

Tutorial slides cs.upb.de/css > Teaching > Tutorials > Computational Argumentation

EuroCSS 2018, Cologne

Computational Argumentation

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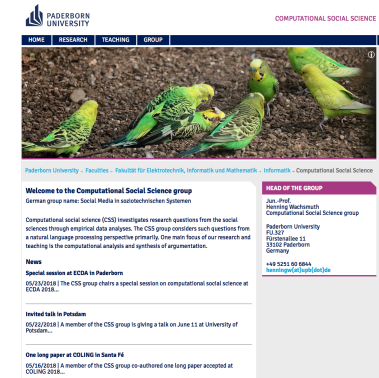
December 5, 2018



People behind the tutorial

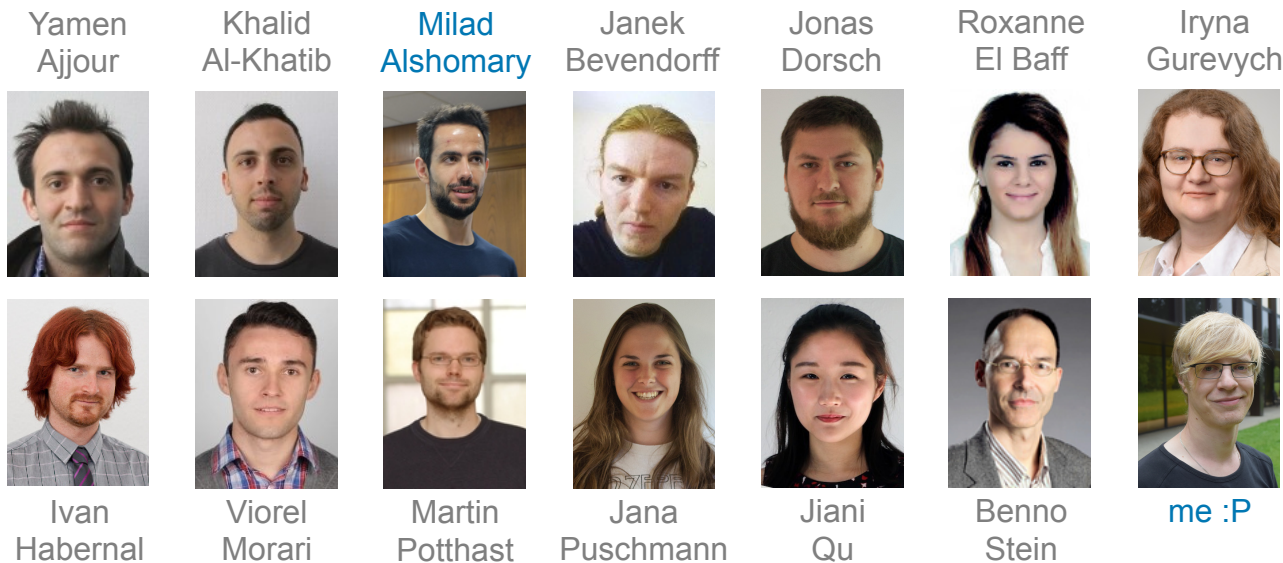
■ Presenter

- 2009 – 2015: PhD student at Paderborn University
Natural language processing
- 2015 – 2018: PostDoc at Bauhaus-Universität Weimar
Computational argumentation
- As of April 1: Junior professor at Paderborn University
Computational social science



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■ The people behind



This tutorial

▪ **Goals**

- Get to know research on computational argumentation
- Learn the basics of considering it in your work



▪ **Focus**

- Analysis of arguments in natural language text
- Arguments in computational social science research



▪ **Elements**

- Overview and in-detail presentations
- Demos, hands-on's, and discussions



Outline

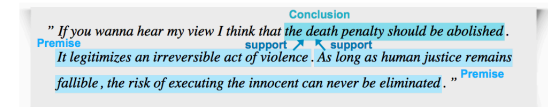
1. Introduction

Argumentation, computational argumentation, applications



2. Argument analysis

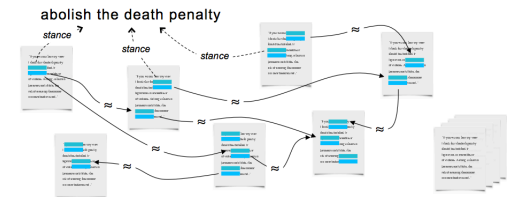
Mining arguments, assessing quality, classifying stance



— coffee break —

3. Arguments in CSS

Ad-hominem, argument relevance, ideology & personality



4. Outlook and conclusion

Beyond arguments, resources, summary



1. Introduction

Argument annotation

Hands-on: Manual argument annotation

- **Annotation**
 - Adding meta-information to a text or text span
Usually in terms of labels; sometimes also terms, numbers, ...
 - **Annotation levels.** Words, phrases, sentences, paragraphs, entire text, ...
- **Your task (alone or in groups)**
 - Given an opinionated news editorial
 - Read once through it
 - **Annotate manually what you consider most relevant in terms of argumentation**
- **Notice**
 - **15 minutes for reading and annotating**
 - Follow your intuition!

Tutorial hands-on task – Argument annotation

An education was my path to financial security. Then I got my student loan bill.
Anthony Akitunde

I have a very distinct memory from my first day of college: My family's minivan slowly pulling into my dormitory's parking lot, through a crowd of first-year students flanked by helicopter parents and, in retrospect, probably hungover orientation week advisers. I remember thinking "Hurry up! I'm ready to start my real life." I had no idea what I was really rushing towards.

As the only daughter of Nigerian immigrants with a tenuous-at-best foothold on the middle class, college was billed as the only path to financial security. "No one can ever take away your education," my father would say repeatedly. While that may be true, two degrees later someone could take away my access to decent housing because of my shit credit, thanks to the nearly \$60,000 in student loans I've essentially defaulted on since graduating from the University of Chicago and Northwestern University.

It seems a college education is part of the American dream that's easy to buy (or borrow) into, but hard to pay off. With tuition soaring, and the middle class shrinking along with their incomes, many students and their families are left holding incredibly expensive bags. In 2013, 69% of graduating seniors at public and private nonprofit colleges took out student loans to pay for college, and "about one-fifth of new graduates' debt was in private loans," according to the Project on Student Debt. Even public schools - long considered a more affordable option - are less accessible: public colleges increasingly rely on tuition dollars as state funding continues to fall (25% and 23%, respectively, in 2012, compared to 17% and 23% in 2003). The country's cumulative student loan debt (\$1.1tn) has surpassed car loans (\$873bn) and credit card debt (\$659bn). Though college graduates make more than their peers who only graduated from high school, for many, monthly student loans leech into that extra \$17,500 in salary.

Yet the party line that college education is the middle class' only hope for upward mobility persists - it will even be the message of President Obama's last stop on his "SOTU Spoiler" tour in Knoxville, Tennessee.

"In today's economy," Dan Pfeiffer, the president's senior advisor, wrote on Medium, "access to a college education is the surest ticket to the middle class - and the President's proposals will help more young people punch that ticket."

One of those proposals is to make student loans affordable and assign values to colleges based on their affordability, access and "outcomes" - such as whether or not people graduate and enter high-paying jobs or go on to get graduate degrees. These changes will perhaps make starry-eyed students less easily swayed than I was by the promise of reading Plato on the quad. Another is making the first two years of community college free for "anybody who's willing to work for it," as the President announced in a preview video on Thursday. A step in the right direction, but one that needs backing from a Republican Congress to happen. Without it, we're back at square one: Graduates and incoming students signing up for the decades-long financial burden taking out student loans to fund your education all but ensures. (President Obama should know - he and the First Lady didn't pay off their student loans until they were in their 40s.)

As someone who punched that ticket twice, I'm still waiting for my express bus to the middle class. The modest income I make as an entrepreneur with a day job is whittled away each month thanks to loan payments (plus interest) to various financial institutions that feel more like bounty hunters than supporters of middle-class aspirants.

With that \$60,000 in student loans hanging over me, I'm still waiting to start the "real" life I'd always imagined for myself. It's just that now I want one with its possibilities a little less hampered by student debt.

1. Introduction

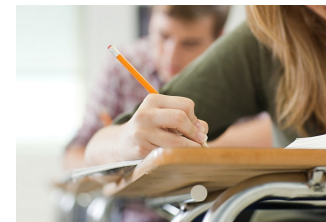
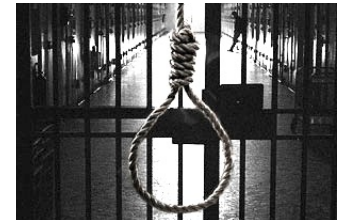
Introduction to computational argumentation

Why do people argue?

■ Reasons for argumentation

(Freeley and Steinberg, 2009)

- No (clearly) correct answer or solution
- A (possible) conflict of ideas, interests, positions, ...
- In other words: **Controversy**



■ Goals of argumentation

(Tindale, 2007)

- **Persuasion**
- Agreement, dispute resolution
- Deliberation
- Justification, explanation
- Decision making
- Recommendation

... and similar



Arguments and argumentation

▪ Argument

- A conclusion (claim) supported by premises (reasons) (Walton et al., 2008)
- Conveys a stance on a controversial topic (Freeley and Steinberg, 2009)

Conclusion
Premises

Conclusion *The death penalty should be abolished.*

Premise 1 *It legitimizes an irreversible act of violence.*

Premise 2 *As long as human justice remains fallible, the risk of executing the innocent can never be eliminated.*

- Often some argument units implicit (Toulmin, 1958)
- Most natural language arguments are defeasible (Walton, 2006)
- Arguments follow some inference scheme (Walton et al., 2008)

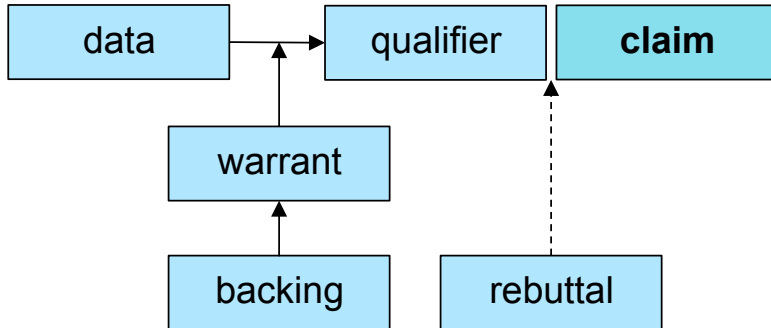
▪ Argumentation

- Usage of arguments to achieve persuasion, agreement, ...
- Includes rhetorical and dialectical aspects

