Historical Developments in the Field of AI Planning and Search

This short research review paper summarrizes **3** major AI planning and search historical aprroaches and highlights the relationships between the developments and their impact on the field of AI.

1.Stanford Research Institute Problem Solver

STRIPS (Stanford Research Institute Problem Solver) is an automated planner developed by Richard Fikes and Nils Nilsson in 1971 at SRI International [1]. The model attempts to find a sequence of operators in a space of world models to transform the initial world model into a model in which the goal state exists. It attempts to model the world as a set of first-order predicate formulas and is designed to work with models consisting of a large number of formulas.

The impact of STRIPS in the artificial intelligence field was that supplied representation language of planning problems, should make it possible for planning algorithms to take advantage of the logical structure of the problem. Many "classical" language is close to what STRIPS used such as ADL (Pednault, 1986) and Nebel (2000) , etc[2].

2.WARPLAN

WARPLAN is a planner written by David Warren in 1974 which implements a solution known as goal-regression planning to the interleaving problem. It was the first planner to be written in a logic programming language (Prolog) and is one of the best examples of the remarkable economy that can sometimes be gained with logic programming[2].

The impact of WARPLAN in AI is that it illustrates many basic idears for planning in a rather compact program[3].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].

3. Binary decision diagram

BDD(Binary decision diagram) is compact data structures for Boolean expressions widely studied in the hardware verification community (Clarke and Grumberg, 1987; McMillan, 1993)[2]. A boolean function can be represented as rooted, directed, acyclic graph, which consists of several decision nodes and terminal nodes[4].

The impact of BDD in AI is that it presents a practical algorithm for the automatic generation of solutions to planning problems in non-deterministic domains (Alessandro Cimatti, Marco Roveri and Paolo Traverso, 1998)[5]. First, the planner generates Universal Plans. Second, it generates plans which are guaranteed to achieve the goal in spite of non-determinism, if suchplans exist. Third, the implementation of the planner is based on symbolic model checking techniques which have been designed to explore effciently large state spaces.[5].

Reference

[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]：Pergamon Infotech, England (1987): Artificial Intelligence; State of the Art Report 15:3.

[4]：Wikipedia Binary Decision Diagram - https://en.wikipedia.org/wiki/Binary decision diagram.

[5]：Alessandro Cimatti, Marco Roveri, Paolo Traverso (1998). "Automatic OBDD-based Generation of Universal Plans in Non-Deterministic Domains"