Three major development in Automated Planning and their contribution to the field of AI

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Planning Domain Definition Languages (PDDL)
The PDDL was developed to make the first International Planning Competition in 1998 possible. It provided a formal framework for the automated planning community to work around and together, testing with different planning goals and algorithms. In terms of how it works, it "describes the initial and goal state as conjunctions of literals" (Russell and Norvig, 2010), while the actions contain preconditions and effects that are also made up of different literals. Reaching the goal is thus, a matter of combining the right sequence of action, so that the effects of the action gives the same literals as the goal state literals. Its simplicity has also meant that it is rather limited, inspiring the creation of many variants that deal with specific gaps, such as NASA's NDDL and APPL, which were built for spacecrafts. As the community work increasingly toward real world problems, the PDDL language itself evolves along with the competition, introducing numeric-fluents, plan-metrics, durative/continuous actions, and many more, to its subsequent versions (Fox and Long, 2003). Some of PDDL's real world application include logistic planning, scheduling, robotic programs planning, and many more.

Planning graphs
Taking inspiration from graph algorithms, Blum and Furst (1995; 1997) came up with general purpose planner that represents the planning problem as a graph of truth-values flow. It should be noted that unlike a state-space graph where each node is a state of a problem, each node in the planning graph is either a single unit of fact (literal) or of an action, inside the entire state. Starting from the initial state, the planning graph builds a graph by alternating in step between all possible literals and all possible actions, making sure that no literals or actions are illegal, or could not happen at the same time. Planning graphs had a big impact on the planning community, drawing a lot of research interest. It inspired many new planners, including those that tried to make planning graphs more efficient to those that tried to incorporate planning languages into it. It also got incorporated in more sophisticated solvers such as BlackBox to help guide search. Even though the planning graph is efficient in that it only builds a skeleton framework of the problem, the main idea behind it is still criticized for its inefficiency in dealing with very huge problems with a lot of irrelevant literals (Brafman, 2001).

Forward State-Space Search
The forward state-space search refers to simply branching out from the initial state and searching forward. Originating as far back as 1960s, it was traditionally deemed to be impractical, as it could easily branch out to a plethora of irrelevant states, and this problem worsens if the state is big (Russel and Norvig, 2013). However, turns out that with an effective heuristic, forward state-space search is not only feasible but indeed effective, as demonstrated by Bonet and Geffner's paper on Heuristic-State Planning (1999), which utilized a heuristic that ignores the delete lists of all operators (ie: disregarding the blank(s2) that may be in the precondition). Most notably though, the Fast-Forward (FF) algorithm won the 2000 AIPS planning competition, which put state-space search back among the ranks of best planning solver. The FF begins with a planning graph to inform where the local search should be conducted. It then uses, pruning, hill-climbing, and iterative deepening with the the ignore-delete-list heuristic to search for a solution.

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