A Generative Dialogue System for Arguing about Plans
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Abstract

By working together and sharing resources and knowledge, cooperative agents are able to achieve objectives exceeding their individual capabilities. Different agents may be holding conflicting beliefs, due to the locality of sensing or because of having conducted different inferences. In order to collaboratively reach a joint decision on the best course of action, the agents need to identify the beliefs that can be justified, and employ them to construct a plan that can achieve the shared objective.

Merging Beliefs Prior to Planning

In cooperative distributed problem solving, conflicts are normally resolved by merging agents’ different views. Such a process requires highly structured knowledge bases and is in general inefficient, since all beliefs are communicated and all conflicts are resolved. In addition, such a process is not appropriate in domains where information is privileged.

Argumentation-Based Approach

Argumentation is a conflict resolution mechanism. Argumentation theory provides semantics for the evaluation of the acceptability of arguments. This process can be also conducted in a distributed fashion through dialogue.

We are working on developing an argumentation-based dialogue framework for the proposal and the evaluation of joint plans. Agents will be able to construct plans using conventional planners, validate other agents’ proposals, and engage in dialogue explaining the validity of plans and the truth behind the beliefs supporting them. The desirable properties of our protocol are soundness, completeness and efficiency.

Parcel World Domain Example

Agent A is the delivery agent, and is able to move, pickup and deliver parcels. Agent B is the processing agent and can only process deliveries. Actions pickup and deliver have no preconditions, but produce conditional effects depending on the position of the object. The Process action requires B to hold the object. Agents have conflicting beliefs about the position of the object. The shared objective of the two agents is to process the object. The initial state of the world for agents A and B is described by the following figures:

Agent A constructs a plan and makes a proposal. B validates the plan and discovers that the final action of the plan is inapplicable, according to her beliefs.

The following figure describes the state of the world after each action in the plan for the two agents.

Preliminary Results

• Sound restricted protocol (Completeness related to planning)
• The length of the dialogue identifying relevant conflicts is at most $2n+2$, where $n$ is the number of actions in the plan
• Polynomial complexity for reasoning to identify relevant beliefs