

Ph.D. research topic

- Title of the proposed topic: **Argument Quality Assessment and Improvement**
 - Research axis of the 3iA: Axis 1
 - **Supervisor (name, affiliation, email): Serena Villata (CNRS), villata@i3s.unice.fr**
 - Co-supervisor (name, affiliation): Elena Cabrio (UCA), elena.cabrio@univ-cotedazur.fr
 - The laboratory and/or research group: WIMMICS teams (Université Côte d'Azur, CNRS, Inria). . The research fields of the team are graph-oriented knowledge representation, reasoning and operationalization to model and support actors, actions and interactions in web-based epistemic communities.
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Apply by sending an email directly to the supervisor and the co-supervisor.

The application will include:

- **Letter of recommendation of the supervisor indicated above**
 - Curriculum vitæ.
 - Motivation Letter.
 - Academic transcripts of a master's degree(s) or equivalent.
 - At least, one letter of recommendation.
 - Internship report, if possible.
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Context and research challenges

Argumentation pervades human intelligent behavior, and it is a mandatory element to conceive artificial machines that can exploit argumentation models and tools in the cognitive tasks they are required to carry out. The field of artificial argumentation [1] plays an important role in AI. The reason for this is based on the recognition that if we are to develop robust intelligent machines able to act in mixed human-machine teams, then it is imperative that they can handle incomplete and inconsistent information in a way that somehow emulates the way humans tackle such a complex task. To do so, artificial argumentation combines formal argumentation, based on critical reasoning, with human natural argumentation extracted through argument mining methods.

Argument(at)ion mining (AM) [2] is the research field in artificial argumentation aiming at automatically processing natural language arguments and reason upon them. It aims at extracting natural language arguments and their relations from text, with the final goal of providing machine-processable structured data for computational models of argument.

Roughly, each argument is a set of premises or assumptions that, together with a claim, is obtained by a reasoning process. The overall goal of argumentation is to increase or decrease the acceptability of claims by supporting or attacking them with new arguments.

The PhD topic is structured around two main challenges:

1. Assessing argument quality, i.e., how do we recognize good and bad arguments? What is the role of context in argument quality assessment?
2. Generating improved arguments, i.e., what makes an argument better?

Despite a few existing approaches [3, 4, 5, 6], the issue of automatically assessing the quality of an argumentation remains largely unexplored. On the one side, it consists in assessing the quality of the mined arguments to decide, for instance, whether a certain argument has to be selected for synthesising a debate, or whether the overall debate is of good quality or not. On the other side, it consists in ensuring that the generated arguments satisfy the defined quality criteria in order to assess them from the qualitative point of view, i.e., a counter-argument to attack a fake news needs to be concise and without repetitions. The quality of the arguments is also characterized by formal properties of the framework, e.g., the argument strength, argument preferences, and argument acceptability.

First, the PhD will focus on the three standard dimensions to characterize arguments' quality, i.e., *cogency* (an argument should be seen as cogent if it has individually acceptable premises that are relevant to the argument's conclusion and that are sufficient to draw the conclusion), *effectiveness* (an argumentation should be seen as effective if it persuades the audience of the author's stance on the discussed issue), and *reasonableness* (an argumentation should be seen as reasonable if it contributes to the resolution of the given issue in a sufficient way that is acceptable to everyone from the expected target audience). The idea is to employ a transformer-based neural classifier with an attention mechanism like Longformer and to empower it with graph embeddings representing the argumentation graphs in the training corpus (e.g., political debates or clinical evidences). These node-level features will be used to create graph level statistics useful for the reasonableness dimension in particular. The second objective of the PhD will be to generate improved arguments from those of bad quality we retrieved. The goal of this PhD program is to tackle these research challenges with a specific focus on the application scenario of political debates.

Expected skills

The candidate should be a Master student in a AI, NLP and/or Machine Learning program, with a strong background in computer science and mathematics. Programming skills are required. Fluent English required, both oral and written. French is appreciated but not mandatory.

References

[1] Katie Atkinson, Pietro Baroni, Massimiliano Giacomin, Anthony Hunter, Henry Prakken, Chris Reed, Guillermo Ricardo Simari, Matthias Thimm, Serena Villata: Towards Artificial Argumentation. *AI Mag.* 38(3): 25-36 (2017).

[2] Elena Cabrio, Serena Villata. Five Years of Argument Mining: a Data-driven Analysis. Proceedings of 27th International Joint Conference on Artificial Intelligence (IJCAI 2018), pages 5427-5433.

[3] Henning Wachsmuth, Nona Naderi, Ivan Habernal, Yufang Hou, Graeme Hirst, Iryna Gurevych, and Benno Stein. Argumentation quality assessment: Theory vs. practice. In Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics (Volume 2: Short Papers), pages 250–255, Vancouver, Canada, July 2017.

[4] Edwin D. Simpson and Iryna Gurevych. Finding convincing arguments using scalable bayesian preference learning. *Trans. Assoc. Comput. Linguistics*, 6:357–371, 2018.

[5] Martin Gleize, Eyal Shnarch, Leshem Choshen, Lena Dankin, Guy Moshkovich, Ranit Aharonov, and Noam Slonim. Are you convinced? choosing the more convincing evidence with a Siamese network. In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, pages 967–976, Florence, Italy, July 2019.

[6] Assaf Toledo, Shai Gretz, Edo Cohen-Karlik, Roni Friedman, Elad Venezian, Dan Lahav, Michal Jacovi, Ranit Aharonov, and Noam Slonim. Automatic argument quality assessment - new datasets and methods. In Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP), pages 5625–5635, Hong Kong, China, November 2019.