Towards a Better Understanding of Critiques about Ancient Texts using Argumentation

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Abstract. Ancient texts are interpreted by critics in order to assign them a given semantics. However, the semantics to be associated to these texts is not unique and different critics may have different conflicting opinions about their "correct" interpretation. In this paper, we propose to adopt argumentation theory, a technique to manage conflicting information, together with Semantic Web languages and techniques to provide an overall view of such conflicting critiques, detect what are the different competing viewpoints and what are the strongest arguments emerging from the debate. An ontology for argumentative documents is used to annotate ancient texts, and an example of such annotation is provided about the topic of the *Eternity of the species in Aristotle*.

1 Introduction

Ancient texts are subject to different interpretations depending on the historical context of the text, the personal interpretation of the critic writing the critique, and the literal sense that is associated to the sentences composing the text. In general, apart from the ecdotic aspects (that is textual criticism), the primary goal of a critique is to ascertain the text's primitive or original meaning in its literal sense and its original historical context. In order to have a better understanding of the ancient text and the associated critiques, the following methodologies have been proposed in the literature:

Genre critique : the literary form of the text is analyzed with special attention to genre requirements and tradition (e.g., prose vs verse, letters, epics, dialog, scientific text, etc.);

Source critique : the search for intertextuality, especially directed to the sources which lie behind a canonical text or compilation literature, such as encyclopedias;

Cultural critique : the study of the historical, social, and intellectual context of the text, used to reconstruct the cultural issues at stake and the historical meaning of the work;

These forms of criticism can be adopted or combined to have a clearer understanding of an ancient text, but one step that is missing is *how to deal with situations where different critics have viewpoints that are in contrast with each*

other? This is the research question we address in this paper, with the aim to detect which critiques could be considered compatible with others and to let emerge competing viewpoints. More precisely, we propose to adopt argumentation theory, a reasoning technique designed to infer non conflicting conclusions starting from a set of heterogeneous possibly conflicting arguments. Our proposal consists in merging argumentation theory as reasoning engine and Semantic Web languages and techniques to represent such data and extract further interesting information.

The combination of these two techniques can actually help in having a better comprehension of a set of critiques from different sources, supporting in such a way an informed choice about the kind of interpretation we aim to back up or to adopt (e.g., in a learning scenario, the fact of providing a clear overall view of a set of different critiques about a specific ancient text can support students in constructing a better grasp of such a text).

The reminder of the paper is as follows: the overall framework we are in introducing is presented in Section 2, and then some conclusions are drawn together with a comparison with the related work.

2   The proposed framework

An abstract argumentation framework [4] aims at representing conflicts among elements called *arguments* through a binary *attack* relation. It allows to reason about these conflicts in order to detect, starting by a set of arguments and the conflicts among them, which are the so called *accepted arguments*. The accepted arguments are those arguments which are considered as believable by an external evaluator, who has a full knowledge of the argumentation framework. A Dung-style framework is based on a binary *attack* relation among arguments, whose role is determined only by their relation to other arguments.

Dung [4] presents several acceptability semantics that produce zero, one, or several sets of accepted arguments. The set of accepted arguments of an argumentation framework consists of a set of arguments that does not contain an argument attacking another argument in the set. Roughly, an argument is *accepted* if all the arguments attacking it are rejected, and it is *rejected* if it has at least an argument attacking it which is accepted. In Figure 1.a, an example of abstract argumentation framework is shown. The arguments are visualized as circles, and the attack relation is visualized as edges in the graph. Grey arguments are the accepted ones. We have that argument a attacks argument b, and argument b attacks argument c. Using Dung's acceptability semantics [4], the set of accepted arguments of this argumentation framework is $\{a, c\}$. The need of introducing also a positive relation among the arguments, i.e., a *support* relation, leads to the emergence of the so called *bipolar* argumentation frameworks [3]. An example of bipolar argumentation framework is visualized in Figure 1.b where the dashed edge represents the support relation.

