

Chapter IR:XI

XI. IR Applications

- Web Technology
- Web Graph
- Web Crawling
- Web Archiving
- Web Content Extraction
- Near-duplicate Detection
- Link Analysis

- The Treachery of Answers
- Argument Retrieval Problems
- Argument Ranking I
- Argument Ranking II
- Argumentation-Related Resources
- Argument Search Engines
- Argument Search Evaluation



Cat / Lifespan

15 years

Domesticated

[Feedback](#)[How Long Do Cats Live? | petMD](#)www.petmd.com/blogs/thedailyvet/.../how_long_do_cats_live-11496 ▾

Aug 8, 2011 - This question, typically rephrased as, "How long will my cat (or dog, horse, etc.) **live**," is something veterinarians hear on a daily basis.

[Aging Cats: Changes, Health Problems, Food, and More](#)pets.webmd.com/cats/guide/aging-cats-qa ▾

WebMD veterinarian experts answer common questions **cat** owners have ... What else can you expect as your **cat** ages? ... Q: **How long do cats** usually live?

[What Is the Life Span of the Common Cat? - Cats - About.com](#)cats.about.com › About Home › Cats ▾

How long is the common **cat** supposed to live? Questions and answers from the About Guide to **Cats**.

[Ageing - How long do cats live | Adelaide Animal Hospital](#)adelaidevet.com.au/pet/.../how-long-do-cats-live-ageing-and-your-feline ▾

Life expectancy depends on many things, including one important factor - whether your cat is an indoor-only cat or an outdoor cat. Indoor cats generally live from **12-18 years** of age. Many may live to be in their early 20s. The oldest reported cat lived to be an

Cat

Animal



The domestic cat or the feral cat is a small, typically furry, carnivorous mammal. They are often called house cats when kept as indoor pets or simply cats when there is no need to distinguish them from other felids and felines. [Wikipedia](#)

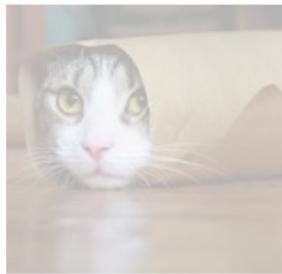
Scientific name: Felis catus**Lifespan:** 15 years (Domesticated)**Gestation period:** 64 – 67 days**Higher classification:** Felis**Daily sleep:** 12 – 16 hours**Mass:** 3.6 – 4.5 kg (Adult)[Feedback](#)



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Konrad
Lischka

How does Google know when my cat will die?

23. September 2015 by Konrad Lischka, in [Blog @en](#)



How long do cats live? Exactly 15 years says Google.com. Not "10 to 15", not "about 15 years", but "15 years". That sounds like a definitive answer. It's Google's answer to the search query ["How long do cats live"](#).

The Treachery of Answers

Retrieving answers as a retrieval paradigm:

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The dilemma of the direct answer: [\[Potthast/Hagen/Stein 2020\]](#)

The dilemma of the direct answer is a user's choice between convenience and diligence when using an information retrieval system.

The impact on society of giving direct answers at scale is not well-understood.

The Treachery of Answers



Hi, how can I help?

How long do cats live?



15 years.



Ceci n'est pas une réponse.

Remarks:

- ❑ Copyright notice:
 - “La Trahison des réponses” (2020; “The Treachery of Answers”) by the Webis Group is licensed [CC BY-NC 2.0](#).
 - “La Trahison des réponses” is a derivation from “La Trahison des images” (1929; [“The Treachery of Images”](#)) by René Magritte.
 - The canvas and handwriting have been derived from a 2019 public domain reproduction of Magritte’s painting by Thomas Hawk at [publicdelivery.org](#).
 - The image of the cat has been taken from a public domain reproduction of the painting “Sitting Cat” (1815) by Jean Bernard Duvivier at [rawpixel.com](#).
 - The cat’s image was kindly colorized manually by user [BlueBudgieOne](#) on Reddit’s [/r/colorizationrequests](#).

