Towards Ordering Sets of Arguments

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1. Introduction

Formal argumentation [2] describes a family of approaches to modeling rational decision-making through the representation of arguments and their relationships. A particular important approach is that of abstract argumentation [4], which focuses on the representation of arguments and a conflict relation between arguments through modeling this setting as a directed graph. Here, arguments are identified by vertices and an *attack* from one argument to another is represented as a directed edge. This simple model already provides an interesting object of study, see [3] for an overview. Reasoning is usually performed in abstract argumentation by considering *sets of arguments*, i. e., sets of arguments that are jointly acceptable given some formal account of "acceptability". Therefore, this classical approach differentiates between "acceptable" arguments and "rejected" arguments.

In this paper, we take a more general perspective on this issue by considering orders—i. e., partial orders in the most general setting—over sets of arguments. So we want to compare different extensions based on their acceptability and then calculate an order accordingly to this comparison.

2. Motivation

The motivation behind our work is the need of a finer-grained assessment of the acceptability of arguments. The *ranking-based semantics* [1] is a line of work which provides an assessment of arguments more precisely it ranks arguments based on acceptability i. e. if argument a is at least as acceptable as argument b then $a \succeq^{\sigma} b$. There are a lot of different approaches like a ranking with respect to a categoriser function [6] or based on a two-person zero-sum strategic game [5].

However all these semantics only consider the relationships between arguments and do not look at the sets of arguments. So we propose a different type of semantics the *ordering semantics*, which provides a order over sets of arguments i. e. the set of arguments a,b is at least as acceptable as the set of arguments c,d then $\{a,b\} \succeq^{\sigma} \{c,d\}$.

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3. Research Question

The first step to order sets of arguments is to define a function, which can answer the question Is a set of arguments s_1 at least as acceptable as a set of arguments s_2?. The classical semantics already provide a simple way to answer this question: either the set satisfies the semantics or not. So we could define a function like: a set of arguments s_1 is at least as acceptable as a set of arguments s_2 if s_1 satisfies a semantics σ while s_2 does not satisfies the same semantic σ. However this function provides only two different levels i.e. s is satisfies semantics σ or not, and inside these levels we can not differentiate between two sets. So our aim should be to find a way to differentiate two sets on the same level, this is especially relevant when considering two sets of arguments that do not satisfy the classical semantics. With the classical semantics there is no way to differentiate these two sets. It is clear, that not every set of arguments which does not satisfy a specific semantics should be considered acceptable on the same level. Based on these observations we can determine two directions we should tackle in detail when we start from the classical semantics:

1. If a classical semantics gives multiple extensions for an argumentation framework, we can differentiate those with different levels of acceptability .
2. For two sets of arguments that are no extensions wrt. the classical semantics, we can differentiate those with different levels of acceptability.

While comparing sets it can occur, that two sets are not comparable and therefore we can not justify any kind of relationship between these sets. So we can not order every possible set easily we have to keep the incomparable sets in mind if we want to construct any ordering semantics.

One idea to define a ordering semantics is to look at the internal structure of the sets. For example we look at internal attacks so we want to consider a set like $s = \{a,b\}$, where a attacks b.

Example 1. Assume the three sets $s_1 = \{a,b\}$, $s_2 = \{c,d\}$ and $s_3 = \{e,f,g\}$, where c attacks d and e as well as f are attacking g. So s_2 has one internal attack and s_3 has two. If we consider a ordering semantic σ, which only counts the number of internal attacks, we get the following order: $\{a,b\} \succeq^{\sigma} \{c,d\} \succeq^{\sigma} \{e,f,g\}$. So this simple idea already present three different levels of acceptability.

References

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