Our idea consists in *i)* exploiting argumentation to provide an overall view of the set of critiques about an ancient text, and *ii)* to provide a semantic machine
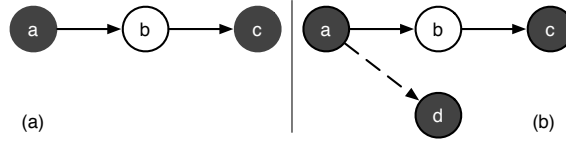
Fig. 1. Example of (a) an abstract argumentation framework, and (b) a bipolar argumentation framework.

readable representation of such argumentative set of possibly conflicting critiques. In order to address the former step, we adopt bipolar abstract argumentation theory such that two possible relations among the critiques are highlighted, i.e., a positive support relation, and a negative conflict relation. Concerning the second step, in order to not introduce yet another argumentation vocabulary, we reuse the SIOC Argumentation module [5], focused on the fine-grained representation of discussions and argumentations in online communities.[1] The SIOC Argumentation model is grounded on DILIGENT [2] and IBIS[2] models. More precisely, we adopt the extension proposed by Cabrio et al. [1] of the SIOC Argumentation vocabulary where two new properties `sioc_arg:challengesArg` and `sioc_arg:supportsArg` whose range and domain are `sioc_arg:Argument`. These properties represent challenges and supports from arguments to arguments, as required in abstract argumentation theory.[3] This needs to be done since in SIOC Argumentation challenges and supports are addressed from arguments towards `sioc_arg:Statement` only.

The following example shows a real instance of ancient text, i.e., *the eternity of the species in Aristotle*, how it is annotated using argumentation theory, and what are the winning arguments we detect.

Example 1. Consider the following five arguments proposed by the critiques about Aristotelian interpretation of the eternity of the species:

Argument 1 : The biological species are eternal.
This argument relies on the following assumptions taken out of the Aristotelian works:
   - The general Aristotelian conception is that the world is eternal and uncreated, and so are the parts of the world, either in number or in another way.
   - A form, consisting logically in the prior cause of everything, can neither be created nor destroyed.
   - The species although not being eternal in number are eternal in form.
   - Through generation each organism is reproduced one in form and replicates the same form it has received.
   - The final cause of animal is to obtain eternity through reproduction.
   - Any kind of generation presupposes the preexistence of a form that has to be transmitted, and this form is transcendent to the individuals.

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[1] For an overview of the argumentation models in the Social Semantic Web, see [6].
[2] `http://purl.org/ibis`
[3] The extended vocabulary can be downloaded at `http://bit.ly/SIOC_Argumentation`

- Even without being fathered (in spontaneous generation) creatures display the form of a regular species.

Argument 2 : The species are not eternal.

This argument relies on the following assumptions:
- The existence of the form characteristic of members of a kind is contingent on members of that species.
- The form is not fixed since the individuals constantly differs, because the form (given by the male) has to struggle with the matter-principle, which is the contribution of the female, and it often turns out that the movements of the male are dominated and the form damaged and altered by the power of the matter-principle.
- Hybrids are fertile, and the offspring has necessarily a form ; yet they are produced by individuals of different species.
- The species is not a universal type, but a series of historical individuals which are the same in form.

Argument 3 : The species do not exist at all as entities or *ousiai*.

This argument relies on the following assumptions:
- Aristotle never gives a definition of an animal, whereas definition is an ontological requirement for all substances (*ousiai*).
- He uses always the word *eidos* (form/species) relative to something else (and not independently).
- An animal *eidos* is not a substance (*ousia*) according to the definition provided by Aristotle in *Posterior Analytics*, where he states that it should have predicates ranked in correct order (which is impossible in the case of animal, the predicate being simultaneously coordinate and not strictly subordinate).
- The animal *ousia* in the biological realm is the concrete individual animal.

Argument 4 : Aristotelian zoology tolerates evolutionary mechanisms.

This argument relies on the following assumptions:
- As Aristotle puts it, new kinds arise from fertile hybrids.
- Continuance of species does not entail fixity.
- Individuals are generated in an approximation to a "form" of that species but never reach the perfect form of a species.
- There are dualizing organisms such as seals, bats, ostriches, ...
- The offspring offers many differences with its parent.

Argument 5 : In the conceptual frame of Aristotelian biology, the species are fixed.

This argument relies on the following assumptions:
- The species exists as such only if it has a hereditary form (*genos*).
- The theory of form and formal cause entails that the species coincide with a fixed pattern.
- The only reason (or formal cause) of generation is the replication of a form granting living creatures existence.
- If species were not fixed there would be no possible science of living creatures, since science requires permanency and only deals with firm realities.

