Review of historical development of AI planning and search

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In this paper, I describe some important historical developments in the field of AI planning.

1 Interleaving and partial-order planning

Early planners used to generate plans for multiple subgoals independently, and stringing them together to form a plan for the entire goal. Unfortunately, this does not always produce a correct plan. A correct plan needs interleaving actions from subplans in order for them not to interfere with each other. This was first done by Waldinger (1975).

This has led to introduce the development of partial-order planners, as interleaving actions do not always need to happen in a given order. This approach was popular for nearly 20 years, from Sacerdoti (1975) and Tate (1977) to Penberthy and Weld (1992).

2 Planning as Boolean satisfiability

Another very important technique in planning consists of translating the planning problem to a Boolean satisfiability problem. One influential planner that used this technique is SatPlan, by Kautz and Selman (1992) and Kautz and Selman (1996). It allowed planning to take advantage of all the algorithms developed for satisfiability. It outperformed many planning algorithms of the time.

3 Planning graphs

Planning graphs were introduced by Blum and Furst (1997) as a basis for their Graphplan planner. Planning graphs are an approximation to the problem state space that can be computed in polynomial time and polynomial space. Graphplan uses the planning graph to search for a plan rather than searching the full state-space.

Planning graphs have been used in other planners as well. They can be used as heuristics for a searching the state-space using A*. They have been used by the Blackbox planner of Kautz and Selman (1998) and Kautz and Selman (1999), which works by converting the planning graph to a Boolean satisfiability problem. They have also been used by the STAN planner of Long and Fox (1999), which improves upon Graphplan by proposing efficient data structures for computing and storing the planning graph. Koehler and Hoffmann's IPP system (Koehler et al. 1997), and later Hoffmann and Nebel's FF (Hoffmann and Nebel 2001) also used planning graphs.

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