Argument Retrieval Problems

Basic Argument Model

Conclusion *Mankind will be able to travel to other galaxies.*

Premise 1 *Photon drives can take you up to relativistic velocities.*

Premise 2 *In August 2019 Lightsail2 demonstrated its functioning.*

Premise 3 *NASA announces progress on torpor (human hibernation).*

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Argument:

- A conclusion (claim) supported by premises (reasons). [Walton et al. 2008]
Conclusion and premises are considered as propositions.
- Conveys a stance on a controversial topic. [Freeley and Steinberg, 2009]
Assignment of truth values to the propositions:
 $\mathcal{I}(\text{"Mankind will be able to travel to other galaxies."}) = 1$, $\mathcal{I}(\text{"Photon ..."}) = 1$, ...
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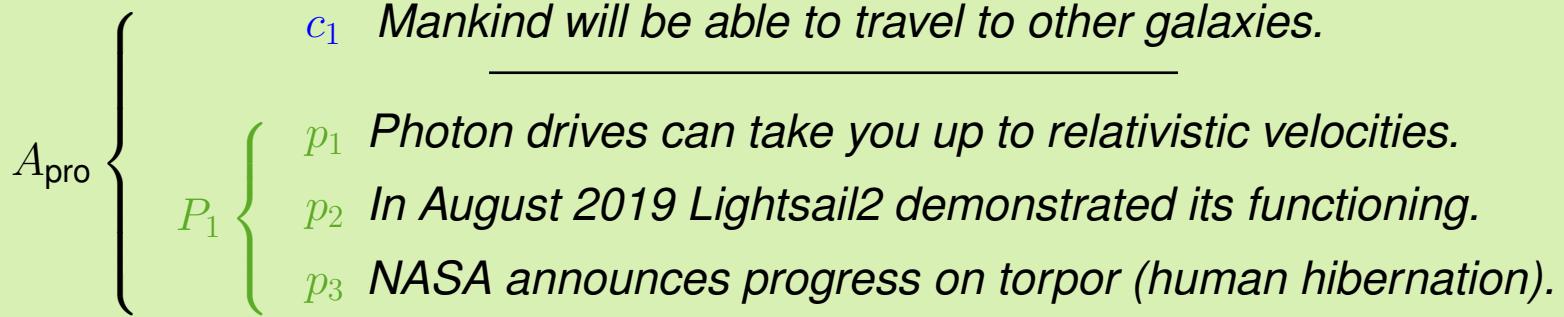
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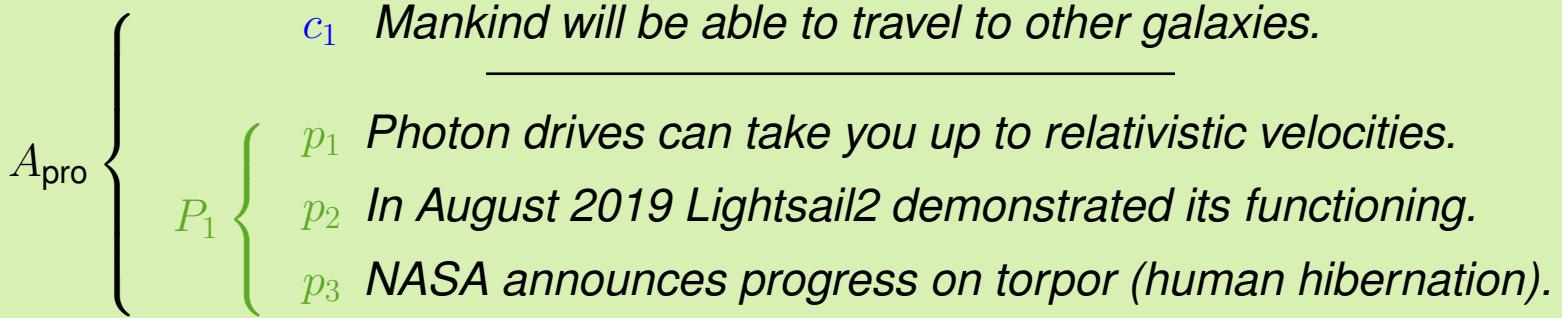
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Argument Retrieval Problems

