is a flow of truth-values through the graph. As this graph is being built, useful information for constraining search can quickly be propagated. Graphplan then exploits this information in the search for a plan. Graphplan always returns a shortest- possible partial-order plan, or states that no valid plan exists.

References

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