Important historical developments in the field of AI planning and search

This document provides a brief overview of some noticeable historical developments in the field of Planning and Search, the problem domain that has been central to Artificial Intelligence research since its inception.

A* Search Algorithm, 1968

In 1968, during his work on “Shakey the Robot” project, Nils Nilsson, computer scientists at Stanford’s Research Institute, was trying to improve the path planning algorithm used by the robot. Supported by his colleagues Peter Hart, Nils Nilsson and Bertram Raphael they have created A* (“A-star”) algorithm that searches among all possible paths to the solution, but first considers paths that “seem” to lead faster to the solution.

For this purpose, the algorithm uses **heuristics** to estimate best path to be selected next. Specifically, A* selects path that at node n minimizes $f(n) = g(n) + h(n)$, where $g(n)$ is the cost of the path from the start node to n, and $h(n)$ is a heuristic that estimates the cost of the cheapest path from n to the goal.

STRIPS, 1971

STRIPS (Stanford Research Institute Problem Solver) is an automated planner developed in 1971 by Richard Fikes and Nils Nilsson of Stanford. STIPRS name was later adopted as a reference to the formal **action language** of the inputs to this planner, which specified: initial state, goal state, and set of operators (or actions) with defined pre- and postconditions.

STRIPS language was used as the base for most of the languages for expressing automated planning problem instances in use today, for example Action Description language (**ADL**) developed in 1987, and later Planning Domain Definition Language (**PDDL**) developed in 1998 as an attempt to standardize Artificial Intelligence (AI) planning languages.

Graphplan, 1995

Graphplan is an algorithm for automated planning developed by Avrim Blum and Merrick Furst in 1995. Graphplan takes as input a planning problem expressed in STRIPS and produces, if one is possible, a sequence of operations for reaching a goal state.

The algorithm is based on the **planning graph** in which nodes are arranged into alternate levels that represent either actions or states; edges link atomic facts of a state to actions for which these facts are conditions, and also actions to their effect facts; the first (state) level of the graph represents initial state.

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.

References

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