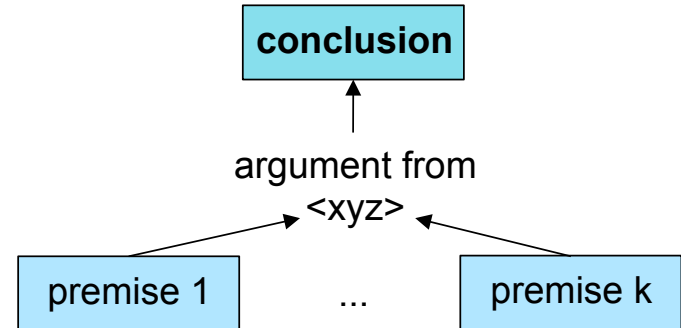
Conclusion
Premises

Diverse argument models

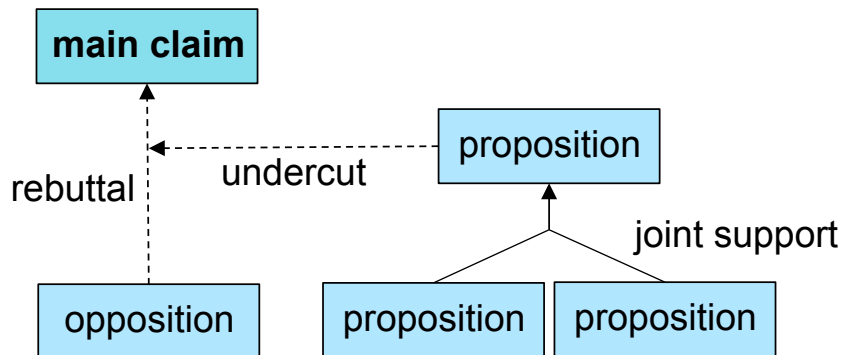
- Capture fine-grained unit roles
(Toulmin, 1958)



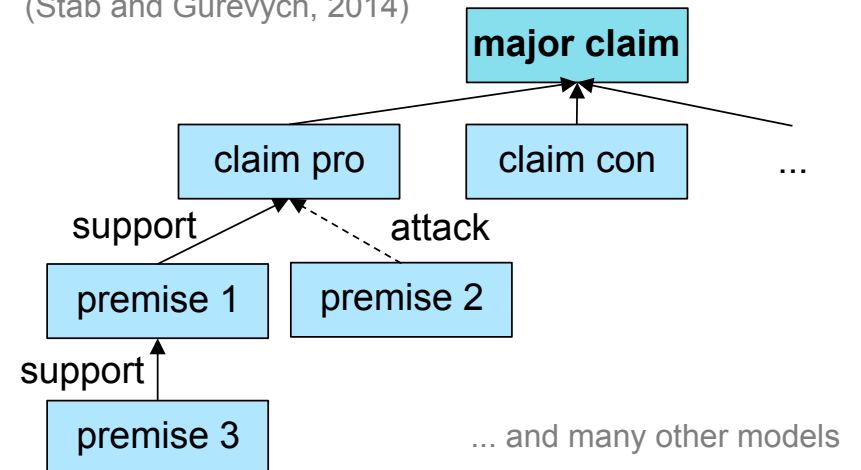
- Capture the inference scheme
(Walton et al., 2008)



- Capture dialectical exchange
(Freeman, 2011)



- Capture argumentative hierarchy
(Stab and Gurevych, 2014)



Monological vs. dialogical argumentation



Monological argumentation

I would not say that university degrees are useless; of course, they have their value but I think that the university courses are rather theoretical. [...]

In my opinion most of the courses taken by first and second year students aim at acquiring general knowledge, instead of specialized which the students will need in their later study and work. General knowledge is not a bad thing in principle but sometimes it turns into a mere waste of time. [...]



Dialogical argumentation

Alice: *I think a university degree is important. Employers always look at what degree you have first.*

Bob: *LOL ... everyone knows that practical experience is what does the trick.*

Alice: *Good point! Anyway, in doubt I would always prefer to have one!*

Argumentative genres



▪ **Written monolog**

- Persuasive essays
- News editorials / opinionated articles
- Argumentative blog posts
- Customer/scientific reviews
- Scientific articles
- Law texts

... among others

▪ **Spoken monolog** (possibly transcribed)

- Political speeches
- Law pleadings

... among others



▪ **Written dialog**

- Comments to news articles
- Forum discussions
- Social media posts
- eMail threads
- Online debates

... among others

▪ **Spoken dialog** (possibly transcribed)

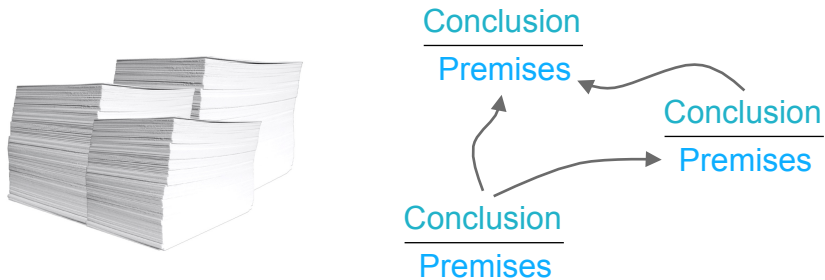
- Classical debates
- Everyday discussions

... among others

What is computational argumentation?

- **Computational argumentation**

- Computational analysis and synthesis of natural language argumentation
- Usually data-driven



$$(1 - \alpha) \cdot \frac{p(d) \cdot |D|}{|A|} + \alpha \cdot \sum_i \frac{\hat{p}(c_i)}{|P_i|}$$



- **Research on computational argumentation**

- **Models** of arguments and argumentation
- **Computational methods** for analysis and synthesis
- **Resources** for development and evaluation
- **Applications** built upon the models and methods

1. Introduction

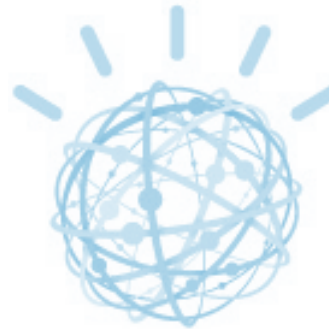
Applications of computational argumentation

Selected envisioned applications

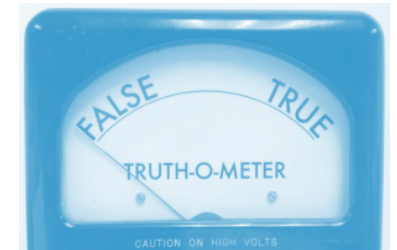
Argument search
(Wachsmuth et al., 2017e)



Intelligent personal assistants
(Rinott et al., 2015)



Fact checking
(Samadi et al., 2016)



Automated decision making
(Bench-Capon et al., 2009)



Argument summarization
(Wang and Ling, 2016)



Writing support
(Stab and Gurevych, 2014)



... and many analyses in computational social science...

IBM Debater



https://youtu.be/UeF_N1r91RQ



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.

Demo: args.me



Q Enter a topic **demo** →

<https://args.me>

Ongoing development of args.me

Arguments in future web search

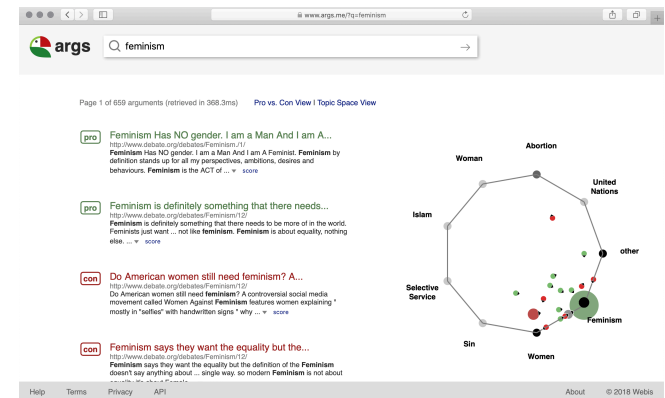
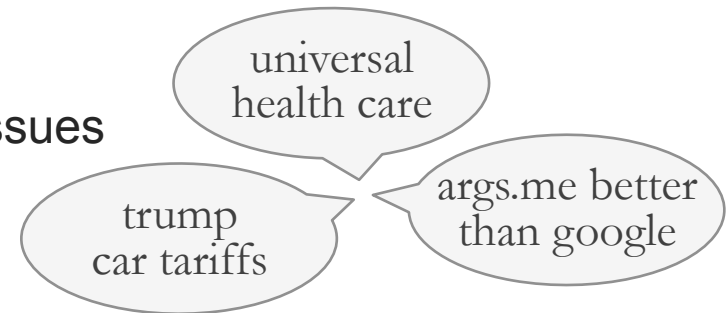
- Support forming opinions on controversial issues
- Make it easy to find relevant arguments

Search results should...

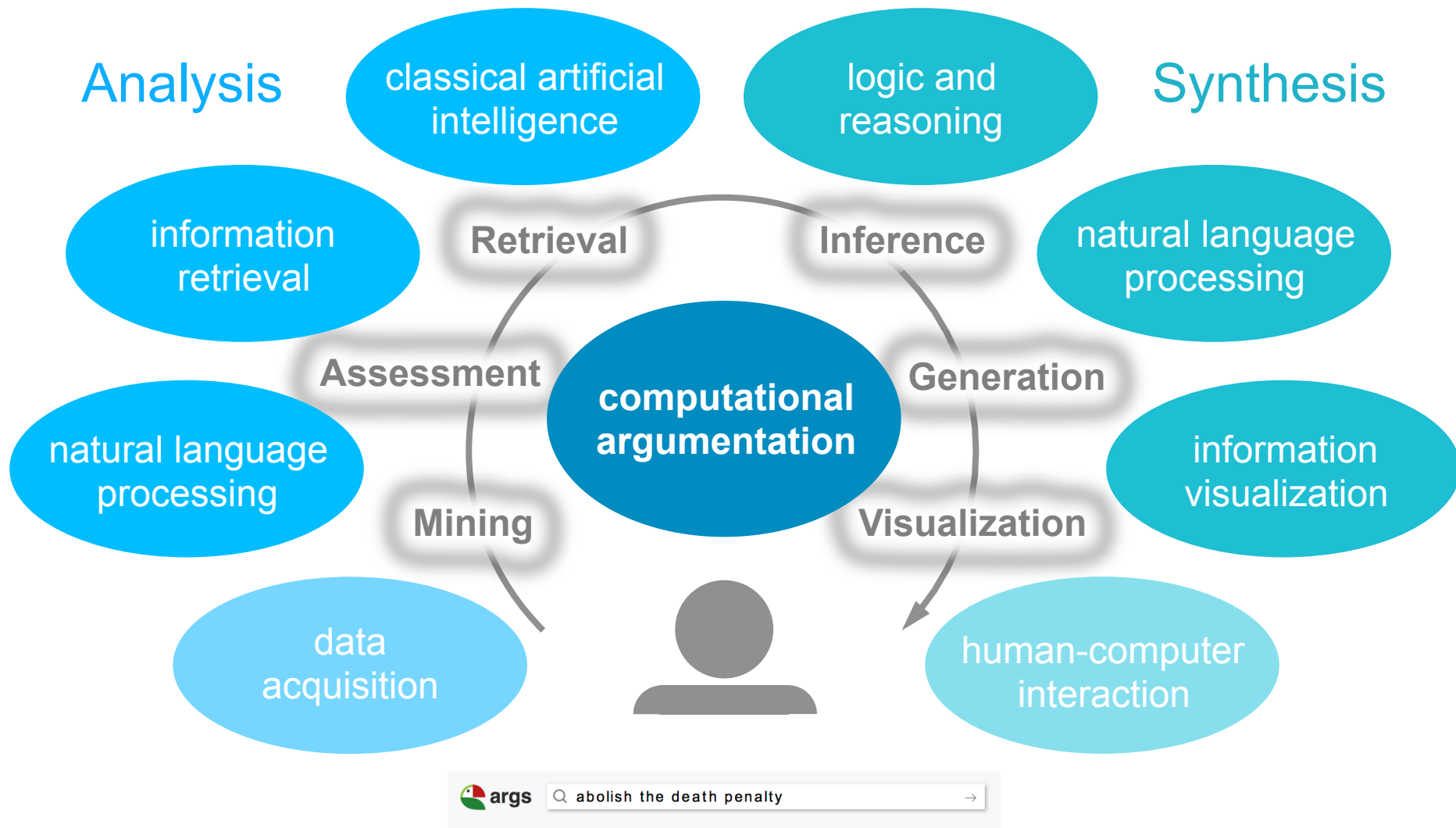
- Rank the *best* arguments highest
 - Cover diverse aspects
 - Cover reliable and heterogeneous sources
 - Be up-to-the-minute
- ... and much more

Our argument search engine...

