Designing expressive languages for specifying strategic abilities in multi-agent systems

Mots-clés

Multi-agent systems, strategic reasoning, logic, expressivity.

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Lieu du stage

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Description du stage

A multi-agent system is an abstraction of a system made up of several autonomous entities (robots, programs, etc.) called agents. A strategy for an agent determines the actions the agent will take at any stage according to the goal she targets (or equivalently the property she wants to enforce) and her knowledge about the situation.

The dedicated literature displays a great amount of works on (logical) languages for strategic reasoning, each of them equipped with quantifiers over strategies, see [AHK2002, CHP2010, PR2007] to cite a few.

These approaches more or less address the following features:
1) Joint strategies/coalition. Groups of agents (a coalition) can play a joint strategy in order to enforce a property. In [AHK2002], it is understood that the agents of the group commit to play their respective strategy. However, one may wish to capture more realistic situations where, for instance, some members of the coalition may deviate from the strategy they committed. Such an approach is considered in [PR2005].
2) Imperfect information setting. A strategy should only rely on the agent's knowledge about the current situation. Most proposals of the literature have been adapted to this more intricate setting.
3) Information about the strategies of others. A typical example is the widely accepted assumption of rationality: all agents will choose to perform the action with the optimal expected outcome for itself from among all feasible actions, and this is common knowledge. Therefore, it is relevant to understand winning strategies as robust against "what the opponents can do rationally", and not merely "what the opponents can do" as done in most existing approaches. Other information about strategies of others can be considered, see for example [PRIMA2015].

The goal of this internship is to design a logical language such that:
a) all the above-mentioned features can be described in the very language (rather than in the semantics, as usually done),
b) epistemic features can be captured, e.g. of the kind "agent A knows that agent B has committed" or "agent A knows that agent B knows that the strategy played by A satisfies some given property",
c) sentences are written in an intuitive manner,
d) expected characteristics hold, such as decidability, good computational properties, etc.

A starting point would be the Strategy Logic [CHP2010], where strategies are first-order citizens, to be enriched with epistemic features.

This internship will be supervised by François Schwarzentruber.

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