RESEARCH REVIEW

Key Developments in the Field of AI Planning and Search

Submitted by
Matt Toledo
As part of the AIND Program, Udacity

FF: The Fast-Forward Planning System

Fast-Forward(Jörg Hoffman, 2001) builds upon the HSP system first introduced by Bonet Loerincs and Geffner in 1997. A heuristic function that is automatically extracted from the domain description is used to guide a forward search. The heuristic function is arrived at by relaxing the problem by ignoring the delete lists of all actions. It also employs more sophisticated methods than the HSP system it was based on such as using a GRAPHPLAN-style algorithm to find an explicit relaxed solution for each search state. Another improvement is using enforced hill climbing to reduce the branching factor during breadth-first search. FF was also the most successful automatic planner in the Fifth International Conference on Artificial Intelligence.

The LAMA Planner: Guiding Cost-Based Anytime Planning with Landmarks

LAMA(Silva Richter and Matthias Westphal) is based on heuristic forward search. It uses a pseudo-heuristic derived from landmarks which are propositional formulas that must become true at some point in every plan for a given task. These landmarks are used to direct the search and act as an additional source of search control. In conjunction with the FF heuristic, landmarks improve performance by being able to solve more problems and find shorter solution paths. LAMA uses anytime search to continue searching for better solutions until the search space is exhausted or it is interrupted. It uses a greedy best-first search to find an initial solution and then it runs a series of weighted A* searches with decreasing weights. The search is restarted each time from the initial state when a better solution is found. LAMA outperformed its competitors by a substantial margin at the International Planning Competition 2008 in the Satisficing Track.

cGamer: Constrained Gamer

cGamer (Álvaro Torralba and Vidal Alcázar, 2014) competed in the 2014 IPC Optimal Track. It expanded on the previous version, Gamer, which competed in 2008 and 2011. It uses Symbolic Search over Explicit-state Search to obtain exponential savings in both time and space. This is made possible by the use of efficient data structures like Binary Decision Diagrams and by representing actions with Transition Relations. An improvements in cGamer over previous versions includes a change to the search algorithm. A Symbolic Bidirectional Dijkstra search is used due to its ability to deal with non-unit cost domains. Álvaro Torralba and Vidal Alcázar were the first to propose ways to derive constraints from state invariants in symbolic search. The most efficient way they found to this is by encoding them in the TRs. They then implemented a similar method to cGamer.

Bibliography:

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