Research Review

Introduction

Multi agent planning (MAP) is a very large field with numerous applications. It involves planning and coordinating the actions of multiple agents. The agents can plan to achieve a common goal, they may merge the plans of multiple agents, or they may refine their own plans for tasks and consumption of resources. Multiple agents can work together as a group to perform a task, or achieve a goal state. To ensure that plans are properly coordinated and executed is a major challenge in MAP. In this research review, I will briefly discuss three key developments in the area of multi agent planning.

1. Preserving Privacy

[1] Agents that have good reason to cooperate do not always want to share all their information with the other agents. An example of this would be ad-hoc teams of agents, cooperating companies, departments. Specifically, the goal is to not share private variable values and private actions with other agents. One reason for this may be the existence of confidential commercial data. However, public actions/variables are the interface to the world and the rest is private.

2. Distributed Planning Through Merging

In [2], Pellier describes a method called Distributed Planning Through Merging (DPGM). DPGM replaces the different stages of the distributed planning process with a single step. This approach is based on a planning graph structure for agent reasoning and a CSP mechanism for individual plan extraction and coordination. DPGM assumes that no individual agent can solve the problem alone.

3. Deriving heuristics from a general problem

This advancement involves having a problem described in a standardized way as understood by the algorithm, which allows for a stronger separation of solving logic and problem description[3][4] . It also opens up new possibilities to derive heuristics. The algorithm benefits from the domain semantics expressed as planning elements. For example, preconditions of an action and effects when executing the actions. Using those preconditions and effects, it can be inferred if actions are mutably exclusive and therefore the problem space can be adjusted accordingly. In the same way, heuristics can also be derived by solving a simpler problem. For example, some or all preconditions can be dropped and then we can count the number of levels until we are able to satisfy the goals. In reality this is only solving the simpler issue, but given that we only aim for a reasonable heuristic (lower or equal estimation as compared to the actual cost) this trade-off may often be useful.

1. Tožička, Jan, et al. "Privacy-concerned multiagent planning." Knowledge and Information Systems 48.3 (2016): 581-618.
2. D. Pellier, “Distributed planning through graph merging,” in International Conference on Agents and Artificial Intelligence , 2010.
3. STRIPS: Fikes and Nilsson (1971)
4. General Problem Solver (GPS): Newell and Simon (1961)