

# The “Games of Argumentation” Web Platform

Pietro BARONI<sup>a</sup>, Serena BORSATO<sup>a,b</sup>, Antonio RAGO<sup>b,1</sup> and Francesca TONI<sup>b</sup>

<sup>a</sup>*Dip. Ingegneria dell’Informazione, University of Brescia, Italy*

<sup>b</sup>*Dept. of Computing, Imperial College London*

**Abstract.** This demo presents the web system “Games of Argumentation”, which allows users to build argumentation graphs and examine them in a game-theoretical manner using up to three different evaluation techniques. The concurrent evaluations of arguments using different techniques, which may be qualitative or quantitative, provides a significant aid to users in both understanding game-theoretical argumentation semantics and pinpointing their differences from alternative semantics, traditional or otherwise, to differentiate between them.

**Keywords.** abstract argumentation, game theory, argument strength

Game-theoretical argumentation was first introduced in [7] as a method for evaluating the dialectical strength of arguments in an abstract argumentation framework [5] in the context of an idealised game between two players, namely a proponent and an opponent. This work was extended in [2] by introducing *Abstract Games of Argumentation Strategy* which generalise the original proposal by allowing different frameworks, e.g. *Bipolar Argumentation Frameworks* [4] or *Support Argumentation Frameworks* [1] and considering a variety of evaluation methods. In particular two variants of the game (symmetrical and asymmetrical) have been identified. A *symmetrical* game corresponds to head-to-head style debates where both players have to obey the same constraints, in particular both have to propose a conflict-free set of arguments, whereas an *asymmetrical* game corresponds to a town hall style meeting, where a proponent defends her argument(s) against the opponent’s set of arguments which need not be coherent.

The differences between alternative notions of strength make them suitable for different application contexts and call for a tool which supports the analysis and comparison of their behavior. This motivated the development of the “Games of Argumentation” Web Platform.

The system architecture is divided into a front-end and a back-end. Through the front-end (see Fig. 1), an abstract representation of a debate or discussion can be created in the form of a bipolar argumentation framework (BAF), in which nodes represent arguments and coloured edges link the nodes and specify the relation type, i.e. attack or support, between them. A framework can be created using the GUI, by editing a textual description based on a specific syntax, or by file upload.

In the bottom part of the GUI the user can select two game-theoretical semantics and a traditional abstract argumentation semantics to be evaluated and compared in the current framework. The available variants of game-theoretical semantics correspond to

<sup>1</sup>Corresponding Author: a.rago15@imperial.ac.uk

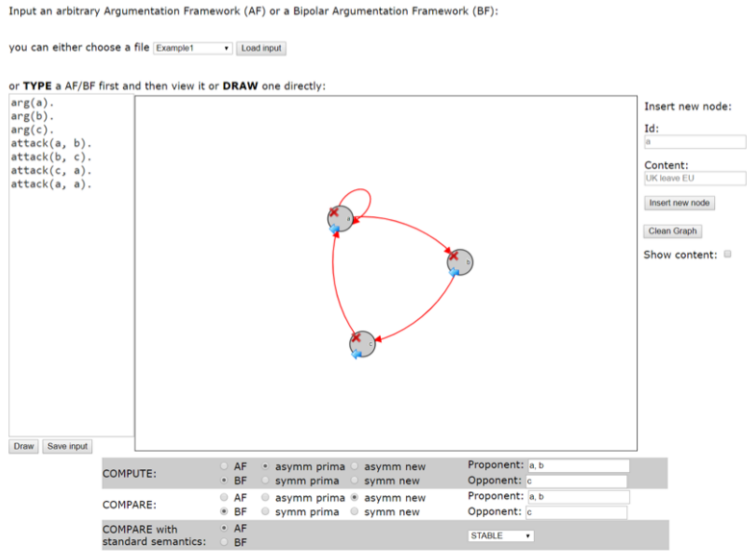


Figure 1. Games of Argumentation GUI

those presented in [2] plus a recent novel definition bridging game theoretical evaluation with the concept of stable semantics [3]. On the traditional side, admissible, stable, complete and grounded semantics from [5] are available.

The user request is sent to the back-end which computes the evaluation outcomes for the selected semantics and returns them back to the front-end. For game-theoretical semantics the argument strengths are obtained as solutions of a linear programming problem and then displayed as a numerical value near the arguments in the GUI. For the traditional semantics the Aspartix solver [6] is invoked and the (credulously) accepted arguments are then displayed as a list and highlighted in green in the GUI.

References

[1] Leila Amgoud and Jonathan Ben-Naim. Evaluation of arguments from support relations: Axioms and semantics. In *Proceedings of the 25th Int. Joint Conf. on Art. Int., IJCAI 2016*. AAAI Press, 2016.

[2] Pietro Baroni, Giulia Comini, Antonio Rago, and Francesca Toni. Abstract Games of Argumentation Strategy and Game-Theoretical Argument Strength. In *Proc. of the 20th Int. Conf. on Principles and Practice of Multi-Agent Systems (PRIMA 2017)*, pages 403–419, 2017.

[3] Serena Borsato. Study and experimentation of innovative methods for quantitative evaluation of argument strength. Master’s thesis, University of Brescia, 2018.

[4] Claudette Cayrol and Marie-Christine Lagasquie-Schiex. Bipolar abstract argumentation systems. In Guillermo Simari and Iyad Rahwan, editors, *Argumentation in Artificial Intelligence*, pages 65–84. Springer US, 2009.

[5] Phan Minh Dung. On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. *Artificial Intelligence*, 77(2):321–358, 1995.

[6] Uwe Egly, Sarah Alice Gaggl, and Stefan Woltran. Answer-set programming encodings for argumentation frameworks. *Argument and Computation*, 1(2):147–177, 2010.

[7] Paul-Amaury Matt and Francesca Toni. A game-theoretic measure of argument strength for abstract argumentation. In *Proc. of the 11th European Conf. on Logics in Artificial Intelligence (JELIA 2008)*, pages 285–297. Springer, 2008.