

Planning Research Review

Planning Search for Air Cargo Transport System

Introduction

During the past several decades, AI planning and search has made significant breakthroughs in terms of the size and difficulty of problems that can be solved. In this report three techniques for fully deterministic planning with single initial state are reviewed in the time order they appear.

STRIPS

AI planning and search began started to develop as an independent research field with the advent of STRIPS(Stanford Research Institute Problem Solver). This automated planner developed by Richard Fikes and Nils Nilsson in 1971^[1] originally aimed to solve control problems of Shakey robot. But as time goes by, the ideas it introduced become the foundation for most of the languages for expressing automated planning problem instances in use today.

Partial-Order Planning

During the 1980s the focus of research field is on partial-order planning. Partial-order planning is an approach to automated planning that leaves decisions about the ordering of actions as open as possible. It contrasts with total-order planning, which produces an exact ordering of actions. Given a problem in which some sequence of actions is required in order to achieve a goal, a partial-order plan specifies all actions that need to be taken, but specifies an ordering of the actions only where necessary. It is generally faster and thus more efficient than total-ordering.

Graphplan

The introduction of the Graphplan algorithm in 1995 by Avrim Blum and Merrick Furst^[3] is the most groundbreaking idea in late 1990s. It takes as input a planning problem expressed in STRIPS and produces, if one is possible, a sequence of operations for reaching a goal state. This algorithm had two characteristics that separated it from earlier ones: it finds plans of a fixed length (that is incrementally increased until a plan is found), and it uses reachability information for pruning the search tree. These differences brought the performance of Graphplan to a level not seen in connection with earlier planners.

References

1. Richard E. Fikes, Nils J. Nilsson. "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving". *Artificial Intelligence*. 2 (3–4): 189–208.
2. Stuart Russell, Peter Norvig. *Artificial Intelligence: A Modern Approach*. 3rd edition.
3. A. Blum and M. Furst. Fast planning through planning graph analysis. *Artificial intelligence*. 90:281-300.