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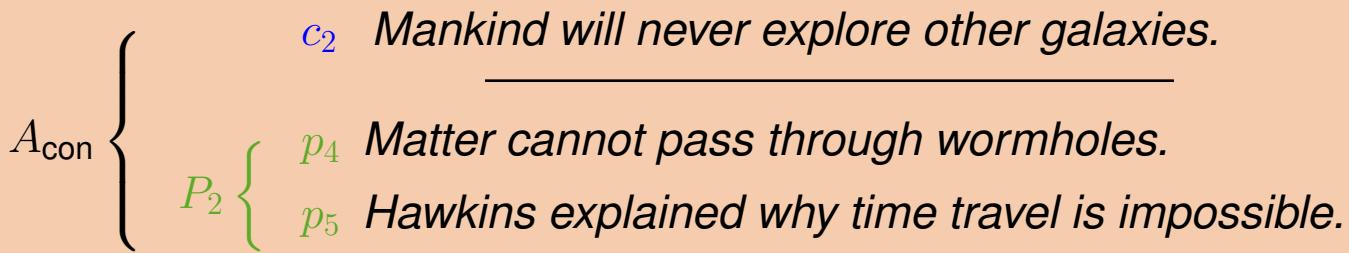
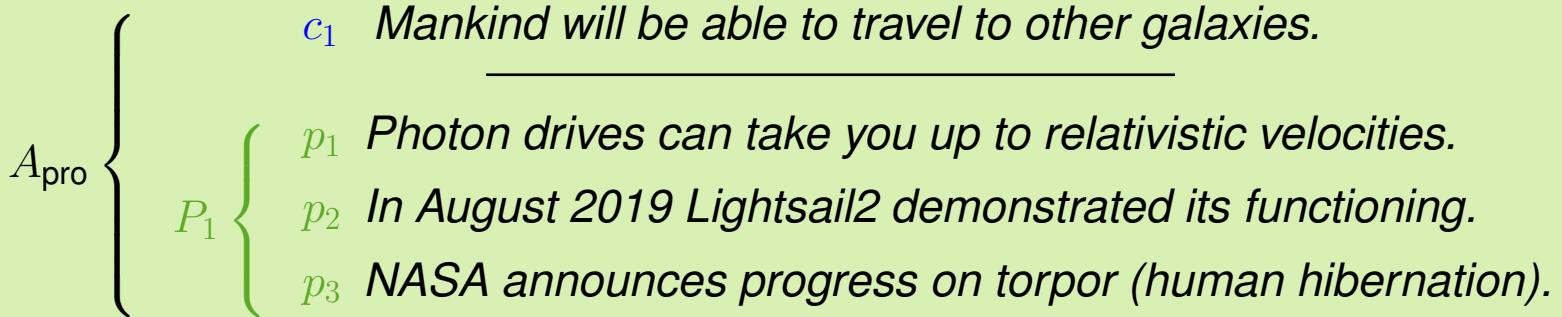
Note: $c_1 \succ t$

- “ c_1 supports t ” (entailment in a cogent, nonobligatory sense)
- “ t is compatible with c_1 ” (but the real argumentation focus)