These arguments are annotated as follows using the extended SIOC-Argumentation vocabulary, where due to space constraints we show only two assumptions for each of the two main arguments of the example:

```
<http://example.org/aristotle/arg1> a sioc_arg:Argument ;
                sioc:content "The species are eternal." ;
                sioc_arg:challengesArg <http://example.org/aristotle/arg2> .
```

```
<http://example.org/aristotle/arg2> a sioc_arg:Argument ;
                    sioc:content "The species are not eternal." ;
                    sioc_arg:challengesArg <http://example.org/aristotle/arg1> .

<http://example.org/aristotle/stat1arg1> a sioc_arg:Statement ;
                    sioc_arg:argues_on <http://example.org/aristotle/arg1> ;
                    sioc:content "The general Aristotelian conception is that the
                    world is eternal and uncreated, and so are the parts of the
                    world, either in number or in another way." .

<http://example.org/aristotle/stat1arg2> a sioc_arg:Statement ;
                    sioc_arg:argues_on <http://example.org/aristotle/arg2> ;
                    sioc:content "The existence of the form characteristic of
                    members of a kind is contingent on members of that species." .
```

More precisely, the arguments (i.e., the general claims that are raised) are expressed as `sioc_arg:Argument`, and the statements (i.e., the statements on which the argument is built) are expressed as `sioc_arg:Statement`. Statements are linked to their related arguments by the property `sioc_arg:argues_on`. The advantage of using RDF is that the stored information can then be queried using SPARQL to retrieve further insightful information from the available data. Finally, Figure 2 shows how the arguments are linked to each other by support and conflict relations. Using acceptability semantics, we have that different set of arguments can be accepted together, i.e., either $\{A_1, A_3, A_5\}$ or $\{A_2, A_3, A_4\}$.
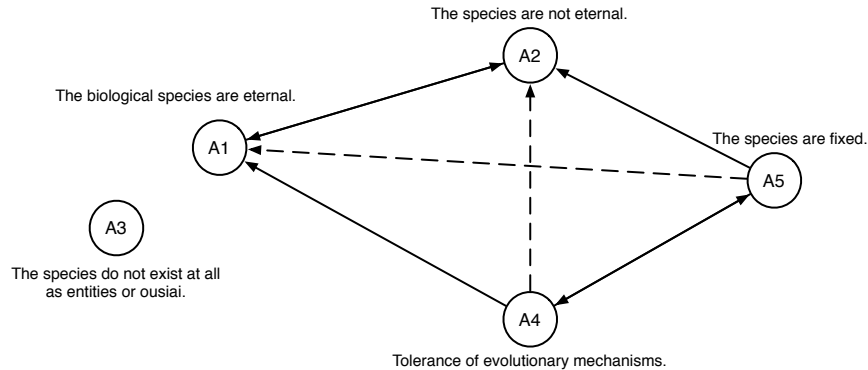

Fig. 2. The complete bipolar argumentation framework resulting from the arguments proposed in Example 1.

Note that an argumentation model where only "challenges" and "supports" are used to represent the relations among the arguments is not sufficient to handle a fine-grained analysis of metaphysical controversies. An example is provided in Figure 2 where argument A_3 is not linked with any of the other arguments because its relation with them cannot be casted in an attack/support relation. For this reason, we plan to consider more complex argumentation structures, namely *argumentation schemes*, to capture finer grained argument patterns in controversies.

3 Conclusions

In this paper, we have proposed a framework to have a better understanding of the critiques about an ancient text by combining argumentation theory and Semantic Web languages and techniques. There are few works with purposes similar to our one. Note that the problem here is that what we call an ancient text is a set of several works (*Posterior Analytics*, *On Generation of Animals*, *Metaphysics* ...). One of them has been proposed by Vasilopoulou-Spitha and Bikakis [7]. They propose to use argumentation as a tool for the natural representation of claims about cultural artifacts and the arguments they are associated with. This point is shared with our present work. On the other side, they propose to extend ontology-based models like CIDOC-CRM to integrate information about the sources of cultural information (e.g. bibliographic data) enabling users to assess the validity of this information. So, the goal of the two papers is different even if similar, and the adopted methodology differs as well.

There are several open issues to be addressed. First of all, we are currently annotating a dataset of argumentative critiques using the extended SIOC-Argumentation ontology, so that we can use query languages like SPARQL to retrieve further interesting information. Second, we will apply our approach to learning scenarios, where the argumentation graphs of the critiques are used to detect the winning opinions and analyse them, improving their comprehension by students. This methodology could be applied also to internal controversies displayed in ancient texts (such as the question debated by Aristotle in *On Respiration* wether fish breath or not, with conflicting arguments). Third, we need to adopt natural language processing techniques to automatically extract such arguments from texts and to detect the relations among them, starting from the approach presented in [1] and adapting it to such a kind of specific texts.

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