

Computational Argumentation — Part IV

Applications of Computational Argumentation

Henning Wachsmuth

henningw@upb.de

May 7, 2019



Outline

I. Introduction to computational argumentation

II. Basics of natural language processing

III. Basics of argumentation

IV. Applications of computational argumentation

V. Resources for computational argumentation

VI. Mining of argumentative units

VII. Mining of supporting and objecting units

VIII. Mining of argumentative structure

IX. Assessment of the structure of argumentation

X. Assessment of the reasoning of argumentation

XI. Assessment of the quality of argumentation

XII. Generation of argumentation

XIII. Development of an argument search engine

XIV. Conclusion

- Introduction
- Argument search
- Intelligent personal assistants
- Writing support
- Conclusion

Learning goals

- **Concepts**

- Get an overview of applications of computational argumentation.



<https://commons.wikimedia.org>

- **Methods**

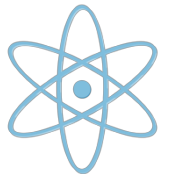
- Get an idea of what works well and what not.
- See "tricks" that can be done in practice.



<https://pixabay.com>

- **Associated research fields**

- Computational linguistics
- Information retrieval



<https://pixabay.com>

- **Within this course**

- Understand what can be done with computational argumentation.



Introduction

Applications of computational argumentation (recap)

Argument search

(Wachsmuth et al., 2017e)



Intelligent personal assistants

(Rinott et al., 2015)



<https://commons.wikimedia.org>

Fact checking

(Samadi et al., 2016)



<https://commons.wikimedia.org>

Argument summarization

(Wang and Ling, 2016)



<https://maxpixel.net>

Automated decision making

(Bench-Capon et al., 2009)



<https://pixabay.com>

Writing support

(Stab, 2017)



<https://www.publicdomainpictures.net>

Argument search

Argument search in academia and industry

- **args.me** (Bauhaus-Universität Weimar, Paderborn University)

- Pro and con arguments on arbitrary issues.
- Indexes *arguments*, and retrieves relevant arguments in response to queries.



- **ArgumenText** (TU Darmstadt)

- Pro and con arguments on arbitrary issues.
- Indexes *web pages*, and mines relevant arguments in response to queries.



- **Bing Multi-Perspective Answers** (Microsoft)

- A pro and a con perspective on selected issues.
- So far, included in US version only, see example here:

blogs.bing.com/search-quality-insights/february-2018/Toward-a-More-Intelligent-Search-Bing-Multi-Perspective-Answers



- **Project Debater** (IBM)

- Actually, a system that debates humans (see below).
- Main tasks very similar to argument search.



Example: args.me



Q abolish the death penalty →

Page 1 of 639 arguments, 326 pro, 313 con (retrieved in 0.4s)

Pro

#1 No execution of the innocent

<http://www.bbc.co.uk> (81 other sources...)

As long as human justice remains fallible, the risk of executing the innocent can never be eliminated.

#2 Everyone has a right to live

<http://www.amnesty.org> (102 other sources...)

Everyone has an inalienable human right to live, even those who commit murder.

#3 Death penalty fails to deter

<http://www.procon.org> (24 other sources...)

There is no scientific proof that executions have a greater deterrent effect than life imprisonment.

Con

#1 Retribution

<http://www.bbc.co.uk> (36 other sources...)

Real justice requires people to suffer for their wrongdoing in a way adequate for the crime.

#2 Death penalty deters

<http://www.debate.org> (15 other sources...)

By executing convicted murderers, would-be murderers are deterred from killing people.

#3 Prevention of re-offending

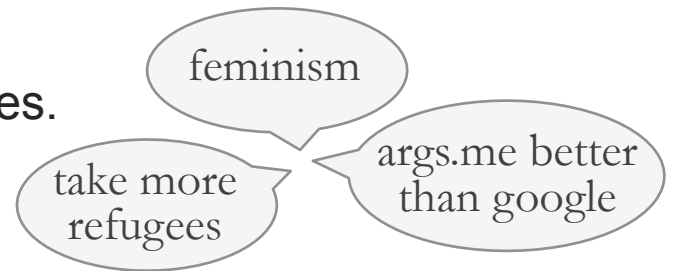
<http://www.bbc.co.uk> (25 other sources...)

Those executed cannot commit further crimes. Imprisonment does not protect sufficiently.

Our vision of argument search

Argument search should...

- Support forming opinions on controversial issues.
- Make it easy to find relevant arguments.
- Not be biased towards either stance.



