

A brief introduction to argument(ation) mining



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Argument(ation) mining – a brief history

- **Argumentation and rhetoric**
 - Dates back to Aristotle's books „Rhetoric“, 4th century BC
- **Computational models of argumentation (non-NLP)**
 - Since the 1990's, Dung's abstract framework and its followers
- **Argumentation in NLP**
 - Teufel, 1999 – argument zoning in research articles
 - „Argumentation Mining“
 - Coined first by Mochales and Moens, 2011
 - First workshop on argumentation mining – ACL14, Baltimore

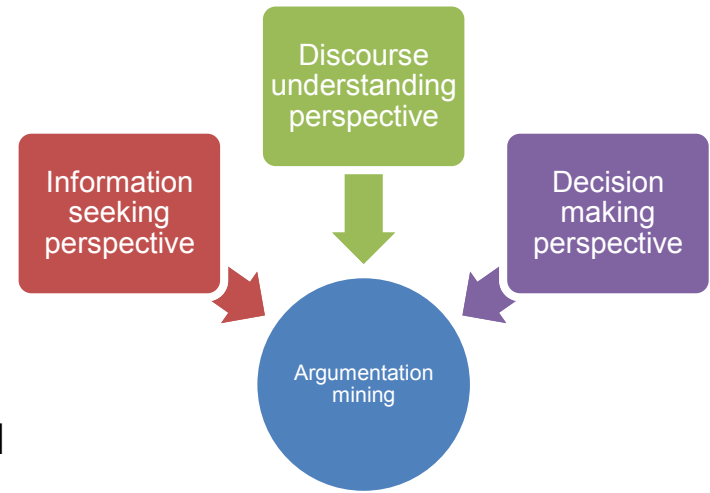
Dung, P. M. (1995). On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. *Artificial Intelligence*, 77(2), 321–357. doi:10.1016/0004-3702(94)00041-X

Teufel, S. (1999). *Argumentative Zoning: Information Extraction from Scientific Text*. PhD Thesis, University of Edinburgh.

Mochales, R., & Moens, M.-F. (2011). Argumentation mining. *Artificial Intelligence and Law*, 19(1), 1–22. doi:10.1007/s10506-010-9104-x

The big picture – why is it important?

- „Mining“ arguments = ability to find, analyze, and assess arguments on **large scale**
 - Cognitive human task doesn't scale
 - Computational methods can process heterogeneous sources and big data
- Analyzing complex lines of argumentation helps in **decision making**
 - For example, complex argument „maps“ from natural language texts [1]
- „**My-side bias**“ in lay argumentation
 - Finding contrasting viewpoints
 - *„We get trapped in a "filter bubble" and don't get exposed to information that could challenge or broaden our worldview.“* [2]

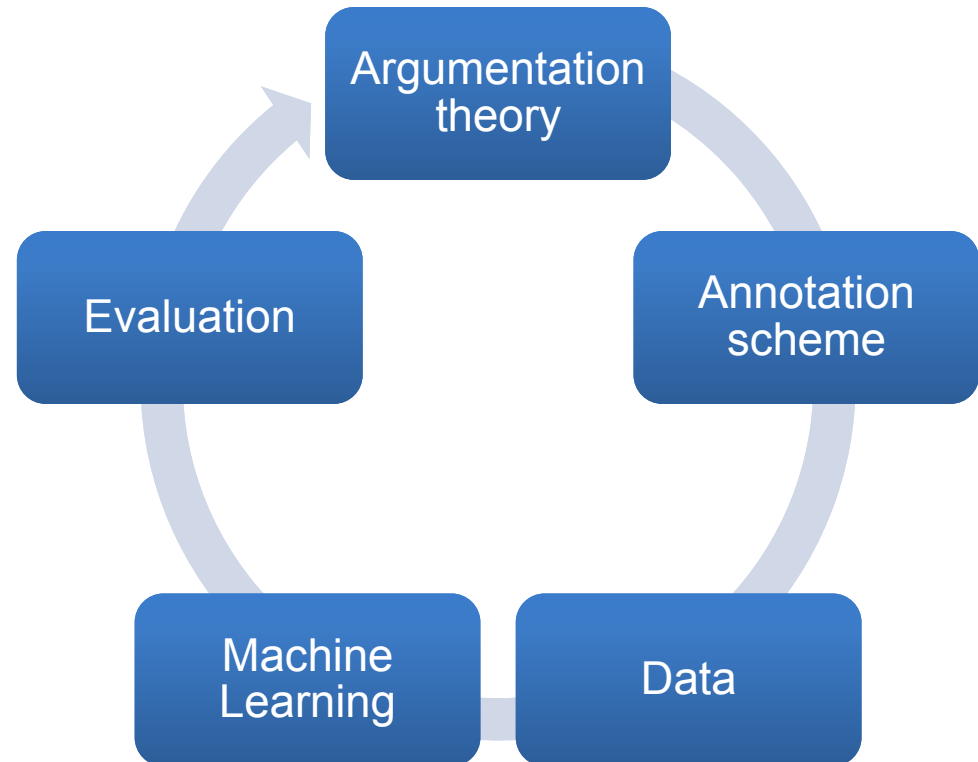


[1] <http://www.argunet.org/2014/08/21/argument-maps-for-debate-moderation/>

[2] http://www.ted.com/talks/eli_pariser_beware_online_filter_bubbles

What is the focus or argument(ation) mining?

