Project No.	Project Title	
2022-01-219	Multi-agent Preference Elicitation	
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Abstract

Most artificial intelligence (AI) research investigates how a single entity, which will henceforth be referred to as an agent, can exhibit intelligent behavior that includes solving problems using heuristic or knowledge-based methods.

There are several real-world applications that involve multiple agents. These problems are distributed in their nature. Thus, distributed AI (DAI) must address some important questions, i.e., how to formulate such problems, how to enable agents to communicate and interact, and how to ensure that agents act for the benefit of a global goal.

Distributed Constraint Optimization Problems (DCOPs) is a model for representing and solving the type of problems mentioned above. In some applications, constraints encode the preferences of human users. As such, some of the constraint costs may be unspecified and must be elicited from the users themselves. Therefore, the Incomplete DCOP (I-DCOP) model, in which some constraint costs are unknown and need to be elicited, was proposed.

Existing I-DCOP approaches rank a solution according to the total constraint and elicitation costs. This can lead to a situation where a solution of higher quality can be given a lower rank than a solution of lesser quality, since the higher quality solution has a higher elicitation cost. However, in our perspective, since the elicitation costs have already been paid in the case of the higher quality solution, there is no reason why such a solution should not be preferred.

To overcome this problem, we propose a new model that considers the elicitation costs, while giving higher priority to the quality of the solution. The proposed model is an I-DCOP in which effort is modeled as a budget, i.e., the maximum amount of effort that an agent is willing to dedicate for eliciting preferences is predetermined and fixed. The distributed variant of the Synchronous Branch-and-Bound (SyncBB) algorithm has been proposed to solve I-DCOPs, where unspecified constraint costs are elicited during its execution. We propose several heuristics that can be used in conjunction with SyncBB to solve our model. Our empirical study shows that the various heuristics have a positive effect to some extent on the calculation of the cost of the solution.

Keywords: Distributed Constraint Optimization Problems; Preference Elicitation; Synchronous Branch-and-Bound