- Is improvable on all these criteria
- Defines a framework to work towards the vision
- Currently 300k arguments indexed
- Many capabilities still rather "standard"



Analysis and synthesis tasks



2. Argument Analysis

Argument mining

Argument mining

- **Argument mining**

- Automatic identification of arguments in natural language text
- Core task in computational argumentation
- Based on any of the argument models



Conclusion

” *If you wanna hear my view I think that **the death penalty should be abolished.***
Premise *It legitimizes an irreversible act of violence.* **support** *As long as human justice remains*
fallible, the risk of executing the innocent can never be eliminated. ” **Premise**

- **Three main argument mining steps**

- Segmenting a text into argument units and other (Ajjour et al., 2017)
- Classifying the type of each unit (Stab and Gurevych, 2014)
- Identifying and classify relations between units (Peldszus and Stede, 2015)

Argument mining: Unit segmentation

- **Argument units** (aka argumentative discourse units)
 - Text segments with an argumentative function
Usually, the premises and conclusions of arguments
- **Unit segmentation**
 - **Task.** Given a text, segment it into argument units and other parts
 - **Method.** Usually, token-level sequence labeling

” If you wanna hear my view I think that the death penalty should be abolished .

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ **B** **I** **I** **I** **I** **I** ○

- **Challenges**
 - Unit granularity differs: Anything between clauses and paragraphs
 - Usually the first mining step: Unclear what are the arguments
- **State of the art** (Ajjour et al., 2017)
 - Rather reliable on narrow genres (F_1 0.72–0.82), unsolved across genres

Background: Evaluation measures

▪ Data-driven research

- Models and methods developed/learned on training texts
- Most methods not fully "correct"
- Effectiveness evaluated on test texts

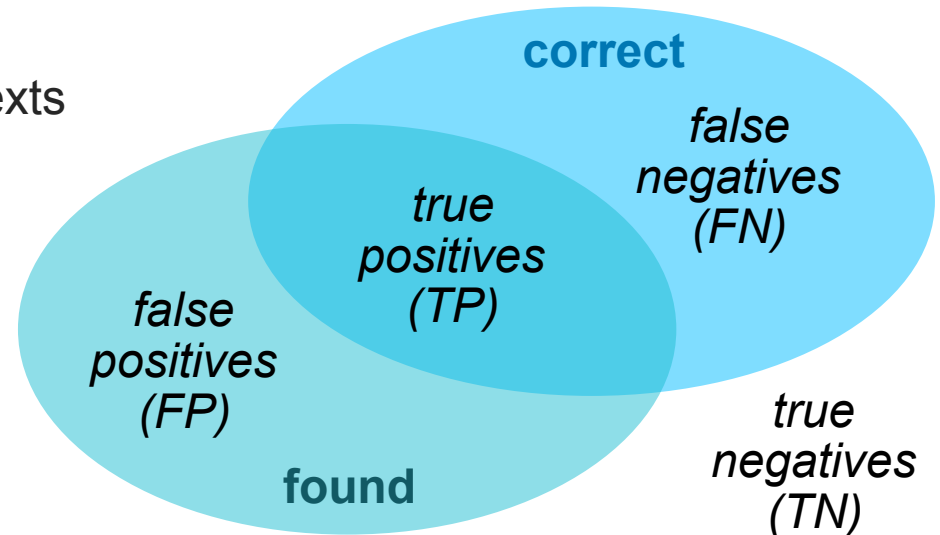
▪ Effectiveness measures

- **Accuracy.** Used if both positives and negatives are of importance

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

- **Precision, recall, and F_1 -score.** Used if positives are in the focus

$$\text{Precision } (P) = \frac{TP}{TP + FP} \quad \text{Recall } (R) = \frac{TP}{TP + FN} \quad F_1\text{-score} = \frac{2 \cdot P \cdot R}{P + R}$$



Argument mining: Unit type classification

- **Unit types** (aka argument components)

- Roles within argumentation

(Stab and Gurevych, 2014; Habernal and Gurevych 2015)

- Claim and evidence types

(Rinott et al., 2015; Al-Khatib et al., 2016b)

- Often corpus-specific

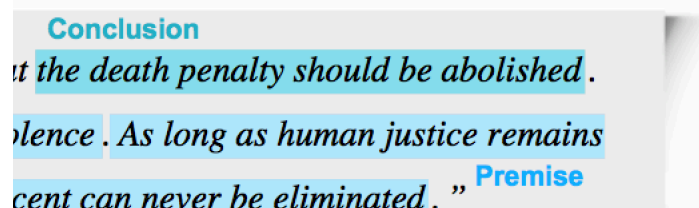
claim premise none
major claim

assumption statistics other
anecdote common ground testimony

- **Unit type classification**

- **Task.** Given an argument unit, assign one type from a set of types

- **Method.** Usually, supervised text classification (more on this below)



Conclusion
at the death penalty should be abolished.
...ence. As long as human justice remains
cent can never be eliminated. ” Premise

- **State of the art**

- Reliable on "explicit" argumentation, such as in essays (F_1 0.87) (Stab, 2017)
- Still rather reliable on news editorials (F_1 0.77) (Al-Khatib et al., 2017)
- Minority classes may be problematic, though

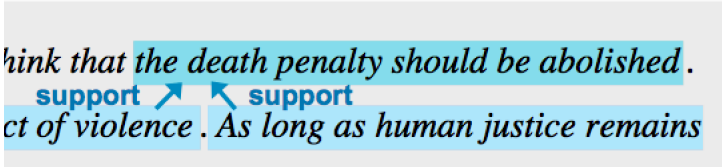
Argument mining: Relation identification & classification

▪ Argumentative relation

- **Within arguments.** From premise to conclusion
- **Across arguments.** From argument to argument
- Support or attack, partly more fine-grained subtypes (Peldszus and Stede, 2015)

▪ Relation identification and classification

- **Task.** Given two units or arguments, what type of relation holds between them, if any
- **Method.** Usually, supervised text classification (more on this below)



think that the death penalty should be abolished.
support ↗ ↖ support
act of violence. As long as human justice remains

▪ State of the art

- Semi-reliable on narrow genres, such as essays (F_1 0.73) (Stab, 2017)
- Identification works better than classification
- Relations hard to agree on in "hidden" argumentation, such as editorials

▪ Related task

- Given an argument, what is the best counterargument? (Wachsmuth et al., 2018a)

2. Argument Analysis

Argument assessment

Classification of schemes and fallacies

▪ Argumentation scheme

- Form of inference from premises to conclusion (Walton et al., 2008)
- Several deductive, inductive, and abductive schemes
- **Examples.** Cause to effect, expert opinion, analogy, ...



” If you wanna hear my view I think that *the death penalty should be abolished* .

It legitimizes an irreversible act of violence . As long as human justice remains fallible , the risk of executing the innocent can never be eliminated . ”

argument
from
consequences

- Classification based on given premises and conclusions (Feng and Hirst, 2011)

▪ Fallacies

- Failed or deceptive scheme instances (Tindale, 2007)
- **Examples.** Ad-hominem, red herring, ...



Argumentation quality assessment

Argumentation quality

- "Strength" of argumentation, arguments, or units
- Logical, rhetorical, and dialectical dimensions (Wachsmuth et al., 2017b)
- Some highly subjective



cogent?

effective?

reasonable?

"If you wanna hear my view I think that *the death penalty should be abolished*.

It legitimizes an irreversible act of violence. *As long as human justice remains*

fallible, the risk of executing the innocent can never be eliminated." **acceptability:**
3 out of 3

acceptable?

clear?

relevant?

more acceptable than

"Human beings never act freely and thus should not be punished for even the most horrific crimes."

Quality assessment

- Absolute or relative?
- How *should* we argue vs. how *do* we argue?

Three main quality aspects

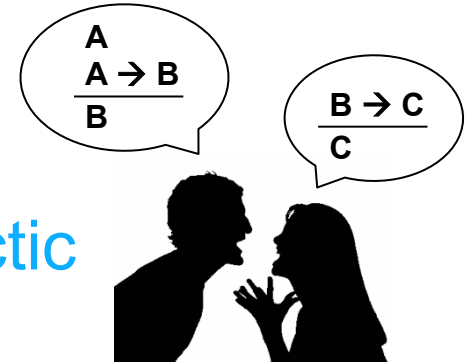
$$\frac{A \quad A \rightarrow B}{B}$$

Logic

"A dialectical discussion derives its reasonableness from a dual criterion: problem validity and intersubjective validity."

van Eemeren (2015)

Dialectic

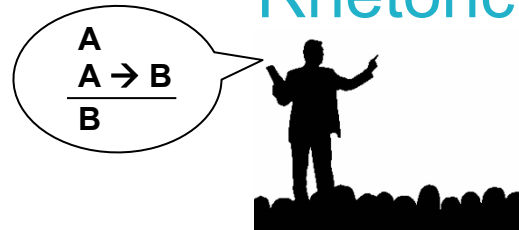


"An argument is cogent if its premises are relevant to its conclusion, individually acceptable, and together sufficient to draw the conclusion."

Blair (2012)

Argumentation
quality

Rhetoric



"In making a speech, one must study three points: the means of producing persuasion, the style or language to be used, and the proper arrangement of the various parts."

Aristotle (2007)

Stance classification

▪ Stance

- Overall position of a person towards an issue or statement
(Somasundaran and Wiebe, 2010)
- Depends on what the person argues to be true



Con towards death penalty

” If you wanna hear my view I think that *the death penalty should be abolished* .