- From theoretical research in argumentation to **NLP applications**
- Combination of
 - **Theoretical foundations**
 - Argumentation models (Ed Hovy's talk earlier today)
 - **Empirical observations**
 - How the theories work for data at hand
 - **Computational approaches**
 - Supervised machine learning with hand-crafted features



Argument(ation) models

▪ **Micro-level**

- Walton's schemes
 - Prototypical patterns
- Toulmin's model
 - Various components
- Components and relations
 - Claims, premises and support, attack

▪ And lots of “**design**” decisions

- What are the single units?
- What NOT to annotate?
- Rich structure versus flat annotations?

▪ **Macro-level**

- Dung's abstract framework
 - Graph-based dialogical model
- Pragma-dialectical theory



https://commons.wikimedia.org/wiki/File:Apple_and_Orange_-_they_do_not_compare.jpg CC-BY

Which tasks have been tackled?

▪ Is a document even argumentative?

- Also called “external relevance” by theorists (Paglieri & Castelfranchi, 2014)
- Mostly neglected processing step
- Habernal & Gurevych, 2016: Identifying persuasive on-topic documents in user comments (990 comments and forum posts), IAA Fleiss’ Pi 0.60
 - Resulting distribution: about 50% labeled as persuasive
 - Supervised learning (SVM-SMO): F-measure 0.69 (humans at about 0.85)

Paglieri, F., & Castelfranchi, C. (2014). Trust, relevance, and arguments. *Argument & Computation*, 5(2-3), 216–236.
doi:10.1080/19462166.2014.899270

Habernal, I., & Gurevych, I. (2016). Argumentation Mining in User-Generated Web Discourse. *Computational Linguistics*, revisions pending

Which tasks have been tackled?

▪ Walton schemes family

- Mochales and Moens, 2011: (1) Binary classification of all the propositions of the text as argumentative or non- argumentative - sentences in the *AraucariaDB* corpus (Reed and Rowe 2004), (2) classification as premise or conclusion
- Feng and Hirst, 2011: Assign argument into one of five most common argumentation schemes (*AraucariaDB*)
- Rooney, Wang, and Browne (2012): Does a sentence belong to an argumentative element or not (*AraucariaDB*)

Mochales, R., & Moens, M.-F. (2011). Argumentation mining. *Artificial Intelligence and Law*, 19(1), 1–22. doi:10.1007/s10506-010-9104-x

Feng, V. W., & Hirst, G. (2011). Classifying Arguments by Scheme. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics* (pp. 987–996). Portland, Oregon: Association for Computational Linguistics.

Rooney, N., Wang, H., & Browne, F. (2012). Applying Kernel Methods to Argumentation Mining. In *Proceedings of the Twenty-Fifth International Florida Artificial Intelligence Research Society Conference Applying* (pp. 272–275). Association for the Advancement of Artificial Intelligence.

Which tasks have been tackled?

▪ Claim-premise family

- Biran and Rambow, 2011: Identify justifications for subjective claims in blog threads and Wikipedia talk pages
- Stab and Gurevych, 2014: (1) Classify sentences to four categories (none, major claim, claim, premise), (2) Find relation between sentences (support, attack)
- Park and Cardie, 2014: Classify propositions in user comments into three classes (*verifiable experiential*, *verifiable non-experiential*, and *unverifiable*)
- *...and others*

Stab, C., & Gurevych, I. (2014). Annotating Argument Components and Relations in Persuasive Essays. In Proceedings of COLING 2014, the 25th International Conference on Computational Linguistics: Technical Papers (pp. 1501–1510). Dublin, Ireland: Dublin City University and Association for Computational Linguistics.

Biran, O., & Rambow, O. (2011). Identifying Justifications in Written Dialogs By Classifying Text As Argumentative. *International Journal of Semantic Computing*, 05(04), 363–381. doi:10.1142/S1793351X11001328

Park, J., & Cardie, C. (2014). Identifying Appropriate Support for Propositions in Online User Comments. In Proceedings of the First Workshop on Argumentation Mining (pp. 29–38). Baltimore, Maryland USA: Association for Computational Linguistics.

And more...

- Dialogical argumentation (Cabrio and Villata, 2012)
- Toulmin's model (Habernal and Gurevych, 2015)
- Stance recognition (Hasan and Ng, 2013)
- ...and others

Cabrio, E., & Villata, S. (2012). Natural Language Arguments- A Combined Approach. In L. De Raedt (Ed.), Proceedings of European Conference on Artificial Intelligence ECAI 2012 (Vol. 242, pp. 205–210). IOS Press.

Habernal, I., & Gurevych, I. (2015). Exploiting Debate Portals for Semi-Supervised Argumentation Mining in User-Generated Web Discourse. In Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing (pp. 2127–2137). Lisbon, Portugal: Association for Computational Linguistics.

Hasan, K. S., & Ng, V. (2013). Stance Classification of Ideological Debates - Data , Models , Features , and Constraints. In Proceedings of the Sixth International Joint Conference on Natural Language Processing (pp. 1348–1356). Association for Computational Linguistics.

Analyzing **discourse** on the **pragmatics** level and applying a certain **argumentation theory** to **model** and automatically **analyze** the data at hand

- Discourse = goes beyond sentence
- Pragmatics = considers the function of the language (which corresponds to the particular role in the argumentation model, for instance)
- Argumentation theory = provides the theoretical foundation
- Model = basically our model of the data at hand (be it a flat annotation, a graph, a scheme category, etc.)
- Analyze = computational approaches to mimic human cognition



- Let's debate!
- **Argumentation mining**
 - Analysis of existing discourse
- **Debating technologies**
 - Interactive process including argument generation
- Also related
 - Debating vs. Macro-level argumentation mining?
 - Argumentation **mining** („Any activity that extracts or undermines.”) vs. **analysis** (“Decomposition into components in order to study (a complex thing, concept, theory...)”)?