Research Review

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Subject : Important historical developments in the field of AI planning and search.

From the beginning, the world is surrounded by planning. When we need to do start something at first, we need a plan and we call the planning as the process of making plans. Along with the development of AI (Artificial Intelligence), there have been efforts to integrate planning with AI, AI planning.

Then how we can apply AI into planning? First of all, we need to translate the real-world problem into the language the computer can understand. In AI planning field, it is called by representation language. STRIPS is considered as a first major planning system.[1] STRIPS stands for Stanford Research Institute Problem Solver, and it is an automated planner developed by Richard Fikes and Nils Nilsson in 1971 at SRI International.[2][3] The name STRIPS is used for a planning system as well as the representation language. Currently the PDDL (Problem Domain Description Language) is considered as a standard language to represent planning problem, and it is also influenced by STRIPS.[1]

We can come up with linear planning as a 1st era of AI planning development. In the early 1970s, the planning system takes the real-world problem as a input with representation language, and then provide the ordered action sequences for the real-world problem as an output. The planning system is able to divide the real-world problem into several sub-problems which can be resolved with sub-plans. After that, the system will be stringing the sub-plans together in order. Based on this ability, the system achieves problem decomposition when they get the big real-world problem. Unfortunately the system was not perfect, and unable to solve some very simple real-world problem.

The main problem of linear planning is in the output with totally ordered action sequence. The 2nd era of AI planning development has been started with the resolution for limitation of linear planning through the support of interleaving of actions from different sub-plans within a single sequence.[1] This concept is developed as a partial-order planning including the detection of conflicts, and it was dominated the next 20 years of research.[1] A lot of enhancements and achievements have been followed like UCPOP, REPOP, UNPOP, Heuristic Search Planner, HSPR, FASTDOWNWARD, etc.

As the last 3rd era of AI planning development, we can see the binary decision diagram which is related with the representation of plans. The binary decision diagram is compact data structures for Boolean expressions.[1] Actually it was widely researched and developed in the hardware verification field. There is a reason why it is interested in the AI planning field recently. The binary decision diagram has been developed by leading hardware verification community and there are already many techniques proving properties of binary decision diagram. Eventually there is a chance to have a property which can be a solution for the planning problem.

Reference

[1] Artificial Intelligence: A Modern Approach (3rd Edition) (11 December 2009) by Stuart Russell, Peter Norvig

[2] Wikipedia - STRIPS (2017, April 16). Retrieved from https://en.wikipedia.org/wiki/STRIPS

[3] Richard E. Fikes, Nils J. Nilsson (Winter 1971). "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving" (PDF). Artificial Intelligence. 2 (3–4): 189–208.