

Abstract

Abstract

Multi-Agent Systems (MAS), Argumentation and Automated Planning are three lines of investigations within the field of Artificial Intelligence (AI) that have been extensively studied over the last years. A MAS is a system composed of multiple intelligent agents that interact with each other and it is used to solve problems whose solution requires the presence of various functional and autonomous entities. Multi-agent systems can be used to solve problems that are difficult or impossible to resolve for an individual agent. On the other hand, Argumentation refers to the construction and subsequent exchange (iteratively) of arguments between a group of agents, with the aim of arguing for or against a particular proposal. Regarding Automated Planning, given an initial state of the world, a goal to achieve, and a set of possible actions, the goal is to build programs that can automatically calculate a plan to reach the final state from the initial state.

The main objective of this thesis is to propose a model that combines and integrates these three research lines. More specifically, we consider a MAS as a team of agents with planning and argumentation capabilities. In that sense, given a planning problem with a set of objectives, (cooperative) agents jointly construct a plan to satisfy the objectives of the problem while they defeasibly reason about the environmental conditions so as to provide a stronger guarantee of success of the plan at execution time. Therefore, the goal

is to use the planning knowledge to build a plan while agents beliefs about the impact of unexpected environmental conditions is used to select the plan which is less likely to fail at execution time. Thus, the system is intended to return collaborative plans that are more robust and adapted to the circumstances of the execution environment.

In this thesis, we designed, built and evaluated a model of argumentation based on defeasible reasoning for planning cooperative multi-agent system. The designed system is independent of the domain, thus demonstrating the ability to solve problems in different application contexts. Specifically, the system has been tested in context sensitive domains such as Ambient Intelligence as well as with problems used in the International Planning Competitions.