Historical developments of AI planning and search

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In the field of AI, problem is decomposed and represented as all possible states and actions, planning technics, combining logic and searching, can take advantage of this structure and give us a good knowledge of solving the problem. This report gives a brief overview of three developments of AI planning and search, including the planning language: STRIPS, ACL, PDDL, and planning approach: Graphplan, then also introduces their impact and relations.

STRIPS, short for "Stanford Research Institute Problem Solver", is the first major automated planning system designed as the planning function part of software for Shakey robot project, now it's also referred as the formal language of inputs to this planning system. Its action representation has a huge impact on AI planning so that almost all languages for describing automated planning problems use it as base today. It provides a seminal framework for processing "classical planning problem" where the world is regarded as a static state and is transformable to another static state only by a single agent performing any of a given set of actions, the planning problem is then to find a sequence of agent actions that will transform a given initial world state into any of a set of given goal states[2]. However, it is insufficiently compatible for some real problems, therefore, many variants were developed.

ADL or Action Description Language, which is one of those language variants, is developed to relax some restrictions in STRIPS language and make it more expressive for more realistic planning problems, like its open world assumption, allowing both positive and negative literals, and conditional effects, etc.

To systematize the planning language with a standard syntax, The Planning Domain Definition Language (PDDL) was introduced in 1988, it has the expressiveness of ADL for propositions, and expressiveness of UMCP (Universal Method Composition Planner) for propositions.[3] It provides standard sets of problems all in comparable notations so that researchers can exchange benchmark problems and compare results.

Graphplan is a famous approach to general-purpose planning problems in STRIPS-like domains, based on constructing and analyzing a compact structure called a Planning Graph, in which a plan is a kind of "flow" of truth-values through the graph. It dramatically reduces the state search space, and returns a shortest possible partial-order plan, or states that no valid plan exists[4].

Planning and search are always central to AI since its inception, it's exciting to see new planning technics emerging continuously, and it's also quite promising for those new technics to be applied to the industry domain problems.

Reference

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4. A. Blum and M. Furst, "Fast Planning Through Planning Graph Analysis", Artificial Intelligence, 90:281--300 (1997)