

Research Review

Planning search has been central to AI since its inception. It arose from investigations into state-space search, theorem proving, control theory and from the practical needs of robotics and many other domains.

In the early days, linear planning was used but soon discovered to be incomplete. The lack of interleaving of action from different subplans, linear planning could not solve simple problems such as the Sussman anomaly (Sussman, 1975). One solution to the interleaving problems was to record totally ordered plan using goal-regression which can avoid conflict between subgoals.

To overcome the problem of linear planning, partial-order planning was invented which include the detection of conflicts (Tate, 1975a) and the protection of achieved conditions from interference (Sussman, 1975). Partial-order planning was the focus of the research community for 20 years till later faster methods were invented.

State-space search is one of this fast method. It became popular and was pioneered by Drew McDermott's UNPOP program (1996). McDermott created the program because he suspected there may be other approaches deserve more attention from partial-order planning. Inspired by McDermott, Bonet and Geffner published Heuristic Search Planner (HSP). HSP and its later derivatives were the first to make state-space search practical for large planning problems. HSP searches in the forward direction while HSPR searches backwards. Following the success of HSP, FF (Hoffmann, 2001; Hoffmann and Nebel, 2001; Hoffmann, 2005) was proposed and become the most successful state-space searcher to date. It was the winner of the AIPS 2000 planning competition.

In the late 90s, the graph-planning system was revitalized by Avrim Blum and Merrick Furst with their GRAPHPLAN system which was orders of magnitude faster than the partial order planners of the time. New graph-planning systems were invented such as IPP(Koehler et al., 1997), STAN (Fox and Long, 1998) and SGP (Weld et al., 1998). The winner of AIPS planning competition was won by a graph-planning system named LPG (Gerevini and Serina, 2002, 2003).

According to Helmert (2001), the constraint-based approaches such as GRAPHPLAN and SATPLAN are the best for NP-hard domains, while search-based approaches do better in domains where a feasible solution can be found without backtracking.