Argument Retrieval Problems

Basic Argument Model

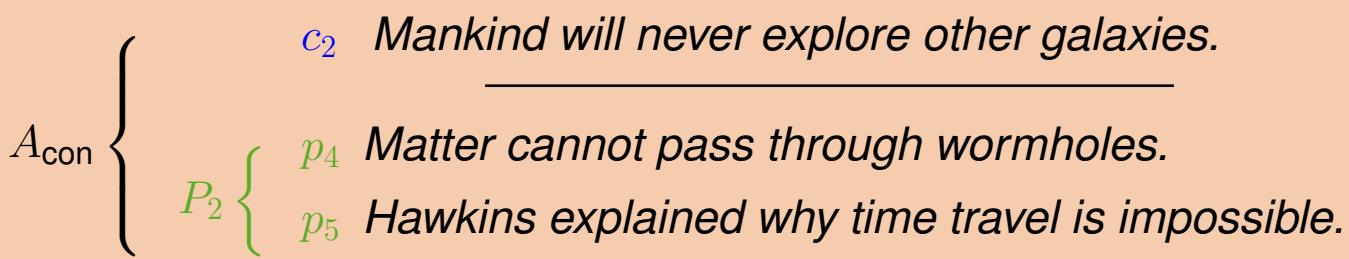
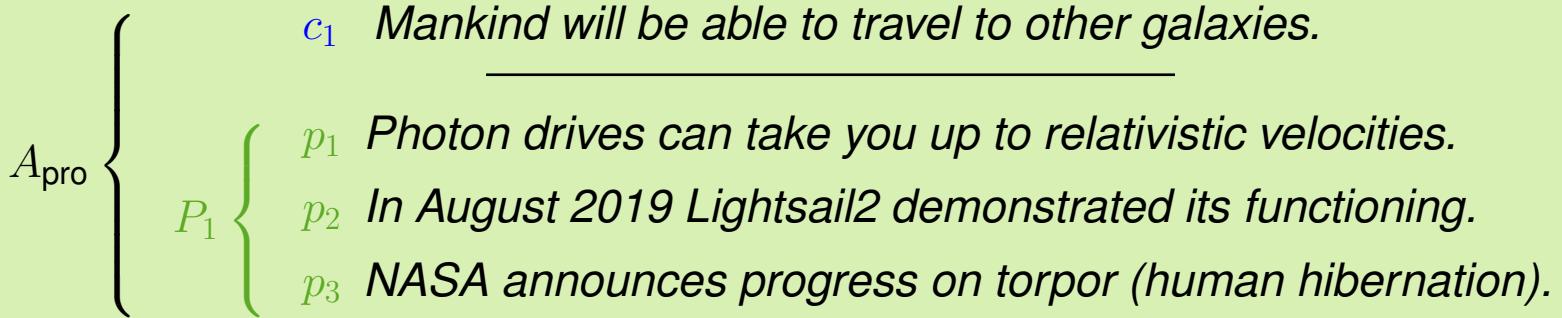
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Argument Retrieval Problems

Basic Argument Model

Thesis / Major claim t *Human beings will colonize other planets.*



- The standard interpretation \mathcal{I} of all propositions, t , c_i , p_j , is 1 (true).

Note:

- $c_1 \approx \neg c_2$ “ $\neg c_2$ is a paraphrase of c_1 ”
⇒ c_2 can be expressed as c_1 with opposite truth assignment, $\mathcal{I}(c_1) = 0$, $\mathcal{I}(c_2) = 1$

