

Historical developments in the field of AI planning and search

Planning is a sub-field of Artificial Intelligence, explored by researchers in the AI community for more than three decades. A planning problem can be described by a collection of actions, their preconditions and post conditions, an initial state and a description of the goals, which need to be achieved. The problem is solved by finding actions that will lead from the given initial state to a state satisfying the goals. Some of the major historical developments in this field are:

1. STRIPS(Stanford Research Institute Problem Solver)

Strips (Richard E. Fikes, 1971) was the first major planning system, it was designed as the planning component of the software for the Shakey robot (Nilsson, 1984) project at SRI. STRIPS introduced a simple syntax for defining action schema. An important contribution to Planning AI made by STRIPS was introducing the STRIPS Assumption as a way to avoid the complexity of the frame problem within situation calculus. This assumption was that the only changes that arise after an action is applied to a situation are the ones, which are explicitly mentioned as positive effects of that action. All other relations and predicates, associated with the situation are automatically deduced to persist in the successor situation.

2. Graphplan

Graphplan (A. Blum, 1997) introduced an approach to planning that was radically new at the time. Graphplan searches for a plan in two stages. First, it constructs a data structure, called plan graph, which efficiently represents information about what could be the results of executing actions from the initial state. The second stage executes a backwards search from the goals, for a path within the graph, which represents a sequence of actions that will achieve the goals. The impact of this approach was that it combined the benefits of depth-first search (low memory consumption) with the benefit of a breadth-first search (finding an optimal solution).

3. Automatically Constructed Heuristics

Heuristic search was used but it did not seem very promising. The major problems with it arose because the heuristic function had to be encoded by hand and it was often hard to implement a function that would reliably guide the planner to make all the correct choices. This changed in the UNPOP (McDermott, 1996) planning system. It introduced a classic heuristic guided search, but with an important difference - a heuristic function, automatically constructed by analyzing the domain. The value of an action is based on an estimate of how much work remains to be accomplished after executing that action. The required future work is measured by the number

of actions required to achieve all the goals if the destructive effects of those actions are ignored. This approach is called relaxed planning and it was major contribution to the AI planning field.

References

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