Pro towards conclusion

It legitimizes an irreversible act of violence . *As long as human justice remains*

fallible , the risk of executing the innocent can never be eliminated . ” **Pro** towards conclusion

▪ Stance classification

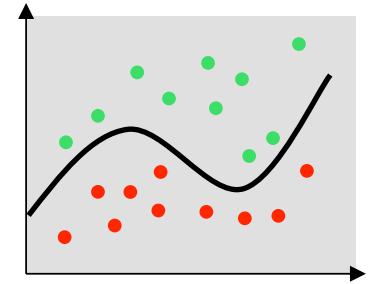
- Determination of the stance encoded in a text or text span
- Pro vs. con, sometimes also: none, not relevant, ...
- Not perspective classification, such as ”republicans vs. democrats“

2. Argument Analysis

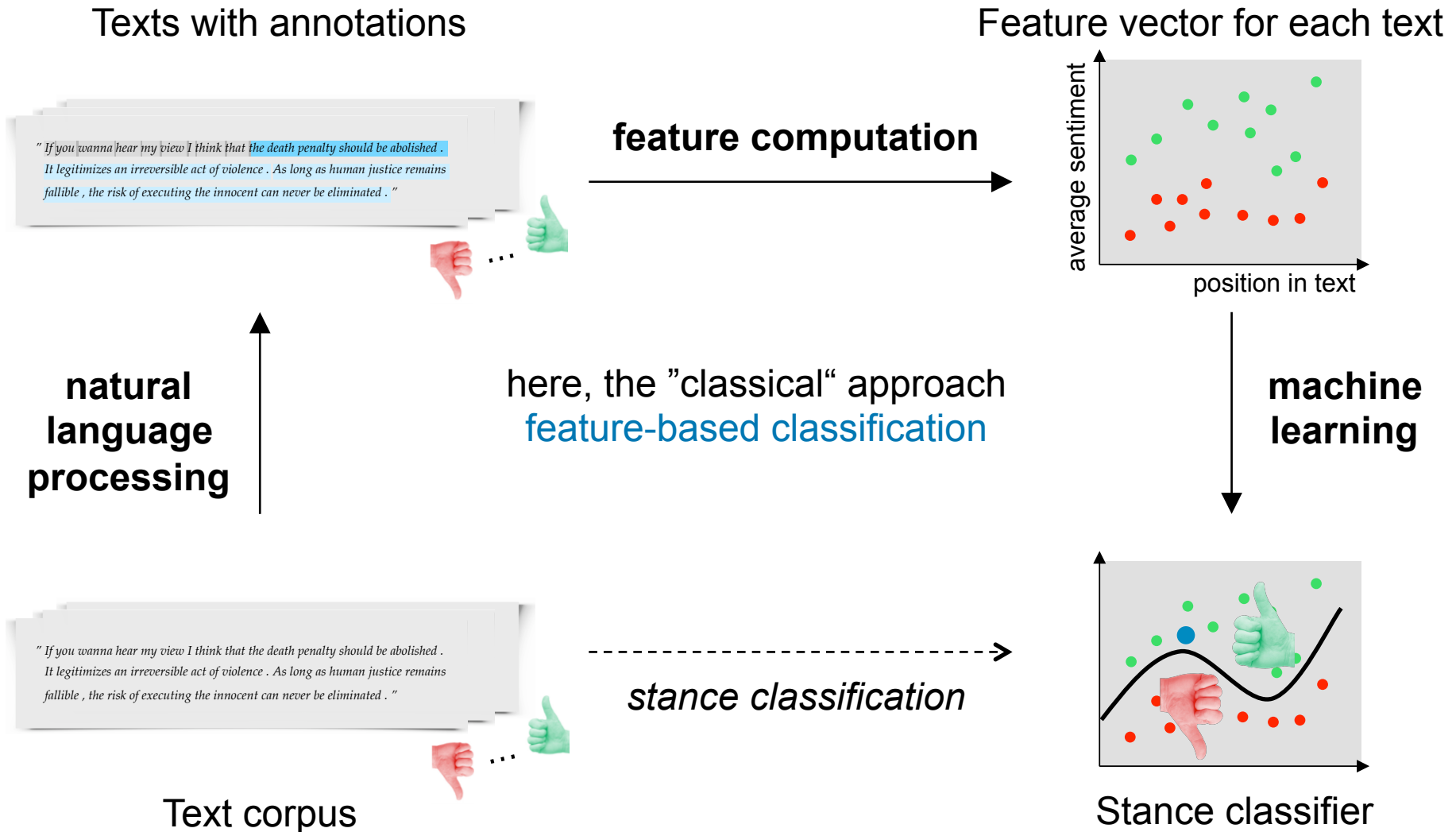
Stance classification: How to

Text classification with supervised learning

- **Text classification** (aka document categorization)
 - **Task.** Given a text, assign it one class from a set of classes
Stance classification is a text classification problem
 - Usually done with supervised machine learning
- **Feature-based classification**
 - Map text to feature vector, map feature vector to class label
Features engineered manually or semi-automatically
 - **Models.** Support vector machines, random forest, ...
- **Neural classification / deep learning** (usually works better, when given enough data)
 - Features (weights in neural networks) learned automatically
 - **Models.** Convolutional neural networks, bi-directional LSTMs, ...
- **Sequence labeling** (applicable, when a sequence of texts is classified)
 - Like other methods, but considering previous classifications
 - **Models.** Conditional random fields, recurrent neural networks, ...



How to develop a stance classification algorithm



Modeling stance

▪ **Candidate features of the text** (Somasundaran and Wiebe, 2010, Hasan and Ng, 2013)

- **Bag-of-words.** Distribution of words or word n-grams
 - **Core vocab.** Terms from arguing or subjectivity lexica
 - **POS.** Distribution of part-of-speech tags
 - **Discourse.** Connectives and relations between units
 - **Sentiment.** Aspect-based or topic-directed polarity
- ... and many more...

→ accuracy up to 0.70 in experiments

▪ **Candidate features of the context**

- Exploit author knowledge in dialog → up to 0.74
(Ranade et al., 2013)
- Exploit opposing views in dialog → up to 0.75
(Hasan and Ng, 2013)
- Connections between claim topics and target topics
(Bar-Haim et al., 2017)

→ 0.84 for most confident 10%, 0.65 overall (3 classes)

Alice: I think a **university degree** is important. Employers always look at what degree you have first.

↓ stance tend to be the same

Alice: Good point! Anyway, in doubt I would always prefer to have one!

↓ stance tend to be opposite

Bob: LOL ... everyone knows that **practical experience** is what does the trick.

ArgMining 2019

The 6th International Workshop on Argument Mining

August 1 or 2 at ACL 2019 in Florence

<https://argmining19.webis.de>

submission due: April 26



— *coffee break* —

Outline (revisited)

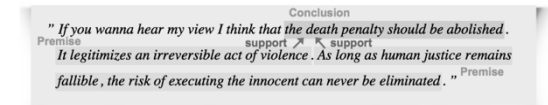
- **Introduction**

Argumentation, computational argumentation, applications



- **Argument analysis**

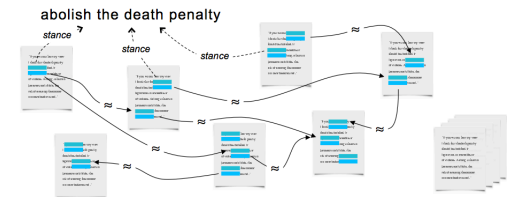
Mining arguments, assessing quality, classifying stance



— coffee break —

- **Arguments in CSS**

Ad-hominem, argument relevance, ideology & personality



- **Outlook and conclusion**

Beyond arguments, resources, summary



3. Arguments in CSS

Computational argumentation in CSS

Hands-on: Plenary brainstorming and discussion

What **CSS** research questions could be studied
based on **computational argumentation**?

3. Arguments in CSS

Ad-hominem arguments

(Habernal et al., 2018)



Studying ad-hominem arguments on the web

Ad-hominem arguments

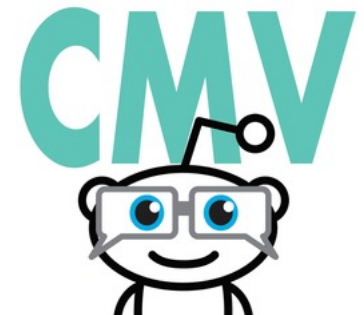
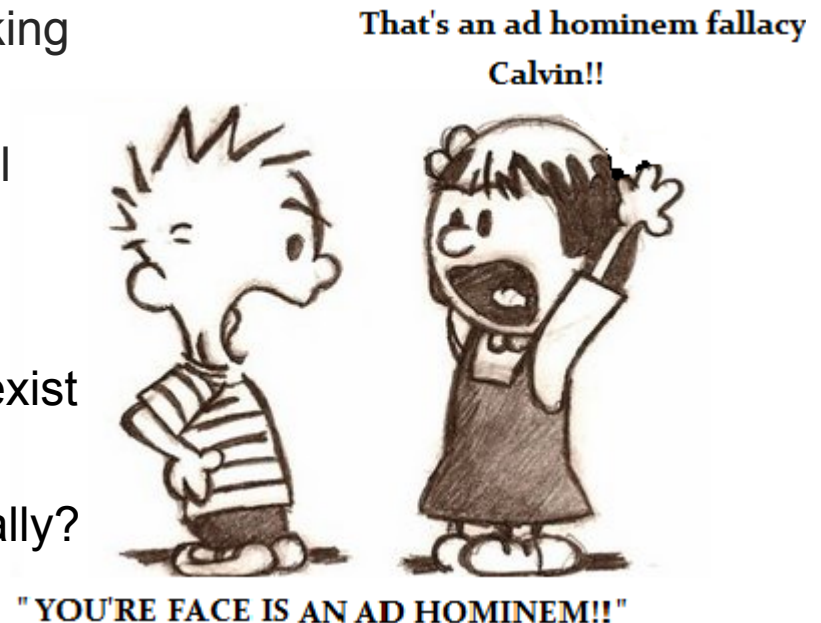
- Attacking the opponent instead of attacking his or her arguments (Tindale, 2007)
- 20% of all online news comments uncivil (Coe et al., 2014)

Research questions

- What types of ad-hominem arguments exist on the web?
- Can we identify ad-hominem automatically?
- What are triggers of ad-hominem?

Approach

- Corpus based on Reddit ChangeMyView <https://www.reddit.com/r/changemyview/>
- Empirical analyses based on crowdsourced annotations
- Neural network classifiers



A CMV corpus (available at <http://github.com/UKPLab/naacl2018-before-name-calling-habernal-et-al>)

▪ Reddit ChangeMyView (CMV)

- An opinion poster (OP) states a view
- Others argue for the opposite
- OP gives Δ to convincing posts
- Being "rude or hostile" is prohibited, respective arguments are deleted

 r/changemyview · Posted by u/gill8672 11 hours ago

Deltas(s) from OP **CMV: Trump has done nothing of substance since being elected to office.**

This is kind of a counter to the other post made recently about Trump being a great president.

He pointed out things like the economy, which was growing before he even took office and it actually seems to be growing less than it really should since he inherited and

View of OP

▪ An ad-hominem corpus based on CMV

- 2M posts from CMV including deleted ones (in collaboration with Reddit)
- 3396 threads with 3866 ad-hominem arguments (0.2%)

▪ Basic corpus insights

75%	49%	66%	23%	12%
threads with 1–2 ad-hominems (but some with >50)	threads stop after ad-hominem	ad-hominem "out of the blue" (but one after 57 posts)	ad-hominem against OP	ad-hominem from OP

Ad-hominem on ChangeMyView

"Reading comprehension is your friend"

"Ever have discussions with narcissistic idiots on the internet? They are so tiring"

"You still refuse to acknowledge that you used a strawman argument against me"

"little buddy"

"Thank you so much for all your pretentious explanations"

"To say that people intrinsically understand portion size is idiotic."

"You started with a fallacy and then deflected."

