

Research Review – Planning Search

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Three important historical developments in the field of AI planning and search are:

1. STRIPS
2. Partial-order planning
3. GRAPHPLAN

STRIPS (1971)

STRIPS (Stanford Research Institute Problem Solver) is an automated planning technique developed by Richard Fikes and Nils Nilsson in 1971^[5]. It is a formal language for describing a problem, its environment, and the actions that can be taken in the environment^[4]. Using a formally-described goals, states, and actions, STRIPS finds a sequence of actions which satisfies the goal conditions^[2].

STRIPS is the base for most languages expressing automated planning problems, which are known as action languages. It created a framework for these action languages (like PDDL), which have helped standardize AI planning languages. And hence, it has had a significant impact on AI planning research, and the overall field of AI research. The action languages that STRIPS helped introduce have a number of real-world applications, like robotics and video game AIs^{[3] [6]}.

Partial-order planning

Partial-order planning (POP) is an automated planning approach which makes the order of actions as open as possible. This flexibility contrasts with the rigidity of total-order planning, which produces an exact ordering of actions^[7]. POP works on several subgoals independently, solves them with subplans, and then combines the subplans to form a solution^[1].

POP was first used by the NOAH planner (1975) and NONLIN system (1975). POP was the focus of planning research for the next 20 years. Chapman's 1987 was the first complete description of a partial-order planner. POP continued to be a big focus until the 1990s, when faster methods appeared. Nonetheless, the development was a big milestone in automated planning research, and eventually lead to the GRAPHPLAN system, which was orders of magnitude faster than previous POP planners^[1].

GRAPHPLAN (1995)

GRAPHPLAN is an automated planning algorithm developed by Avrim Blum and Merrick Furst in 1995. It takes a problem expressed using STRIPS and produces a sequence of actions for reaching the goal state (assuming the goal is possible)^[9].

GRAPHPLAN was orders of magnitude faster than any other partial-order planner when it was created. It did this by reducing the branching factor by searching in a special data

structure. It lead to numerous other planning systems to follow, many of which used ideas from GRAPHPLAN, such as: IPP, STAN, SGP, Blackbox, and Medic^[8].

References

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