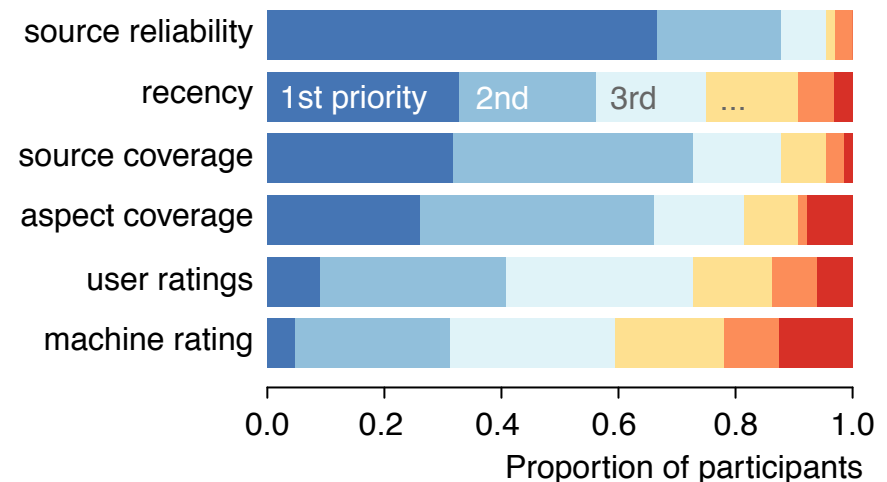
Search results should...

- Rank the *best* arguments highest.
- Cover various reliable sources.
- Cover diverse aspects.
- Be as recent as possible.

... and much more

Our argument search engine...

- Is improvable on all these criteria.
- Currently indexes 300k debate portal arguments.
- Defines a framework to work towards the vision.



Demo: args.me



Q Enter a topic **demo** →

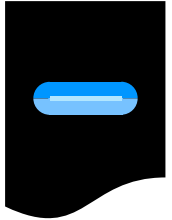
<https://args.me>

Intelligent personal assistants

Example: Project Debater

▪ Project Debater

- A system that can debate humans on arbitrary issues.
- The ultimate goal is to support better and more informed decisions.
- Recently showcased on *intelligence*² against a top human debater.



▪ Intelligence² debates

- Famous TV show where two parties debate against each other.
- **Three stages.** Opening (~4 minutes each), rebuttal (4 min.), closing (2 min.).
- **Goal.** Change stance of audience (which votes before and afterwards).

Additional question in the given debate: Who better enriched your knowledge?

*intelligence*²
THE WORLD OF DEBATE

<https://en.wikipedia.org>

▪ Showcase <https://www.research.ibm.com/artificial-intelligence/project-debater/live/>

- **Issue.** "We should subsidize preschool".
Issue was chosen from curated list, but not trained on.
- **Stances.** Project Debater is **pro**, Harish Natarajan is **con**.
- **Background.** Parties are given 15 minutes for preparation.



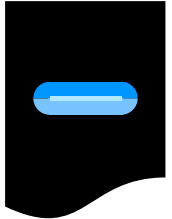
<https://flickr.com>

Project Debater showcase: Opening

▪ Opening Project Debater

- Minutes 11:25 – 15:03 (intro starts at 10:50).
- Observations?

Discussed in the course only.



▪ What is done (during preparation)

- **Input.** ~10B preprocessed, indexed sentences from newspapers and journals.
- Retrieves a few hundred relevant text segments, removes redundancy.
- Selects the strongest segments classified as pro/con claims and evidence.
- Arranges them by clustered themes to create a narrative.
- Phrases full text on this basis, converts to speech.
- **Output.** A four-minutes speech.

▪ Opening Harish Natarajan

- Minutes 15:42 – 19:50 (intro starts at 15:28).
- Observations?

Discussed in the course only.



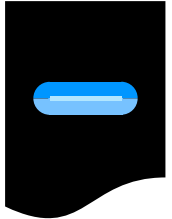
Project Debater showcase: Rebuttal

▪ Rebuttal Project Debater

- Minutes 24:36 – 28:40 (intro starts at 24:22).

- Observations?

Discussed in the course only.



▪ What is done (during break)

- **Input.** Opening speech of Harish Natarajan (and own speech).
- Speech recognition to transcribe speech to text.
- Preprocess text in several standard NLP analyses.
- Mine claims and key concepts from text.
- Construct rebuttal (similar to opening steps).
- **Output.** A four-minutes speech.

▪ Rebuttal Harish Natarajan

- Minutes 28:58 – 33:14 (intro starts at 28:48).