"Please dont waste peoples time pretending to know what you're talking about"

"boy"

"Did you even read this?"

"Read what I posted before acting like a pompous ass"

"Do you even know what you're saying?"

"Again, how old are you?"

"You're making the claims, it's your job to prove it. Don't you know how debating works?"

"You're obviously just Nobody with enough brains to operate a computer could possibly believe something this stupid"

"Your second paragraph is fairly idiotic"

"You have no capability to understand why"

"Wow. Someone sounds like a bit of an anti-semite"

"you dumb fuck"

"Your just an asshole"

"Possible lie any harder?"

"How can you explain that? You can't because it will hurt your feelings to face reality"

"You're just a dishonest troll"

"You are just a liar."

"Can you also use Google?"

"Willful ignorance is not something I can combat"

"You're trash at debating."

"You're too dishonest to actually quote the verse because you know it's bullshit"

"You're using troll tactics"

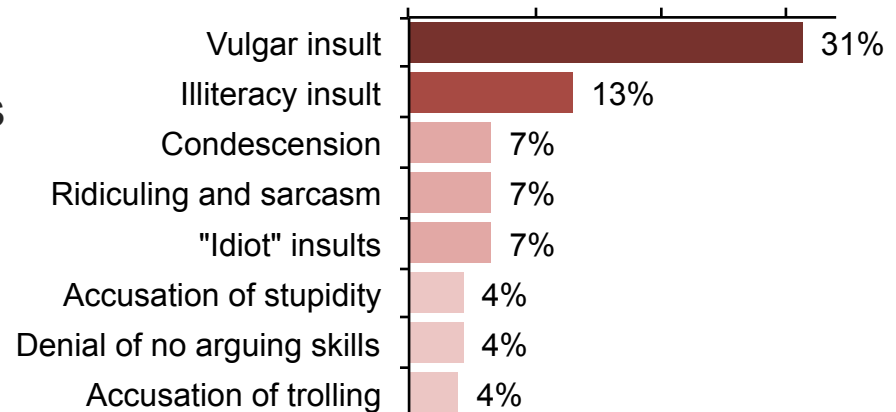
"sir"

"If you can't grasp the concept, I can't help you"

Ad-hominem types, identification, and triggers

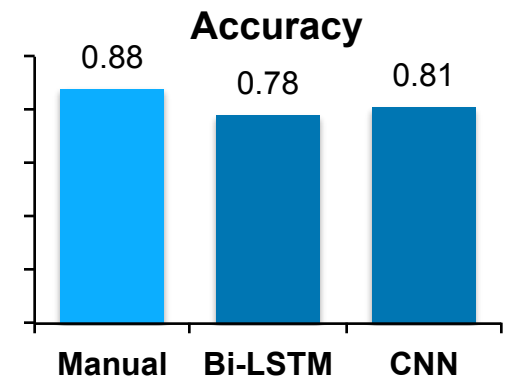
Types of ad-hominem

- Ad-hominem parts in 400 arguments annotated by 7 crowdworkers
- **15 types** derived manually from the annotations



Identification of ad-hominem

- **Manual.** 100 balanced arguments (50 ad-hominem) classified by 6 workers
- **Automatic.** 7242 balanced arguments classified by 2 neural classifiers (Bi-LSTM & CNN)
- 5% ad-hominem overlooked (agreement $\kappa = 0.79$)



Triggers of ad-hominem (part 1)

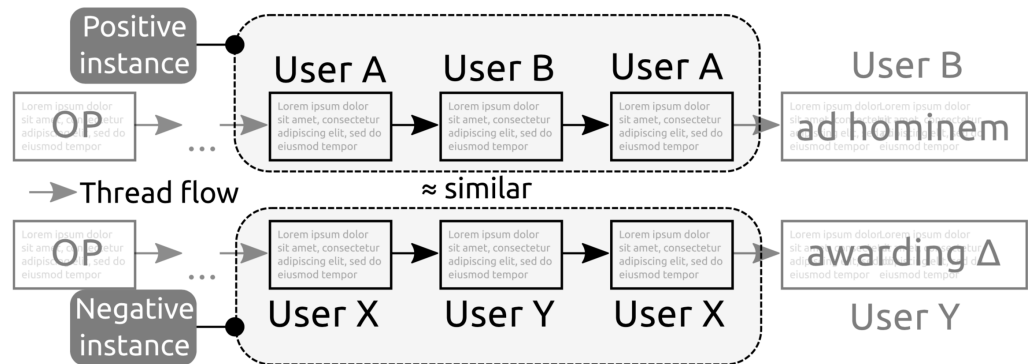
- 1800 balanced arguments annotated by 5 workers for **controversy** and **reasonableness** (scale 1–3)

controversy **reasonableness**
1.23* / 1.06 **1.20 / 1.11**

Triggers of ad-hominem (part 2)

■ Prediction of ad-hominem

- **Attentive LSTM** trained on 2852 argument 3-tuples
- Accuracy 0.72
- Manual attention analysis



(OOV_comment_begin) If only you would n't rely on [fallacious] (http : OOV) [arguments] (http : OOV) to make your point. So no , I do n't realize how stupid and naive I am. All I 've realized is that you are n't actually prepared to have an actual discussion .

(OOV_comment_begin) What god do you believe in ? And it 's not a fallacy when it 's very comparable to the most popular gods .

(OOV means out-of-vocabulary)

■ Terms with much attention

- Mostly topic-independent rhetorical devices
- A few loaded keywords, such as "rape" or "racist"
- Mostly not profane
- Partly meta about argumentation

vulgar intensifiers
"... the fuck..."

direct imperatives
"You should..."

bad argumentation
"You're grasping at straws"

missing evidence
"unsupported claims!"

...

3. Arguments in CSS

Argument relevance assessment

(Wachsmuth et al., 2017a)

Mining of relevant arguments

▪ Argument relevance

- Contribution to conclusion on an issue (Walton, 2006)
- Often perceived subjectively

” The death penalty legitimizes an irreversible act of violence. As long as human justice remains fallible, the risk of executing the innocent can never be eliminated.”

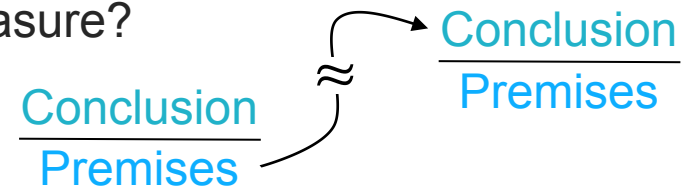
” The death penalty doesn’t deter people from committing serious violent crimes. The thing that deters is the likelihood of being caught and punished.”

▪ Research question

- Can we develop an “objective” relevance measure?

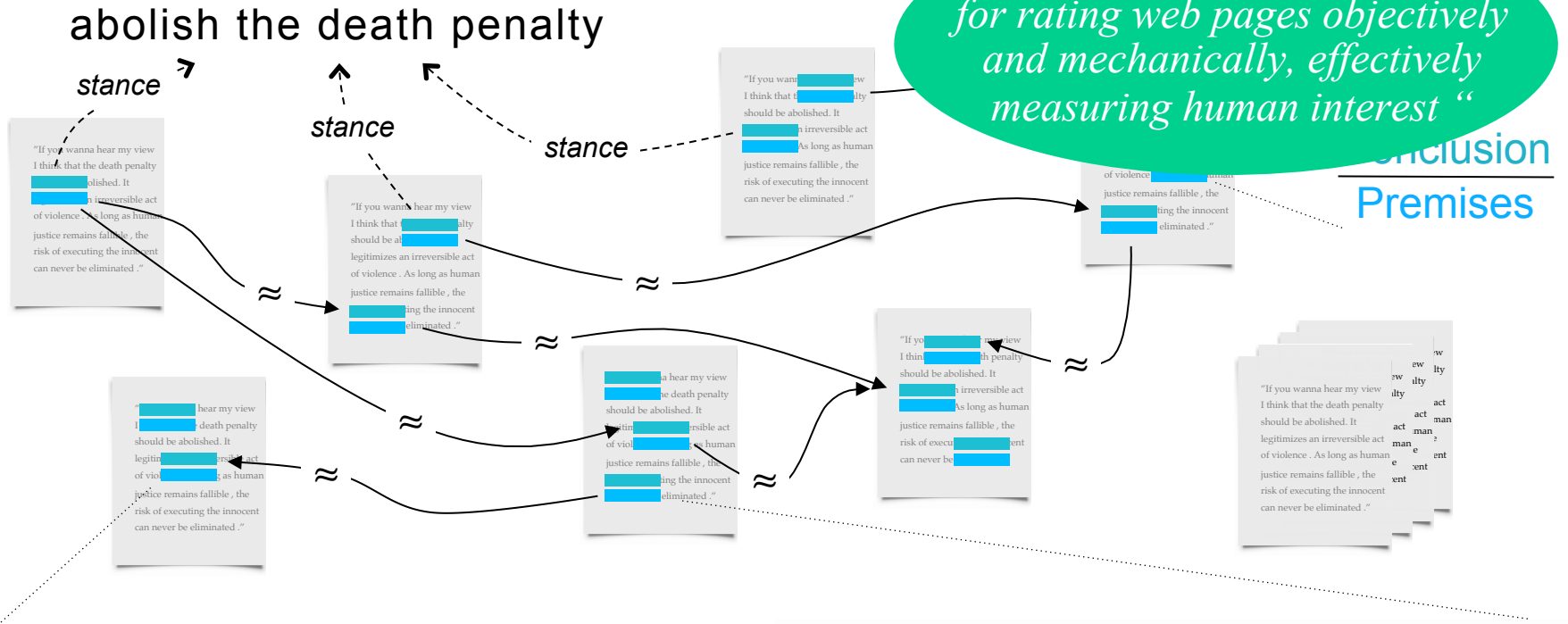
▪ Approach

- Decide relevance structurally only
- **Hypothesis.** Relevance of a conclusion depends on what other arguments across the web use it as a premise



Build an argument graph for the web

"PageRank, a method for rating web pages objectively and mechanically, effectively measuring human interest"



Conclusion
Premises

The death penalty doesn't deter people from committing serious violent crimes.

A survey of the UN on the relation between the death penalty and homicide rates gave no support to the deterrent hypothesis.

The death penalty should be abolished.

