ONECG: Online Negotiation Environment for Coalitional Games

Demonstration

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ABSTRACT

Coalitional games can be used to model a variety of problems in the real world. In coalitional game theory, how players form coalitions and divide payoffs is one fundamental issue to be answered. This demo presents an online negotiation environment for coalitional games (ONECG), in which coalitional negotiation can be conduced in a distributed way between people, agents, or in mixed settings via offer exchange and natural language communication. ONECG also allows configuration of specifications of coalitional games, and supports the rapid development of new negotiating agents through a set of well-defined APIs. This new environment is helpful to facilitate research on training human negotiation skills in coalitional games as well as the design of negotiation agents.

KEYWORDS

Negotiation; Human-agent interaction; Coalitional negotiation games; Cooperative game theory

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1 INTRODUCTION

Negotiation is ubiquitous in our daily life and serves as a key approach to facilitate conflict-resolving and achieve consensus between two or multiple parties. Recent years have witnessed an increasing interest in developing automated negotiation strategies[2–4, 7, 9] (i.e., agent-agent) due to the prevalence of negotiation platforms like Genius[5]. In spite of the great success, automated negotiation platforms tend to seek for Pareto or other optimality to reach most efficient agreements over resource allocation between rational agents, thereby being little helpful in developing the negotiation skills of human users for more complicated scenarios.

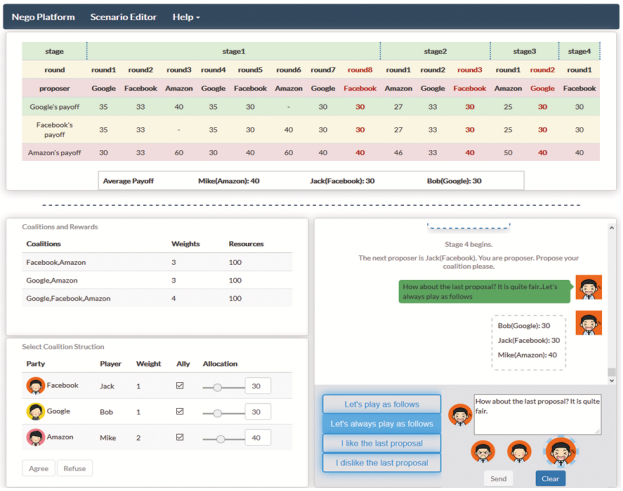

Figure 1: Screenshot of coalitional negotiation dynamics

Coalition formation, as one of the main research questions in cooperative game theory, can be used to model problems arising in a wide variety of domains such as economics, politics, and many other social fields [8]. It studies how a group of individuals form coalitions to produce jointly and share surpluses. Although a coalition is cooperative once formed, its formation process might take place in a rather non-cooperative way because each rational player would try as possible as she can to maximize its own payoff[1]. Coalition formation is thus a mixed-motive situation (e.g., both cooperative and competitive) where participants negotiate strategically in order to secure their positions in advantageous contracts. Moreover, the repetition of coalitional games makes participants consider the effects of reciprocity on their negotiation strategies (e.g., exclusion of a player in a proposal may lead to getting excluded in future coalitions)[10]. As a result, such context asks for new requirements of negotiation platforms.

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In this demo[1], we present a new negotiation platform for multiple-player coalitional negotiation games, called online negotiation environment for coalitional games (*ONECG*). It is designed as a user-friendly negotiation platform, with no installation efforts needed for users. ONECG aims at facilitating training human negotiation skills in coalitional games as well as the design of agent-based negotiation algorithms and strategies. With that purpose, the environment provides a web-based GUI for users to conduct coalitional negotiation between other human players or agents. In addition, ONECG allows organizing negotiation tournaments among autonomous agents in a wide range of coalitional game settings. The environment has the following core functionality:

- support of various specifications of coalitional games
- management of game scenarios, including creating new scenario, modifying existing game profiles
- multiple channels (behavior, language[6] and emotion) for user/agent to perform coalitional negotiation
- simulation of agent-based coalitional negotiation games

2 GAME SCENARIO MANAGEMENT

Scenario management of ONECG is used to create and modify coalitional scenario profiles. A negotiation scenario profile describes the specifications of a coalitional game, including the number of required players, the payoff of each possible coalition, weight vector of players and the minimal weight to form a winning coalition (these two parameters are usually considered for weighted voting games) as well as some rule parameters like the repetition of stage games and the maximal number of negotiation rounds for each stage.

The XML file format is employed to specify the scenario profiles, and the configuration of a game scenario is saved as four separate XML files. The use of XML significantly simplifies information maintenance work, and also allows easy extension of the current platform. It is convenient for users to apply new parameters through these files to customize game configurations. For example, using the management tool, users can add or remove a player from a game, or edit its resource (or weight); she can also change the coalition structure by changing the valid set of coalition.

Message exchanges and the negotiation outcomes can be helpful for human to learn negotiation skills and for researchers to further improve the design of agents. The data of negotiation sessions is exported to a CSV file on the server for future analysis. The transcript contains the following:

- details of negotiation setup, information of participants, scenario profile;
- all exchanged proposals, dialogues and actions of players during a game;
- the outcomes of each stage and averaged payoff of each participant.

[1]A video demonstration is available at https://youtu.be/5Zpz6lspQiI

3 SESSION AND TOURNAMENT MODE

ONECG has two primary game modes, each one with a separate GUI. In negotiation session mode, users can either negotiate with others by themselves or choosing an agent representative. The GUI depicts all proposal exchanges and a full conversational history during the session (please see Fig.1). When it is the user's turn to make a proposal, the system asks the user to select the next action and input any argumentation to justify her choice if she'd like to. After the user receives a proposal that invite her to form a coalition, she must decide to agree upon or reject the solution. The GUI also provides an easy way for users to choose coalition members and divide the reward among prospective members.

The tournament mode offers a testbed for the efficiency of a group of automated agents given a coalitional scenario. Before a tournament starts, users are allowed to pick any agent combination, change the number of stages and maximal rounds for each stage. The GUI gives negotiation dynamics about the outcomes of each round and the average payoff of players.

4 AGENT APIS

The negotiation environment provides a core set of abstractive behaviors (interfaces) for users to implement automated negotiation agent as listed blew:

- Initilize – provides agents with necessary information to initialize itself.
- Get_info – allows an agent to obtain the game information including weight setting, valid set of coalitions, the current stage and round, and players's role-name, and so on.
- Receive_signal & Receive_proposal – allows for an agent to receive the signals in dialog box including conversations and emotions of other players, and the latter API is to receive a proposal including coalition members and allocation of resources.
- Send_proposal & Send_signal – allows an agent to send a proposal generated by its negotiation strategy; the latter is to send an argumentation suggested by its signal strategy.
- Send_response – allows an agent to respond to the proposal offered by other player.

Once complied successfully, the user can easily upload its new agent (i.e., a java class file) to ONECG via GUI.

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