- Observations?

Discussed in the course only.

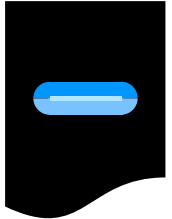


Project Debater showcase: Closing and results

▪ Closing Project Debater

- Minutes 37:44 – 39:35 (intro starts at 37:29).
- Observations?

Discussed in the course only.



▪ Closing Harish Natarajan

- Minutes 39:52 – 42:17 (intro starts at 39:43).
- Observations?

Discussed in the course only.



▪ Results

- Minutes 52:48 – 54:36.
- **Before the debate.** 79% pro, 13% con, 8% undecided.
- **After the debate.** 62% pro, 30% con, 8% undecided.

Knowledge enrichment. ~60% Project Debater, ~20% Harish Natarajan, ~20% undecided.

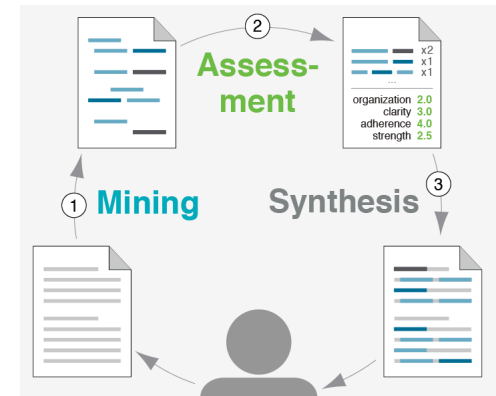
Writing support

Writing support in academia and industry

- **Argumentation-related essay scoring** (Wachsmuth et al., 2016)

- Mine argumentative structure of persuasive essay.
- Assess four argumentation quality dimensions based on the structure (such as organization).

Demo found at: <https://demo.webis.de/essay-scoring>



- **Argumentative writing support** (Stab, 2017)

- Mine argumentative structure of persuasive essay.
- Detect several structure-related flaws.
- Provide feedback on document and paragraph level (such as whether all claims are supported).

Prototype system fully implemented, but not available.

Essay	Feedback	Details
<p>Using animals for the benefit of the human being</p> <p>With the rapid development of the standard of people's life, increasing numbers of animal experiments are done, new medicines and foods, for instance. Some experiments say that it is good for animals and human, however, I believe that unethical research will deny that it is a basically cruel activity to humanity if the final result or medicine are allowed to exist without testing its suitability. In my essay, I will discuss this issue from twofold aspects.</p> <p>First of all, as we all know, animals are friendly and vital for people, because if there are no animals in the world, the balance of nature will break down, and we, human, will do not do well. The animal experiments accelerated the winning of some categories of animals. In other words, doing this various testing is a hazard of human's future and next generation.</p> <p>Through animal experiments have negative impact on the animal themselves, it is necessary to make sure that people can live a long life. To begin with, it is indisputable that every new kind food or drug may be medicine, and medicine that is searching to benefit that the new medicine benefits people instead of making people ill or even dying. The new foods or medicines are necessary to promote the quantity of human's life. Thus even if they are cruel, the current take the place of animals to save the new, based on medicine. Furthermore, it also have potentially harm for human's health without any testing.</p> <p>To sum up, I conclude that although there is some disadvantage of animal people, the results of animal experiments will outweigh the benefits.</p>	<p>✓ This sentence present</p> <p>✓ Introduction of your process</p> <p>✓ The background process</p> <p>✓ This sentence present</p> <p>✓ The sentence are paragraph</p> <p>✓ The sentence are paragraph</p> <p>✓ This sentence is the key sentence</p> <p>✓ Appropriate number of sentence present</p> <p>✓ Appropriate present</p> <p>✓ Appropriate present</p> <p>✓ Appropriate present</p> <p>✓ Appropriate number of sentence present</p> <p>✓ Appropriate number of sentence present</p> <p>✓ Appropriate number of sentence present</p> <p>✓ Appropriate number of sentence present</p>	<p>A claim is a controversial statement that should not be accepted without additional support. An unsupported claim in your essay is a weak point of your argumentation, since it can be easily refuted and questioned by its opponent. In order to make your essay more stronger, you should provide reasons for such claims.</p> <p>The example below illustrates a body paragraph including an unsupported claim (that example). We show that the same paragraph becomes more persuasive after adding previous text that support the claim (good example).</p> <p>Bad example</p> <p>First, following will be beneficial for many people who are in need of organ transplants. (Claim) In the process of producing similar populations of genetically identical individuals that occurs in nature, some experience such as heartless, insane or genius experience occasionally.</p> <p>Good example</p> <p>First, following will be beneficial for many people who are in need of organ transplants. (Claim) organ will reach people in the final stage of their development, after other people will be added. It allows the leading generation.</p> <p>The author of this paragraph wants to highlight the importance of cloning for people who need organ transplants. In the first sentence, we suggest we provide. So after reading the paragraph it is very unlikely that reader understands why cloning is beneficial for people who need organ transplants. In contrast, the good example includes several previous lines support the claim. In the first paragraph, it is a signpost for the reader. Due to the previous reason, the reader can understand why the author claims that who donate claims. Thus, it is highly recommended to include enough reasons or evidence for your claims in the body paragraphs.</p>