It does not deter people from committing serious violent crimes. *Even if it did, is it acceptable to pay for predicted future crimes of others?*

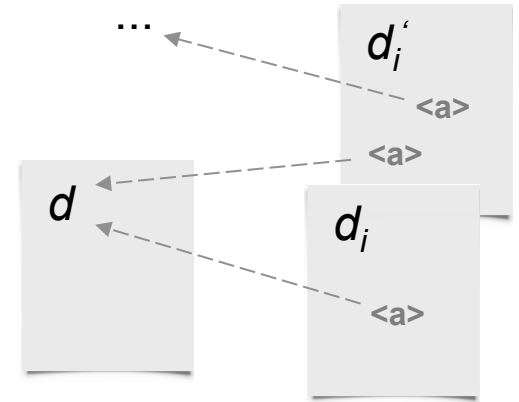
Adapt PageRank for argument relevance

- Original PageRank score of a web page d (Page et al., 1999)

same score for each page

$$p(d) = (1 - \alpha) \cdot \underbrace{\frac{1}{|D|}}_{\text{ground relevance}} + \alpha \cdot \underbrace{\sum_i \frac{p(d_i)}{|D_i|}}_{\text{recursive relevance}} \text{ page } d_i \text{ links to } d$$

pages d_i links to

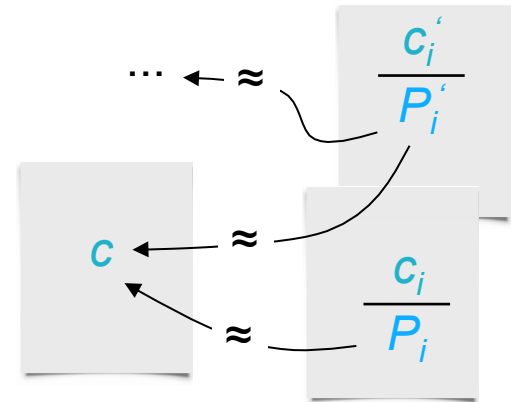


- Adapted PageRank score of an argument unit c

PageRank of page d containing c

$$\hat{p}(c) = (1 - \alpha) \cdot \underbrace{\frac{p(d) \cdot |D|}{|A|}}_{\text{ground relevance}} + \alpha \cdot \underbrace{\sum_i \frac{\hat{p}(c_i)}{|P_i|}}_{\text{recursive relevance}} \text{ conclusion } c_i \text{ uses } c \text{ as premise}$$

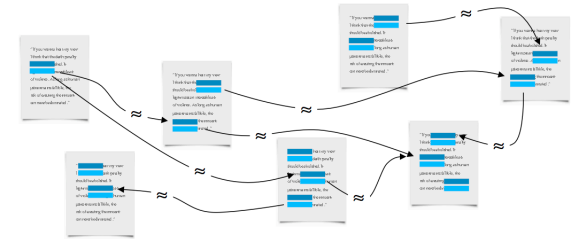
premises of c_i



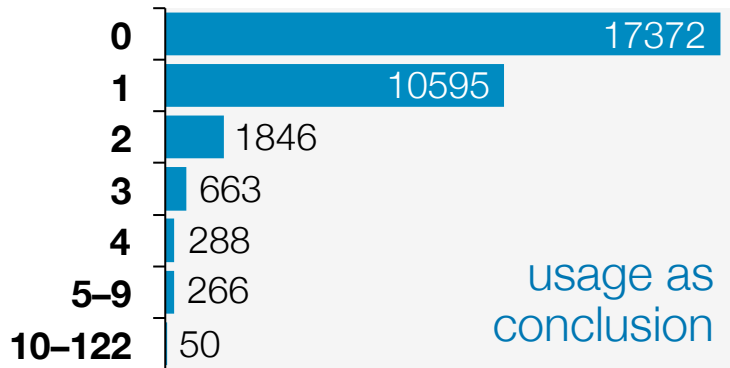
- Argument relevance is aggregation of premise scores
 - Minimum, average, maximum, or sum

A large ground-truth argument graph (available at <http://www.arguana.com>)

- **No use of argument mining here**
 - Evaluation of PageRank without noise
- **Construction of a ground-truth argument graph**
 - 57 argument corpora from www.aifdb.org
 - Merged all arguments except for duplicates
 - Units assumed to match if they span the same text
 - Computed PageRank for each unit



- **17,877 arguments with 31,080 different units**



Ranking arguments by relevance

▪ Evaluation of unsupervised ranking approaches

PageRank
of premises

\hat{p}

Frequency
of premises

Σ

Similarity
of units

$c \sim P$

Sentiment
of premises



Number
of premises

$|P|$

Random
ranking



each for minimum, average, maximum, and sum aggregation

▪ Experiment on graph with 18k arguments

- Rank with each approach
- Correlate with benchmark rankings

▪ Results

- PageRank best (with sum aggregation)
- Notable correlation despite ignorance of content and inference

best results for each ranking approach

#	Approach	Kendall's tau
1	PageRank	0.28
2	Number	0.19
3	Sentiment	0.12
4	Frequency	0.10
5	Similarity	0.02
6	Random	0.00

Examples of "objective" argument relevance



" Strawberries are the best choice for your breakfast meal. "

#1 *" Berries are superfoods because they're so high in antioxidants without being high in calories, says Giovinazzo MS, RD, a nutritionist at Clay health club and spa, in New York City. "*

#3 *" Strawberries are good for your ticker. "*

#2 *" One cup of strawberries, for instance, contains your full recommended daily intake of vitamin C, along with high quantities of folic acid and fiber. "*



" Technology has enhanced the daily life of humans. "

#3 *" The use of technology has revolutionized business. "*

#1 *" The internet has enabled us to widen our knowledge. "*

#2 *" Technology has given us a means of social interaction that wasn't possible before. "*

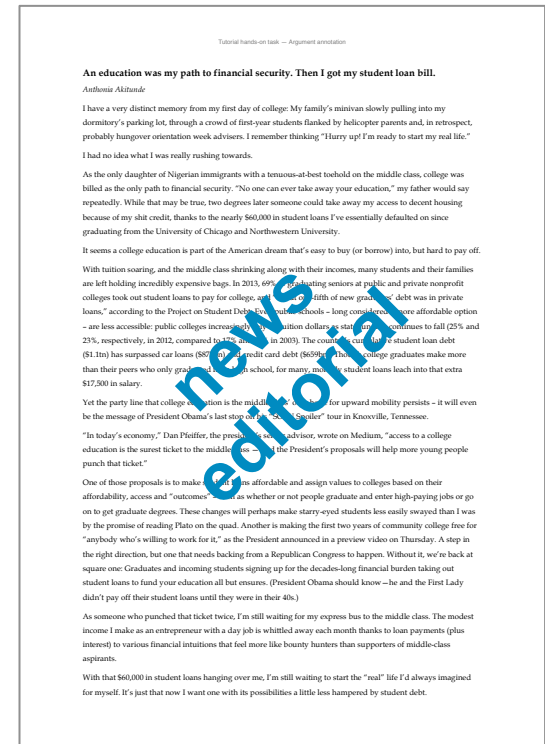
3. Arguments in CSS

Ideology and personality in argumentation

(El Baff et al., 2018)

Ideology and personality in argumentation

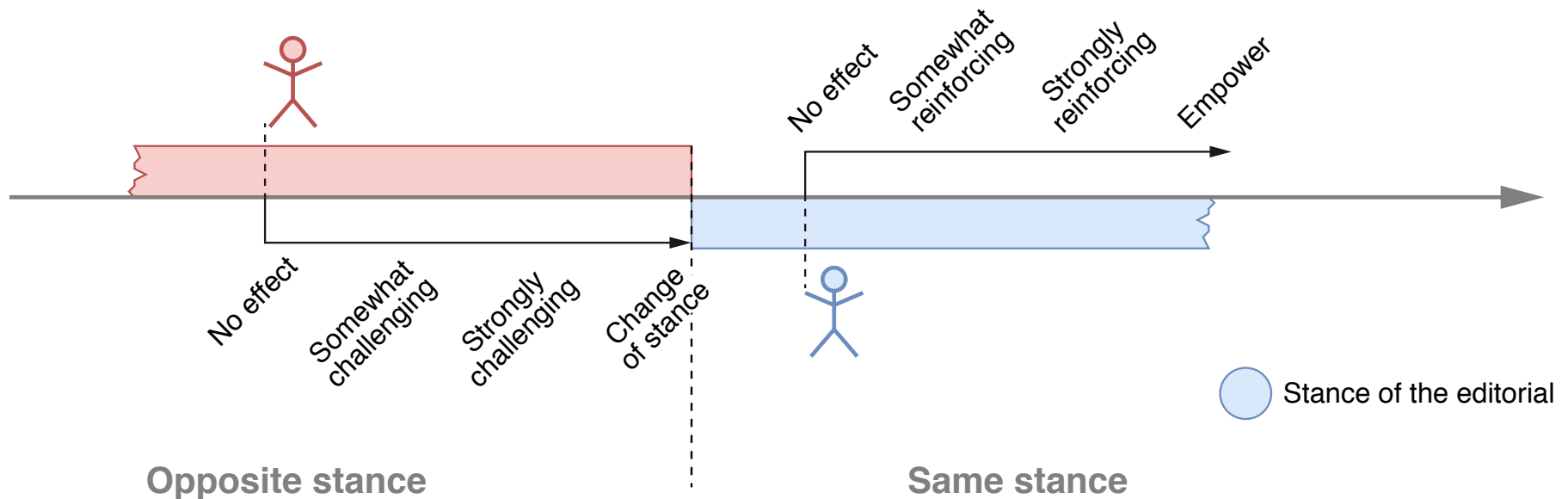
- **Argumentation quality in news editorials**
 - News editorials are said to shape public opinion
 - But they rarely *change* a reader's prior stance
- **Research questions**
 - What is argumentation quality in editorials?
 - Can we identify good editorials computationally?
- **Hypotheses**
 - Prior stance depends on ideology and personality
 - A good editorial closes the gap between readers with opposing stance
- **First step**
 - Corpus with annotations by people with different ideology and personality
 - Study impact of ideology and personality on the persuasive effect



News editorials: Effects and quality

- **Persuasive effect depending on prior stance**

- An editorial challenges or reinforces stance — or neither



- **Dialectical notion of argumentation quality**

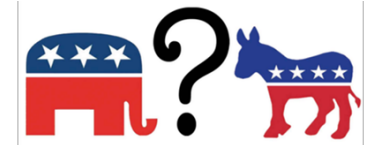
- A good editorial reinforces one side and challenges the other
- Or it challenges both sides

An editorial corpus with effect annotations (available at webis.de/data)

