Enforcement in Argumentation Is a Kind of Update

Pierre Bisquert, Claudette Cayrol,
Florence Dupin de Saint-Cyr, and Marie-Christine Lagasque-Schiex
IRIT – UPS, Toulouse, France
{bisquert,ccayrol,dupin,lagasq}@irit.fr

Abstract. In the literature, enforcement consists in changing an argumentation system in order to force it to accept a given set of arguments. In this paper, we extend this notion by allowing incomplete information about the initial argumentation system. Generalized enforcement is an operation that maps a propositional formula describing a system and a propositional formula that describes a goal, to a new formula describing the possible resulting systems. This is done under some constraints about the allowed changes. We give a set of postulates restraining the class of enforcement operators and provide a representation theorem linking them to a family of proximity relations on argumentation systems.

Keywords: dynamics in argumentation, belief change.

1 Introduction

During a trial, a lawyer makes her final address to the judge; the lawyer of the opposite party, say O, is able to build the argumentation system (a graph containing arguments and attacks relation between them) corresponding to this pleading. O is also able to compute all the arguments that are accepted according to the pleading, i.e., the set of consensual arguments. Suppose now that O wants to force the audience to accept another set of arguments. She has to make a change to the argumentation system, either by adding an argument or by making an objection about an argument (to remove it) in order to achieve this goal. In the literature, the operation to perform on an argumentation system in order to ensure that a given set of arguments is accepted given a set of authorized changes is called “enforcement” [3].

This enforcement may be done more or less easily, since it may involve more or less changes (costs to add/remove arguments may be introduced). The aim of the speaker will be to find the least expensive changes to make to the argumentation system.

The previous example is a particular case of a more general enforcement operator. Since we could consider cases where Agent O does not know exactly the argumentation system on which she must make a change but knows only some information about it (e.g. some arguments that are accepted or that are present in the system). In this more general case, the idea is to ensure that the argumentation system after change satisfies a given goal whatever the initial system is. The result of enforcement will give a characterization of the set of argumentation systems that could be obtained (taking into account a set of authorized changes).

The key idea developed in this paper is the parallel between belief update theory [19,16] and enforcement in argumentation. Enforcement consists in searching for the
argumentation systems that are closest to a given starting argumentation system, in a set of argumentation systems in which some target arguments are accepted. This gives us the parallel with preorders on worlds in belief update. Hence worlds correspond to argumentation systems while formulas should represent knowledge about these argumentation systems. In classical enforcement this knowledge is expressed in terms of a description of an initial argumentation system and a set of arguments that one wants to see accepted. This is why we propose to introduce a propositional language in which this kind of information may be expressed. This language enables us to generalize enforcement with a broader expressiveness.

Our paper is situated in the growing domain of dynamics of argumentation systems [8,7,9,18,17] which covers both addition and removal of arguments or interactions. It is organized as follows. We first restate abstract argumentation theory. Then we present a framework that illustrates a particular case of change in argumentation, it concerns an agent that wants to act on a given target system, this agent has a given goal and her possible actions are limited. We then recall classical enforcement. In the third section we propose a generalization of classical enforcement. Finally, we do a parallel with belief update. As classical update postulates do not allow to deal with restrictions about the authorized changes, we had to introduce a new set of postulates that characterizes generalized enforcement. All the proofs can be found in [4].

2 Framework

2.1 Abstract Argumentation

Let us consider a set $\text{Arg}$ of symbols (denoted by lower case letters) representing a set of arguments and a relation $\text{Rel}$ on $\text{Arg} \times \text{Arg}$. The pair $\langle \text{Arg}, \text{Rel} \rangle$, called universe, allows us to represent the set of possible arguments together with their interactions. More precisely, $\text{Arg}$ represents a maybe infinite set of arguments usable in a given domain (e.g. if the domain is a knowledge base then $\text{Arg}$ and $\text{Rel}$ are the set of all arguments and interactions that may be built from the formulas of the base). We can also, as in the following example borrowed from [5], assume that $\text{Arg}$ and $\text{Rel}$ are explicitly provided.

Example 1. During a trial concerning a defendant (Mr. X), several arguments can be involved to determine his guilt. This set of arguments i.e., the set $\text{Arg}$ and the relation $\text{Rel}$ are given below.

| $x_0$ | Mr. X is not guilty of premeditated murder of Mrs. X, his wife. |
| $x_1$ | Mr. X is guilty of premeditated murder of Mrs. X. |
| $x_2$ | The defendant has an alibi, his business associate has solemnly sworn that he met him at the time of the murder. |

[1] In real life, lawyers may be confronted to tougher problems than the one presented here. Namely objection should often be done before an argument is fully laid out in order to stop the jury forming an impression. Unfortunately, this side of real life argumentation is not yet handled in our proposal.