Argument Retrieval Problems

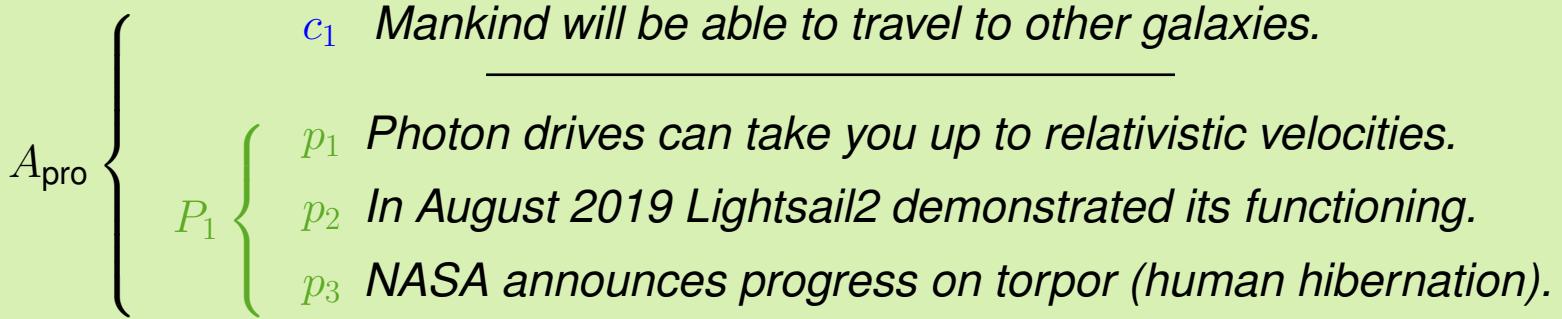
(1) Argument Relevance Π_{rel}

Query *Will human beings colonize other planets?*

Argument Retrieval Problems

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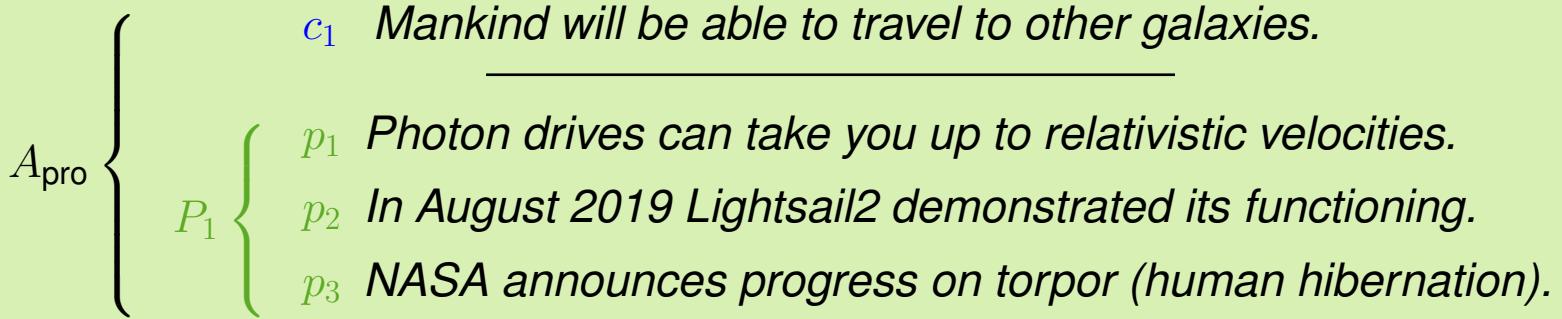
Given in Π_{rel} :

- information need, expressed as query, $q \in Q$
- set of arguments, $\mathbf{A} = \{(c_1, P_1), (c_2, P_2), \dots, (c_n, P_n)\}$
- * (possibly hidden) human selection of the relevant arguments, $\mathbf{A}_q^*, q \in Q$

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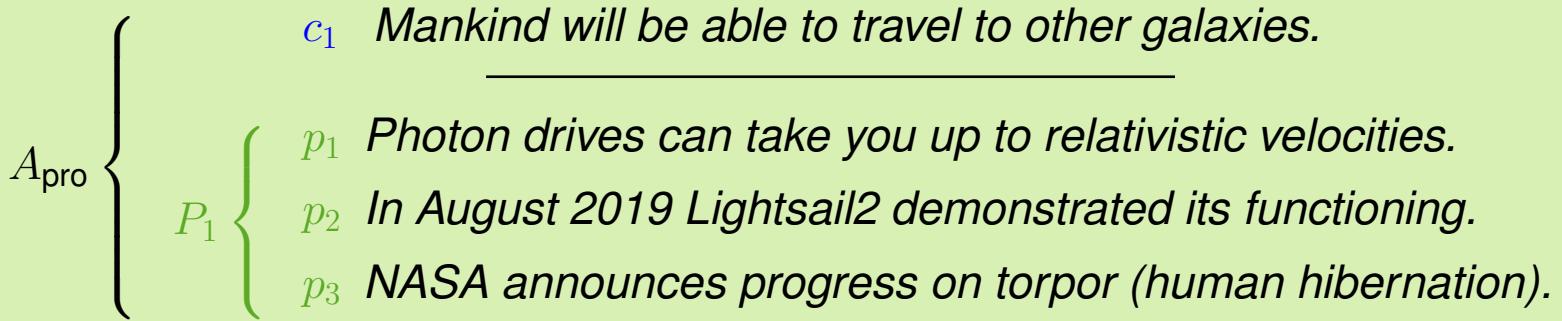
Sought in Π_{rel} :