Corpus construction

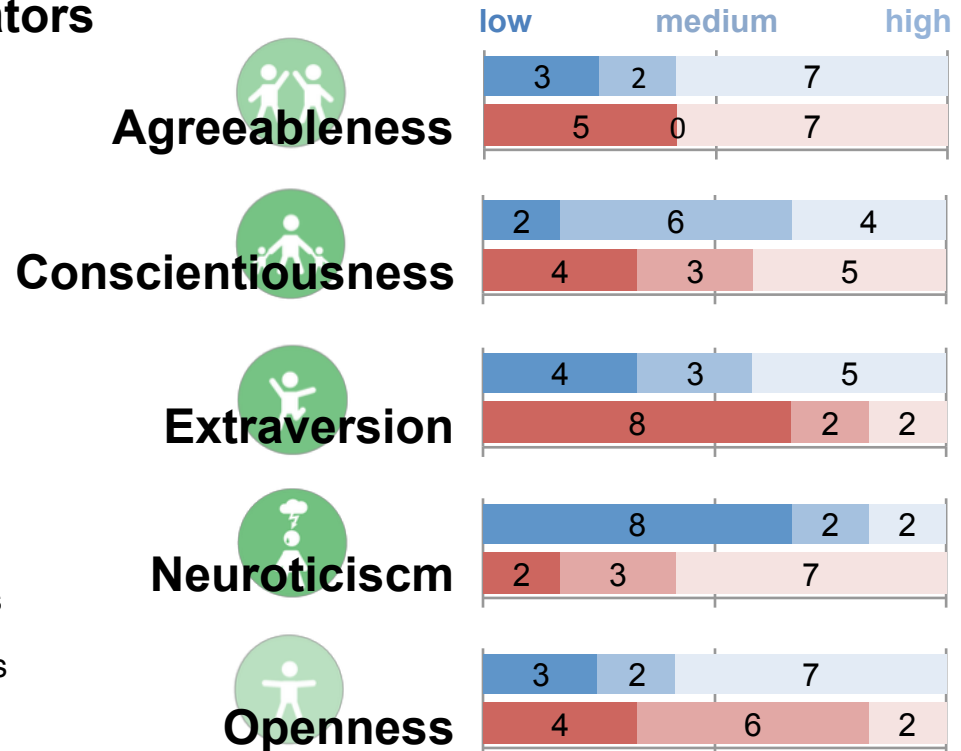
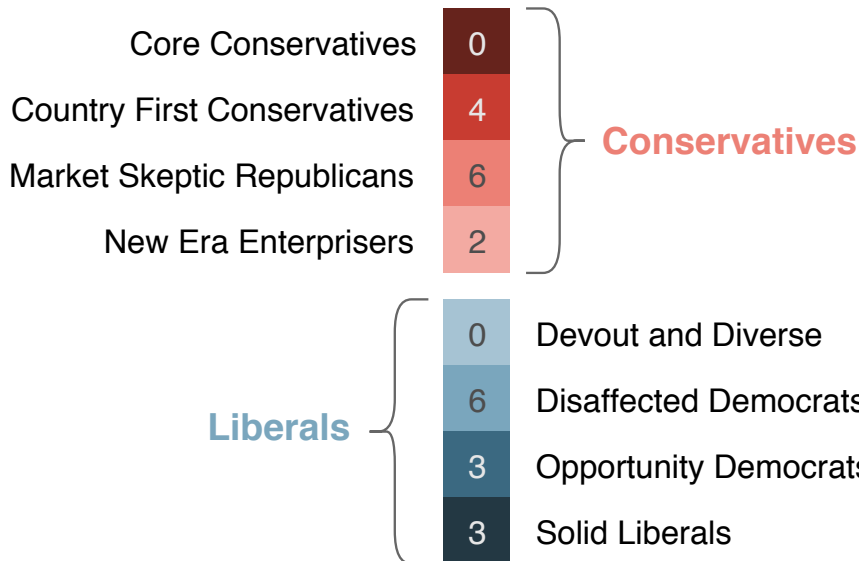
- 1000 editorials from New York Times
- Each annotated for persuasive effect by 3 conservatives and 3 liberals

The New York Times



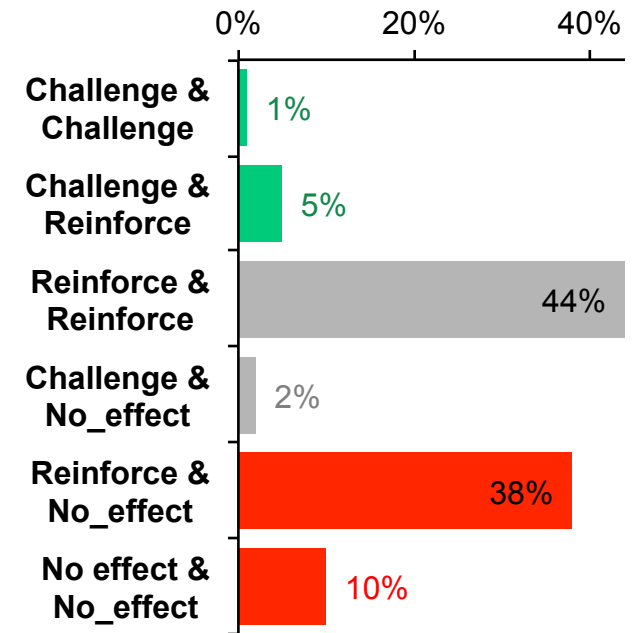
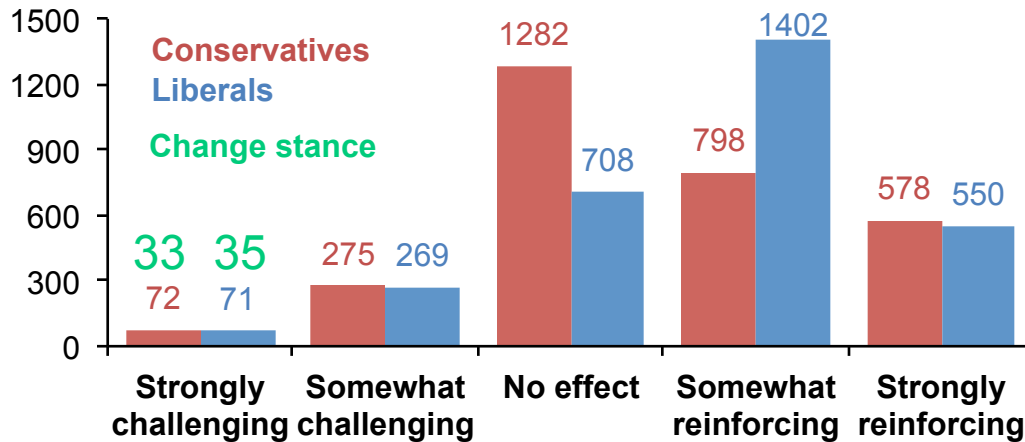
Ideology and personality of annotators

- All did [Political Typology Quiz](#) and [Big Five personality test](#)



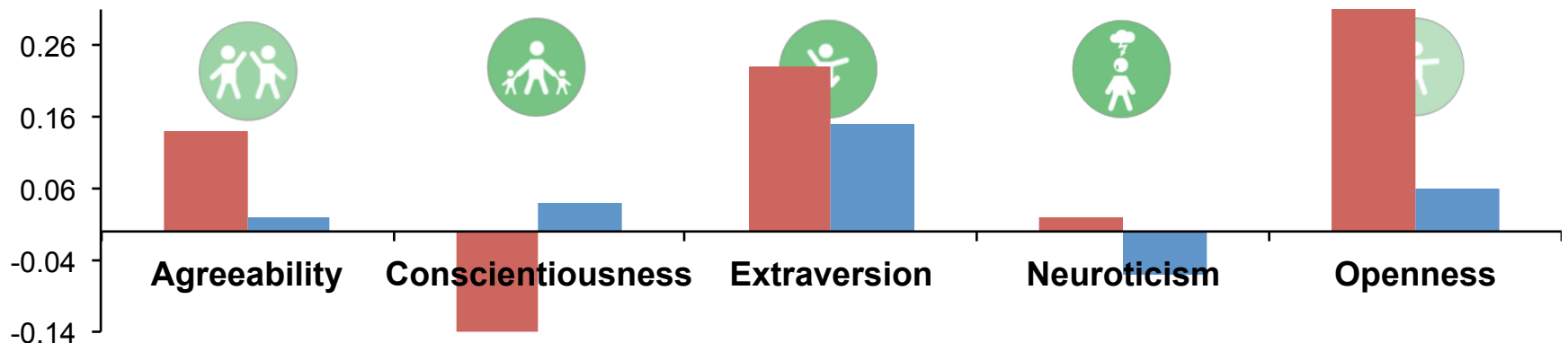
Corpus statistics and correlations

Majority effect distribution in the corpus



Effect depending on ideology and personality

Kendall's τ correlation with challenge/reinforce



4. Outlook and Conclusion

Beyond arguments

From arguments to argumentation

▪ Building blocks of monological argumentation

- **Argument units** only one part of argumentation
In some genres, only secondary
- **Other units** serve rhetorical and dialectical functions or give context information



▪ Overall structure of monological argumentation

- **Hierarchical** structure induced by relations
- **Sequential** structure of a text or speech
For models, see next slide

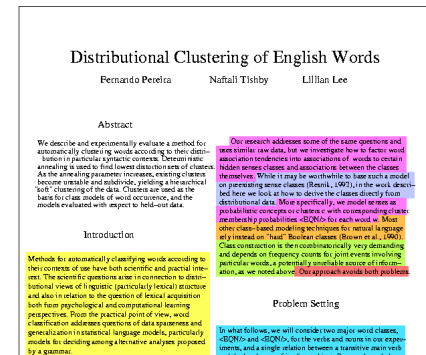
▪ Dialogical argumentation

- **Process-oriented.** Series of argumentative turns
- **Fragmented.** Arguments split into disconnected turns
- **Not plannable.** Need to react on opponents turns
Models still largely missing



Selected argumentation analysis tasks

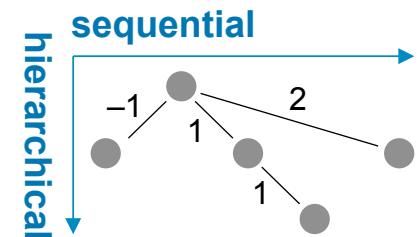
- **Argumentative zoning** (Teufel, 1999)
 - Argumentative zones capture discourse functions of text segments
 - **Examples.** Background, aim, contrast, own, other, ...
 - Well-studied for scientific articles



- **Identification of frames** (Naderi and Hirst, 2015)
 - A frame captures an aspect under which a topic may be considered
 - Studied, e.g., for parliamentary debates

fiscal benefits discrimination
gay marriage
man and woman world religions

- **Overall argumentation analysis** (Wachsmuth et al., 2017f)
 - Both sequential and hierarchical overall structure may be decisive
 - Studied, e.g., for stance classification



The role of the participants

- **Author (or speaker)**
 - Argumentation is connected to the person who argues
 - The same argument is perceived differently depending on the author
- **Reader (or audience)**
 - Argumentation often targets a particular audience
 - Different arguments and ways of arguing work for different persons

”University education must be free. That is the only way to achieve equal opportunities for everyone.“

”According to the study of XYZ found online, avoiding tuition fees is beneficial in the long run, both socially and economically.“



From analysis to synthesis

- **Argumentation synthesis**

- Generation of argument units, arguments, and argumentation
- Using an argument "knowledge base" or a (usually neural) language model

- **Selected synthesis approaches**

- Generating claims by recycling topics and predicates (Bilu and Slonim, 2016)

*Democratization **contributes to** stability.*

*Nuclear weapons **cause** lung cancer.*

- Select and arrange units following a rhetorical strategy (Wachsmuth et al., 2018b)

Emotion-oriented. Germany should by no means introduce capital punishment. Every human, even those who have committed a despicable crime, can bring themselves to regret...

- Change the stance/bias of a given sentence (Chen et al., 2018)

Obama accepts nomination, says his plan leads to a "better place"



Obama blasted re-election, saying it a "very difficult" to go down.