- **Augmented writing** (textio flow)

- A system that writes text semi-automatically, using similar previous content and adapting to style.
- Not focused on argumentation, but apparently related.



Demo: textio flow



<https://textio.com/press/>

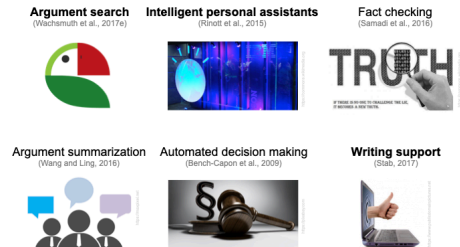
<https://textio.com/products/flow/>

Conclusion

Conclusion

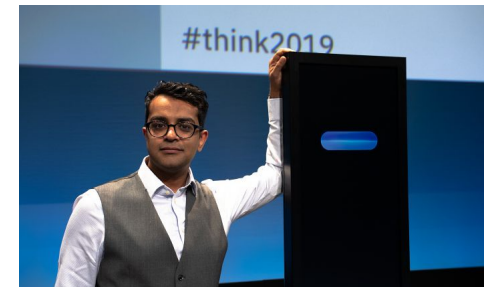
■ Applications of computational argumentation

- Opposition and summarization of arguments.
- Support of opinion formation and decision making.
- Assessment and support of argumentative writing.



■ Exemplary applications from research and academia

- *args.me* opposes pro and con arguments.
- *Project Debater* debates humans.
- *textio flow* semi-automatically writes texts.



■ Capabilities and limitations

- Computational argumentation will never work perfectly.
- Often, tricks make applications practically look fine.
- Still, there's much research to be done.



References

- **Bench-Capon et al. (2009).** Trevor Bench-Capon, Katie Atkinson, and Peter McBurney. Altruism and Agents: An Argumentation Based Approach to Designing Agent Decision Mechanisms. In: Proceedings of The 8th International Conference on Autonomous Agents and Multiagent Systems – Volume 2, pages 1073–1080, 2009.
- **Rinott et al. (2015).** Ruty Rinott, Lena Dankin, Carlos Alzate Perez, M. Mitesh Khapra, Ehud Aharoni, and Noam Slonim. Show Me Your Evidence — An Automatic Method for Context Dependent Evidence Detection. In: Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing, pages 440–450, 2015.
- **Samadi et al. (2016).** Mehdi Samadi, Partha Talukdar, Manuela Veloso, and Manuel Blum. ClaimEval: Integrated and Flexible Framework for Claim Evaluation Using Credibility of Sources. In Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence, pages 222–228, 2016.
- **Stab (2017).** Christian Stab. Argumentative Writing Support by means of Natural Language Processing, Chapter 5. PhD thesis, TU Darmstadt, 2017.
- **Wachsmuth et al. (2016).** Henning Wachsmuth, Khalid Al-Khatib, and Benno Stein. Using Argument Mining to Assess the Argumentation Quality of Essays. In: Proceedings of the 26th International Conference on Computational Linguistics, pages 1680–1692, 2016.
- **Wachsmuth et al. (2017e).** Henning Wachsmuth, Martin Potthast, Khalid Al-Khatib, Yamen Ajjour, Jana Puschmann, Jiani Qu, Jonas Dorsch, Viorel Morari, Janek Bevendorff, and Benno Stein. Building an Argument Search Engine for the Web. In Proceedings of the Fourth Workshop on Argument Mining, pages 49–59, 2017.
- **Wang and Ling (2016).** Lu Wang and Wang Ling. Neural Network-Based Abstract Generation for Opinions and Arguments. In: Proceedings of the 15th Conference of the North American Chapter of the Association for Computational Linguistics, pages 47–57, 2016.