

Research Review - Planning

Federico Bogado, January 01, 2017

Introduction

The field of Ai planning is the one that tries to build control algorithms that enable an agent to synthesize a course of action that will achieve its goals.

Nevertheless there are a lot of different approaches on how to make the plan to solve the problem. New researches and studies are constantly shaping the field, and new techniques are build upon the latests tools.

This document will explore some developments on this area, trying to give a high level understanding of them.

Planning techniques and approaches

- GRAPHPLAN

Graphplan is a simple algorithm that alternates between two phases, graph expansion and solution extraction.

The graph expansion phase, builds a planning graph forward in time until it has achieved a condition for a plan existence.

The solution extraction phase then performs a backward-chaining search on the graph, looking for a plan that solves the problem; if no solution is found, the cycle repeats by further expanding the planning graph.

- SATPLAN

This technique showed that a general propositional theorem prover could be competitive with some of the best specialized planning systems.

The success of this algorithm can be attributed to two factors:

- The use of a logical representation that has good computational properties.
- The use of powerful general reasoning algorithms, with really fast SAT engines.

This algorithm also works on two phases. first it creates a propositional structure (CNF wff) and then searching in that structure. The main difference between GRAPHPLAN and SATPLAN is that the first uses a better algorithm for

instantiating the propositional structure, and the last one uses a more powerful search engine.

- **BLACKBOX**

This system combines the best features of GRAPHPLAN and SATPLAN. It works in three phases:

1. The planning problem is converted to a plan graph (as in GRAPHPLAN).
2. The plan graph is converted to a CNF wff (studies have proven that the graph plan has a direct translation to CNF).
3. the wff is solved by any of a variety of fast SAT engines.

This system includes a variety of local-search SAT solvers, as well as the original GRAPHPLAN engine. This let this solution to use a wide variety of solvers during execution time, and this makes the system have a robust coverage over a variety of domains.

Bibliography

1. Artificial Intelligence: A Modern Approach (3rd Edition) - Norvig and Russell
2. Recent Advances in AI Planning - Daniel S. Weld - October 1998
3. H. Kautz and B. Selman. Blackbox: A new approach to the application of theorem proving to problem solving. In AIPS98 Workshop on Planning as Combinatorial Search, pages 58{60, June 1998.