4. Outlook and Conclusion

Argumentation resources

Argument resources (1)

▪ Selected corpora on argumentative structure

- [AAE-v2](#). Persuasive essays, proprietary model (Stab and Gurevych, 2014)
- [Arg-microtexts](#). Short texts, Freeman model (Peldszus and Stede, 2015)
- [Araucaria](#). Mixed argumentative texts, Walton's schemes (Reed and Rowe, 2004)
- [AZ](#). Scientific articles, argumentative zones (Teufel, 1999)
- [IBM Debater](#). Wikipedia articles, claims and evidence (Rinott et al., 2015)
- [Web discourse](#). Mixed web arg's, Toulmin model (Habernal and Gurevych, 2015)
- [Webis-Debate-16](#). Debate portal arg's, argumentativeness (Al-Khatib et al., 2016a)
- [Webis-Editorials-16](#). News editorials with six unit types (Al-Khatib et al., 2016b)

▪ Selected corpora on argumentation quality

- [ArgQuality](#). Debate portal arg's, 15 quality scores (Wachsmuth et al., 2017b)
- [Cornell ChangeMyView](#). Discussion posts, effectiveness labels (Tan et al., 2016)
- [UKP-ConvArg](#). Debate portal arg's, convincingness pairs (Habernal et al., 2016)
- [Webis-ArgRank-17](#). Mixed arguments, relevance rankings (Wachsmuth et al., 2017a)
- [Webis-Editorials-18](#). News editorials, effectiveness ratings (El Baff et al., 2018)

Argument resources (2)

Selected corpora on stance and similar

- [ArguAna Counterargs](#). Debate portal counterargument pairs (Wachsmuth et al., 2018a)
- [ArguAna TripAdvisor](#). Hotel reviews with sentiment flows (Wachsmuth et al., 2014)
- [IBM Debater](#). Wikipedia articles, claim-related stance (Bar-Haim et al., 2017)
- [Ideological debates](#). Online discussions with stance (Hasan and Ng, 2013)
- [Internet arguments](#). Web discussions with topic and stance (Walker et al., 2012)

... and many others...

Online debate portals

- [Pro and con arguments](#) on controversial issues
- Some give comprehensive overviews, others let users debate
- Often sources given
- Some let users vote



Selected argumentation-related projects

- **Argument Web** www.argumentinterchange.org
 - Tools to create, analyze, and interact with arguments
- **ArguAna** www.arguana.com
 - Corpora, Java code, and tools for argumentation research
- **RATIO** www.spp-ratio.de
 - Priority program of the German research foundation with several projects
- **UKP Argumentation mining** <http://ukp.tu-darmstadt.de>
 - Corpora, Java code, tools, and another argument search engine
- **And many more...**

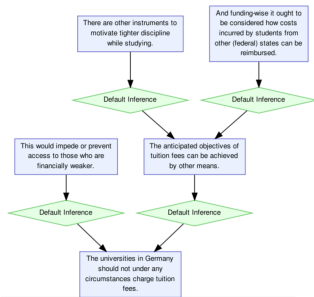
argument interchange
Home of the AIF: Infrastructure for the argument web

ArguAna



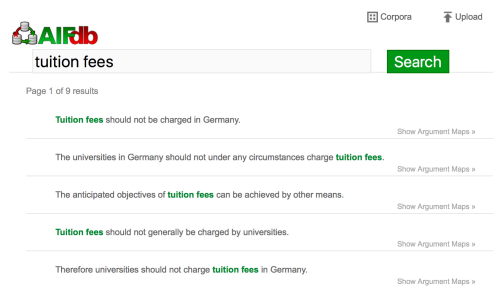

Example project: Argument Web

AIFdb Corpora



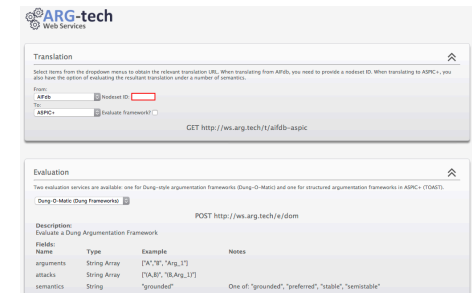
Structured argument data in uniform format

AIFdb Browser



Search interface for argument resources

ARG-tech API



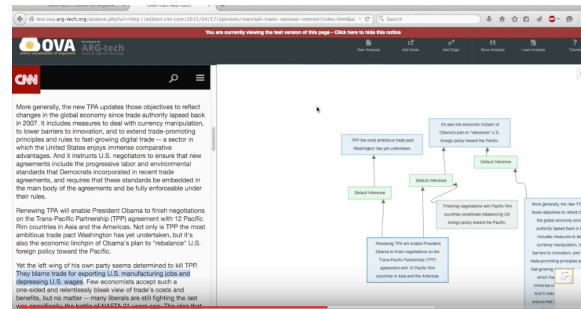
Several argument web services

Argublogging



Widget for argument annotation in blogs

OVA



Online visualization and analysis of arguments

Arvina

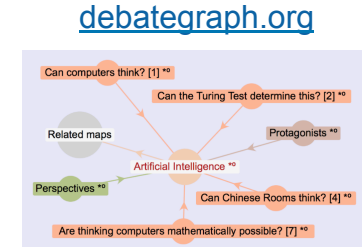
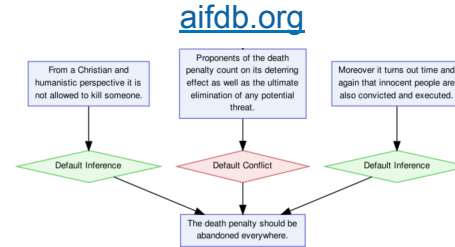


Dialog platform based on AIFdb

Argumentation visualizations

Single argumentative texts

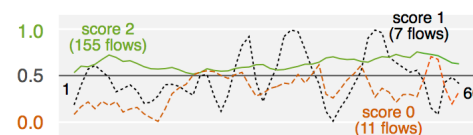
- Majority of existing visualizations
- Mostly in form of directed graphs
- **Goal:** Create or explore structure of arguments



Multiple argumentative texts

- Sequential and/or hierarchical overall structures
- **Goal:** Find argumentation patterns

Wachsmuth et al. (2014b)



Wachsmuth et al. (2017f)



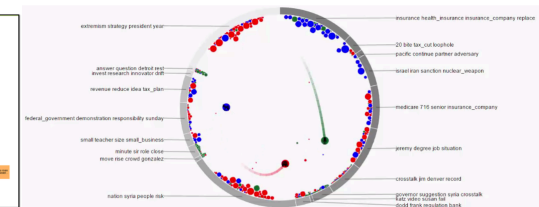
Dialogical discussions

- Process and content of debates
- **Goals:** Assess discourse quality, learn about interaction, ...

Gold et al. (2015)



visargue.inf.uni-konstanz.de



- ... and more

Argumentation-related research groups (1)

- **Disclaimer**

- Sorry to anyone that should be on this list but isn't — please mail me!

- **Groups with a focus on argumentation** (first half)

- Elena Cabrio, University of Nice Sophia Antipolis wimmics.inria.fr
- Claire Cardie, Cornell University nlp.cornell.edu
- Cristian Danescu-Niculescu-Mizil, Cornell University www.cs.cornell.edu/~cristian/
- Nancy L. Green, Uni. of North Carolina at Greensboro www.uncg.edu/cmp/faculty/nlgreen
- Iryna Gurevych, Technische Universität Darmstadt www.ukp.tu-darmstadt.de
- Graeme Hirst, University of Toronto www.cs.toronto.edu/compling
- Marco Lippi, Uni. of Modena and Reggio Emilia www.agentgroup.unimore.it/Lippi/index.html
- Diana Litman, University of Pittsburgh people.cs.pitt.edu/~litman/itspoke.html
- Marie-Francine Moens, Katholieke Universiteit Leuven liir.cs.kuleuven.be
- Smaranda Muresan, Columbia University www.cs.columbia.edu/~smara/index.html
- Vincent Ng, University of Texas at Dallas www.hlt.utdallas.edu

Argumentation-related research groups (2)

- **Disclaimer**

- Sorry to anyone that should be on this list but isn't — please mail me!

- **Groups with a focus on argumentation** (second half)

- Chris Reed, University of Dundee arg-tech.org
- Jodi Schneider, University of Illinois at Urbana-Champaign jodischneider.com/jodi.html
- Noam Slonim, IBM Debater researcher.watson.ibm.com/researcher/view_group.php?id=5443
- Jan Snajder, University of Zagreb takelab.fer.hr
- Manfred Stede, University of Potsdam angcl.ling.uni-potsdam.de/index.html
- Benno Stein, Bauhaus-Universität Weimar www.webis.de
- Francesca Toni, Imperial College London www.doc.ic.ac.uk/~ft/argumentation.html
- Henning Wachsmuth, Paderborn University cs.upb.de/css
- Marilyn Walker, University of California at Santa Cruz nlds.soe.ucsc.edu
- Lu Wang, Northeastern University homedirs.ccs.neu.edu/luwang/
- Adam Wyner, University of Aberdeen www.wyner.info/LanguageLogicLawSoftware/

Scientific events related to argumentation

▪ **Conference series**

- **Argumentation.** COMMA
- **NLP.** ACL, EMNLP, NAACL, EACL, COLING, CoNLL, IJCNLP, ...
- **Other.** SIGIR, ECIR, AAI, IJCAI, WebConf, WSDM, ...

▪ **Workshop series**

- **Natural language.** ArgMining, CMNA
- **Mixed.** ECA, CAF, SAFA, Computational Rhetoric, Argument Strength, ...

▪ **Seminars**

- Frontiers ARG-NLP, Dagstuhl 15512, Dagstuhl 16161

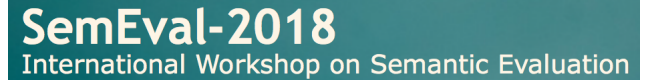
▪ **Tutorials and schools**

- NLP Approaches to Computational Argumentation (ACL 2016)
- Argumentation Retrieval and Analysis (ASIRF 2018)
- 3rd Summer School on Argumentation (and previous ones)

Shared tasks (aka dataset challenges or similar)

▪ **Argument reasoning comprehension**

- **Task.** Given a premise and conclusion, identify the correct warrant out of two options
- **Venue.** SemEval-2018 workshop
competitions.codalab.org/competitions/17327



▪ **Ranking of argumentative tweets**

- **Task.** Given a topic, find and rank the most argumentative tweets on the topic
- **Venue.** CLEF 2018 conference
mc2.talne.eu/spip/tasks-2018/2-mining-opinion-argumentation/



▪ **Same side classification**

- **Task.** Given two claims on a controversial topic, are they on the same side?
- **Venue.** RATIO Hackathon 2018, Bielefeld University
<http://www.spp-ratio.de/de/hackathon>



4. Outlook and Conclusion

Computational argumentation in CSS revisited

Hands-on: Plenary discussion

Are the **presented methods sufficient**
for the collected research questions?

What is particularly important? **What is missing?**

4. Outlook and Conclusion

Summary and concluding remarks

Take aways

- **Computational argumentation**

- Argumentation is pervasive in natural language
- Computational analysis (and synthesis) important



- **Argument analysis**

- Mining of argument units, types, and relations
- Assessment of schemes, quality, and stance

... and much more



- **Arguments in CSS**

- Types and triggers of ad-hominem arguments
- Role of ideology and personality

... and much more



- **Argumentation in your research**

- Effect on social phenomena in everyday life and politics
- Several resources available to start with



References (1 of 6)

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- **Al-Khatib et al. (2016a)**. Khalid Al-Khatib, Henning Wachsmuth, Matthias Hagen, Jonas Köhler, and Benno Stein. Cross-domain Mining of Argumentative Text through Distant Supervision. In Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, pages 1395–1404, 2016.
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