- a relevance function $\rho : Q \times \mathbf{A} \rightarrow \{0, 1\}$, such that ...
the macro-averaged F -measure (precision, recall) regarding $\mathbf{A}_q^*, q \in Q$, is maximum

Argument Retrieval Problems

(2) Argument Ranking Π_{rank}

Query *Will human beings colonize other planets?*



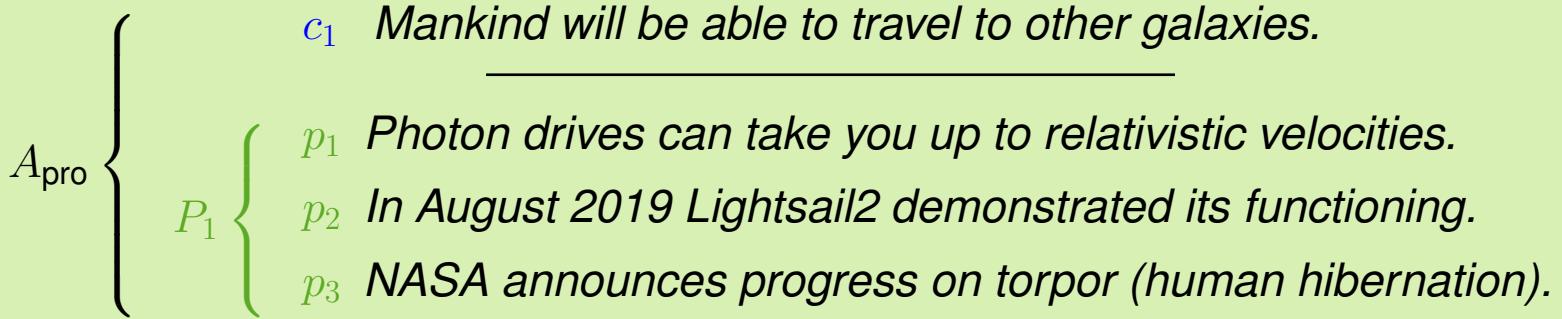
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- * (possibly hidden) human ranking of the relevant arguments, $\pi_{\mathbf{A}_q}^*, q \in Q$

Argument Retrieval Problems

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- * (possibly hidden) human ranking of the relevant arguments, $\pi_{\mathbf{A}_q}^*, q \in Q$

Sought in Π_{rank} :

- a ranking function $\sigma : Q \times \mathcal{P}(\mathbf{A}) \rightarrow \Pi$, such that ...
the mean rank correlation $\bar{\tau}$ regarding $\pi_{\mathbf{A}_q}^*$, $q \in Q$, is maximum

Argument Retrieval Problems

(3) – (6) Further Problems

3. Π_{counter} Retrieve the “best” counterargument

Given: query q , argument set A , argument A

4. Π_{sameside} Retrieve (all) arguments with the same stance

Given: argument set A , argument A

5. Π_{argdoc} Is the document argumentative?

Given: document d

6. Π_{argquery} Is the query argumentative?

Given: query q

Argument Retrieval Problems

(3) – (6) Further Problems

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Given: query q

Notes:

- ❑ Π_{counter} can be cast as Π_{rank} if the query is negated.
- ❑ Π_{docquery} and Π_{argquery} are decision problems.
- ❑ Π_{counter} and Π_{sameside} can be cast as decision problems as well.
- ❑ Challenge: development of **domain-independent** or “topic-agnostic” approaches.

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Argument Ranking I

args

All Discussions People Pro vs. con view 9238 arguments retrieved in 1.0ms

PRO

[Abortion is the ending of pregnancy by the removal or...](#)

► Show full argument
Abortion is the ending of pregnancy by the removal or forcing out from the womb of a fetus or embryo before it is able to survive on its own. An **abortion** can occur spontaneously, in which ...
<https://www.debate.org/debates/abortion/350/> score ▾

[Great, another forfeiter. As someone who has debated...](#)

► Show full argument
Great, another forfeiter. As someone who has debated **abortion** before, I will put a link to my original **abortion** debate right here: <http://www.debate.org...> I will be using arguments that ...
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[This should be fun :\) The legalisation of abortion has...](#)

