Planning in AI
Research Review - AIND October 2017

KAROLY ALBERT SZABO
szabo.karoly.a@gmail.com

Introduction

Planning was always at the core of AI, as most of the problems can be defined as a path to find, a sequence of action to optimize and other problems that will take advantage of the language used in planning to define a problem and use its mechanism to achieve a certain set of conditions, our goal. All of this problems solve a simplified view of the world, by implementing actions that have some outcome only in this limited vision of the world[2].

STanford Research Institute Problem Solver [9]

This work were developed at SRI International. The world model is represented by a set of well formed formulas of the first-order predicate calculus, the initial state adds to ta a world model a set of actions with prerequisites and effects on the model and a goal state. Previous works were based on formal theorems proof to determine the correct sequence of actions, STRIPS surmounted this problem by dividing the state searching problem from the theorem proving problem [9][1].

It uses GPS-like means-end analysis strategy to search in the world states [10].

The problem of finding if any solution exists is PSPACE-Complete

PDDL

This is the current Planning Domain Definition Language, with many variations to describe complex problems (PDDL+, OPS, NDDL, ...).

This work derive as an extension and refinement of ADL (Action Description Language 1987 Pednault [8]), that comes from the a relaxed version of the language used in STRIPS, with conditional operations. PDDL was introduced as a way to standardize the AI world in 1998. In this way different context were able to communicate by talking in the same standardized language. PDDL[2] balances the power of the language with the complexity of the problems and the algorithm used to solve it.

D* Lite

The authors based their work on LPA*[6], an algorithm based on continuous problem redefinition and replanning. The aim is to calculate the best plan as fast as possible, from an initial vertex S to a goal vertex G while nodes in the graph are added and deleted. This algorithm still used the problem definition language derived from STRIPS.

The goal in D* Lite[7] is the same as LPA, the main difference here is algorithmical, it takes a lot from D* and combines with the ideas from LPA*.

This work was used in self driving cars and autonomous robotics as it offered good replanning system with solid theoretical basis, good performances and reliable results

Conclusion

The strategies used and developed by planning are mainly: search and logic, two of the cornerstones of AI. It can solve a really wide set of problems, and thanks to all the contributions during the years, it is supported with an excellent modeling language.

Currently there are many conferences[4] and competitions that will push forward this field, probably a future work will overcome the current hard work to find the right approach to each problem.

References

1. Strips - a retrospective (1993): Richard E. Fikes and Nils J. Nilsson
2. PDDL - Planning Domain Definition Language(1998) - AIPS-98 Planning Competition Committee

3. Artificial Intelligence - A Modern Approach: Stuart Russel and Peter Norvig
4. ICAPS Conference
5. Planning and Acting in partially observable stochastic environment (1998) -
6. Lifelong Planning A* (2003) - Sven Koenig, Maxim Likhachev, David Furcy
7. D* Lite (2005) : Sven Koenig, Maxim Likhachev
8. Pednault, E. P. D. 1989. ADL: Exploring the middle ground between STRIPS and the situation calculus.
9. STRIPS - A New Approach to the application of theorem Proving to Problem Solving (1971) - Richard E. Fikes, Nils J. NHsson
10. Ernst, G. and .~4ewell, A. GPS: A Case Study in Generality and Problem Solving. ACM Monograph Series. Academic Press, New York, New York, 1969