Aggregation of Argumentative Stances

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1. Thesis Summary

When several agents are engaged in a debate, we may wish to aggregate their stances into a global view which represents the consensus of the group. Abstract argumentation [5] provides tools for modelling stances of agents at different levels of abstraction. An abstract argumentation framework is a set of arguments together with a binary attack-relation defined on this set. By indicating for every pair of arguments that is being considered in a debate whether the first attacks the second, an abstract argumentation framework can be used to model an agent's argumentative stance. By identifying for every argument whether it is acceptable under the same abstract argumentation framework, an agent's stance can be represented by a set of arguments. Similar question has received attention from authors in the past decade or so (see, e.g., [1, 4, 8, 9]).

In my thesis, I investigate the problem of aggregation of argumentative stances at two levels. At the first level, I analyse in what circumstance the semantic properties agreed by the individuals will be preserved under aggregation. At this level, we make use of recent results in graph aggregation [6]. At the second level, I analyse the scenario of extension aggregation, i.e., a group of agents who each take an individual view on the merits of an extension, and we aggregate such extensions. At this level, we make use of known results in judgment aggregation [7].

At both levels, we are interested in the aggregation of individual points of view in the context of abstract argumentation. Even though the techniques are different, the preservation results are similar. At both levels, some properties are easy to preserve, such as conflict-freeness. Enforcing the preservation of some properties leads to rules that are unacceptable from an axiomatic point of view. This indicates that these properties are too demanding and relaxing the requirements of preservation is necessary.

2. Aggregation of Argumentation Frameworks

At this level, we aggregate argumentation frameworks by aggregating attacks. Every individual framework shares the same set of arguments but disagrees on which attacks are acceptable. We study the problem of aggregation of argumentation frameworks by indicating which attacks between the arguments are in fact acceptable. The attacks are

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used as the individual information to obtain the output framework under aggregation. For example, under the majority rule, only the attacks supported by the majority of agents will appear in the output framework. In the meantime, the semantic properties represent high-level agreements among agents. One example of the semantic properties is a set of arguments being the grounded extension. Given a set of arguments which is the grounded extension of every individual argumentation framework, we want to find out under what circumstance this set of arguments also is the grounded extension of the output argumentation framework.

We analyse in what circumstance the semantic properties agreed by every individual will be preserved under aggregation. At this level, a given semantic property that is supported by the majority of individuals could be violated in the output framework. This is similar to the Condorcet Paradox in the theory of preference aggregation.

We show that some desirable semantic properties can be preserved by desirable rules: every quota rule preserves conflict-freeness; the nomination rule preserves admissibility and stability. In the meantime, some negative results show that only aggregation rules that are clearly unacceptable from an axiomatic point of view (namely, so-called dictatorships) can preserve the most demanding semantic properties: no rule with desirable properties preserves the property of being the grounded extension, argument acceptability under different semantics, or the properties which reduces semantic ambiguity, namely, acyclicity and coherence. See [2] for more details.

3. Aggregation of Alternative Extensions

At the above level, only attacks have been considered during aggregation. But in some scenarios, we may wish to vote on arguments instead of attacks. Agents may disagree on which arguments are acceptable, and they would want to aggregate such arguments directly. In this scenario, every individual confronts with the same argumentation framework and proposes different sets of arguments.

At this level, we aggregate alternative extensions by quota rules under the same argumentation framework. The question we ask is whether certain high-level properties of extensions that all individual agents agree on will be preserved under aggregation. For example, if all agents report extensions that are conflict-free, will the collective extensions returned by the majority rule be conflict-free as well?

We show that for some properties, there are quota rules that guarantee their preservation. For example, a quota rule F_q for n agents with quota q preserves conflict-freeness if and only if $q > \frac{n}{2}$; every quota rule F_q for n agents with a quota $q > \frac{n}{2}$ preserves admissibility for all argumentation frameworks AF with $\mathrm{MaxDef}(AF) \leqslant 1$ in which $\mathrm{MaxDef}(AF)$ is the maximum number of attackers of an argument that itself is the source of an attack. While the preservation of conflict-freeness and admissibility are possible, for the more demanding properties it is impossible to do so in general. More details are available in [3].

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