AI planning and search Review

Important historical developments in the field of AI planning and search

STRIPS:

STRIPS (Stanford Research Institute Problem Solver) is an automated planner developed by Richard Fikes and Nils Nilsson in 1971 at SRI International.STRIPS is an action language which was a part of the first major planning system with the same name. Shakey, the robotOriginally STRIPS was a name for the planning component in software used in Shakey, the robot developed at the Stanford Research Institute (SRI), which was the first machine to be able to reason about its own actions. Shakey with his abilities (visual analysis, route finding, object manipulation and more) is called an ancestor of self driving cars, military drones, Mars rovers and overall field of Robotics and AI. While Shakey's hardware wasn't very impressive, its software (architecture and algorithms) was a game changer in world of AI.

As a part of this revolution, STRIPS planner gave Shakey the ability to analyse commands (the goals) and break them down into plan of all needed actions (even if Shakey itself wasn't be able to complete all of them). STRIPS represents a world as an arbitrary collection of first-order predicate calculus formulas and is designed to work with models consisting of large numbers of formulas. It employs a resolution theorem prover to answer questions of particular models and uses means-ends analysis to guide it to the desired goal-satisfying model. A STRIPS instance is composed of an initial state, the specification of the goal states – situations which the planner is trying to reach, a set of actions. For each action, the following are included: preconditions (what must be established before the action is performed); postconditions (what is established after the action is performed).Deciding whether any plan exists for a propositional STRIPS instance is PSPACE-complete. Various restrictions can be enforced in order to decide if a plan exists in polynomial time or at least make it an NP-complete problem.

GRAPHPLAN:

Graph Graphplan is a general-purpose planner for STRIPS-style domains, based on ideas used in graph algorithms. Graph plan is popular from 1996. Given a problem statement, Graphplan explicitly constructs and annotates a compact structure called a Planning Graph, in which a plan is a kind of "flow" of truth-values through the graph. This graph has the property that useful information for constraining search can quickly be propagated through the graph as it is being built. Graphplan then exploits this information in the search for a plan. Graphplan always returns a shortest-possible partial-order plan, or states that no valid plan exists. Graphplan was created by Avrim Blum and Merrick Furst, with subsequent extensions and improvements made by many researchers at many different institutions around the world.

SATPLAN:

Satplan (better known as Planning as Satisfiability) is a method for automated planning . Satplan is popular from 1995. It converts the planning problem instance into an instance of the Boolean satisfiability problem , which is then solved using a method for establishing satisfiability such as the DPLL algorithm or WalkSAT . WalkSat is a local search algorithms , work on formulae in Boolean logic that are in, or have been converted into, conjunctive normal form . They start by assigning a random value to each variable in the formula. If the assignment satisfies all clauses , the algorithm terminates, returning the assignment. Otherwise, a variable is flipped and the above is then repeated until all the clauses are satisfied. The Davis–Putnam–Logemann–Loveland (DPLL) algorithm is a complete, backtracking -based search algorithm for deciding the satisfiability of propositional logic formulae in conjunctive normal form .

Reference:

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