An overview of recent algorithms for AI planning

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In this issue, we give an overview of the techniques that have been part of the recent developments more in **classic planning.** Instead of concentrating on individual planning systems, we review the **underlying principles** behind many of the successful planners

- **GraphPlan**

This algorithm had two characteristics that separated it from earlier ones: it finds plans of a fixed length, 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. The success of Graphplan led the research community to look at techniques outside the traditional AI planning toolbox.

- **Planning as a Constraint Satisfaction Problem**(includes the Graph- plan and the satisfiability planning approaches)

Many of the recent planning algorithms and translational approaches to planning look for plans of a given length n that is increased step by step until a plan is found. Doing plan search in this way has several benefits. First, **shortest plans (in terms of points of time) are found**. Second, the descriptions of both the initial and the goal states can be used for effectively inferring fluent values at different time points, thereby **reducing exhaustive search**. The constraint-based model of classical planning allows plan search in several alternative ways. The main approaches have been **backward chaining, as in the Graphplan algorithm**, and **general constraint solving in** satisfiability planning approach.

- **Planing with Distance heuristics**

The techniques compute approximate distances between states, which helps in operator selection. In some benchmarks, the heuristics give a very good estimate of the distances, and plan search even with a **plain forward or backward chaining algorithm can be very efficient**. However, these heuristic planners have been **most successful in finding non-optimal solutions to computationally easy** (polynomial time) **planning problems**, and the situation may be different when optimal (shortest) solutions are needed and in connection with computationally more difficult problems (that are NP-hard or PSPACE-hard) that inherently require search.

- **Planning with ordered binary decision diagrams**

So far, OBDD-based algorithms for classical planning have been rather good on certain benchmarks, but they also have had serious problems with memory consumption, which is an inherent problem of OBDDs. There may be planning problems where symbolic breadth-first search as used by OBDD-based planners would outperform other approaches to classical planning discussed in this article, but it seems that the main applications are in the more general forms of planning like conditional and probabilistic planning

Reference

An overview of recent algorithms for AI planning, Jussi Rintanen and Jörg Hoffmann, Albert-Ludwigs-Universität Freiburg, Institut für Informatik Georges-Köhler-Allee, 79110 Freiburg im Breisgau Germany