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AIND Project 3: Implement a Planning Search

Planning Historical Developments Research Review

In this short review major planning and search developments are described highlighting the relationship between them and their influence in the artificial intelligence field.

Stanford Research Institute Problem Solver (STRIPS)

STRIPS is an automated planner designed by Richard Fikes and Nils Nilsson [1]. The automated planner goal was to find a series of operators in a space of models to alter an initial state into a model in which a given goal can be proven to be true.

The impact of STRIPS in the artificial intelligence field was greater in terms of the representation language it created [2], which is very close to the "classical" planning language. This language described a set of applicable operators that allowed to transform one state into a different state. This definition of a framework to solve complex planning problems has been a central to much of the research in artificial intelligence [3].

STRIPS was primarily used for robot research at SRI (Stanford Research Institute) [1].

Planning Domain Definition Language (PDDL)

The PDDL was the first modeling language to be used widely for solving planning problems and it has remained the standard for the International Planning Competition since 1998 [2].

The PDDL was primarily inspired by STRIPS (discussed above), and ADL (The Action Description Language), which is a simpler representation of STRIPS that allows to encode more realistic problems by relaxing some of the STRIPS restrictions [2].

The usage of a common language for representing and solving planning problems encourages greater reuse of research, allows to analyze different approaches in an easier way and thus aids faster progress in the artificial intelligence field [4].

WARPLAN

Early research in the planning domain normally used linear programming [2], which considers totally ordered action sequences. This approach was soon learned to be incomplete and the notion of interleaving; being able to interleave actions from different sub-plans within a single sequence was introduced.

WARPLAN is a planner written by David Warren which implements a solution known as goal-regression planning to the interleaving problem.

WARPLAN was the first planner to be written in a logic programming language (Prolog) [2]. The implementation of a planner using such language was able to showcase the great benefits in terms of reduced complexity that can be achieved by using logic programming languages. WARPLAN is only 100 lines of code [2].

References

1. Richard E. Fikes, Nils J. Nilsson (Winter 1971). "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving".

2. Stuart J. Russell, Peter Norvig (2010), Artificial Intelligence: A Modern Approach (3rd Edition).

3. Nilsson, N. J. Problem-Solving Methods in Artificial Intelligence. McGraw-Hill Book Company, New York, New York, 1971.

4. M.; Long, D. (2002). "PDDL+: Modeling continuous time dependent effects". Proceedings of the 3rd International NASA Workshop on Planning and Scheduling for Space.