► Show full argument
This should be fun :) The legalisation of **abortion** has been a big issue worldwide for a long period of time, not only politically but also on social and religious fronts. **Abortion** can be ...
<https://www.debate.org/debates/Abortion/156/> score ▾

[There are many good and bad sides to abortion. But just...](#)

► Show full argument
There are many good and bad sides to **abortion**. But just like everything, there is no black and white. Just a whole range of gray. **Abortion** is one way that poverty can decrease. Most unplanned ...
<https://www.debate.org/debates/Abortion/741/> score ▾

[Although I oppose abortion in most cases, I accepted this...](#)

► Show full argument
Although I oppose **abortion** in most cases, I accepted this debate because Con's position is that **abortion** "can never be justified regardless of circumstances." That is the point I want to ...
<https://www.debate.org/debates/abortion/309/> score ▾

[Abortion is needed to control the population so that the...](#)

► Show full argument
Abortion is needed to control the population so that the population doesn't get too excess. By the 22 century, the population estimated to be 11.2 billion people and if **abortion** were illegal, ...
<https://www.debate.org/debates/Abortion/543/> score ▾

CON

[In 2011 there were about 730,322 abortions reported to...](#)

► Show full argument
In 2011 there were about 730,322 abortions reported to the centers for disease control. There are about 1.7% of **abortion** of women's ages from 15-44 each year. Women who already had **abortion** ...
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[The greatest destroyer of peace is abortion because if a...](#)

► Show full argument
"The greatest destroyer of peace is **abortion** because if a mother can kill her own child, what is left for me to kill you and you to kill me? There is nothing between," says Mother Teresa ...
<https://www.debate.org/debates/Abortion/507/> score ▾

[Yes the government has the obligation to protect the...](#)

► Show full argument
Yes the government has the obligation to protect the rights of people, in general. Women have a right to decide whether and when to become a parent. But not **abortion**. It's an ending life ...
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Argument Ranking I

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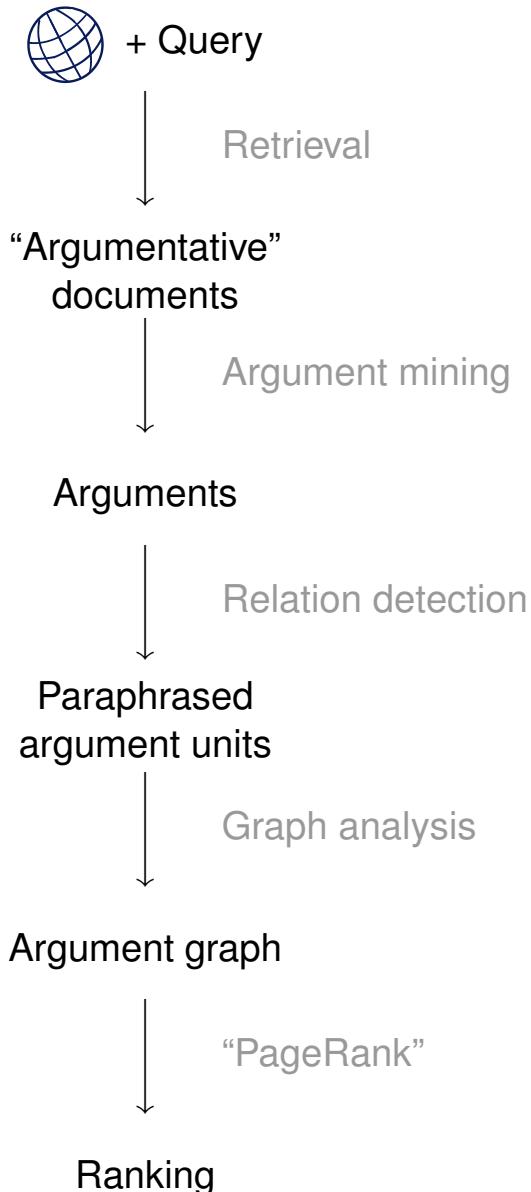
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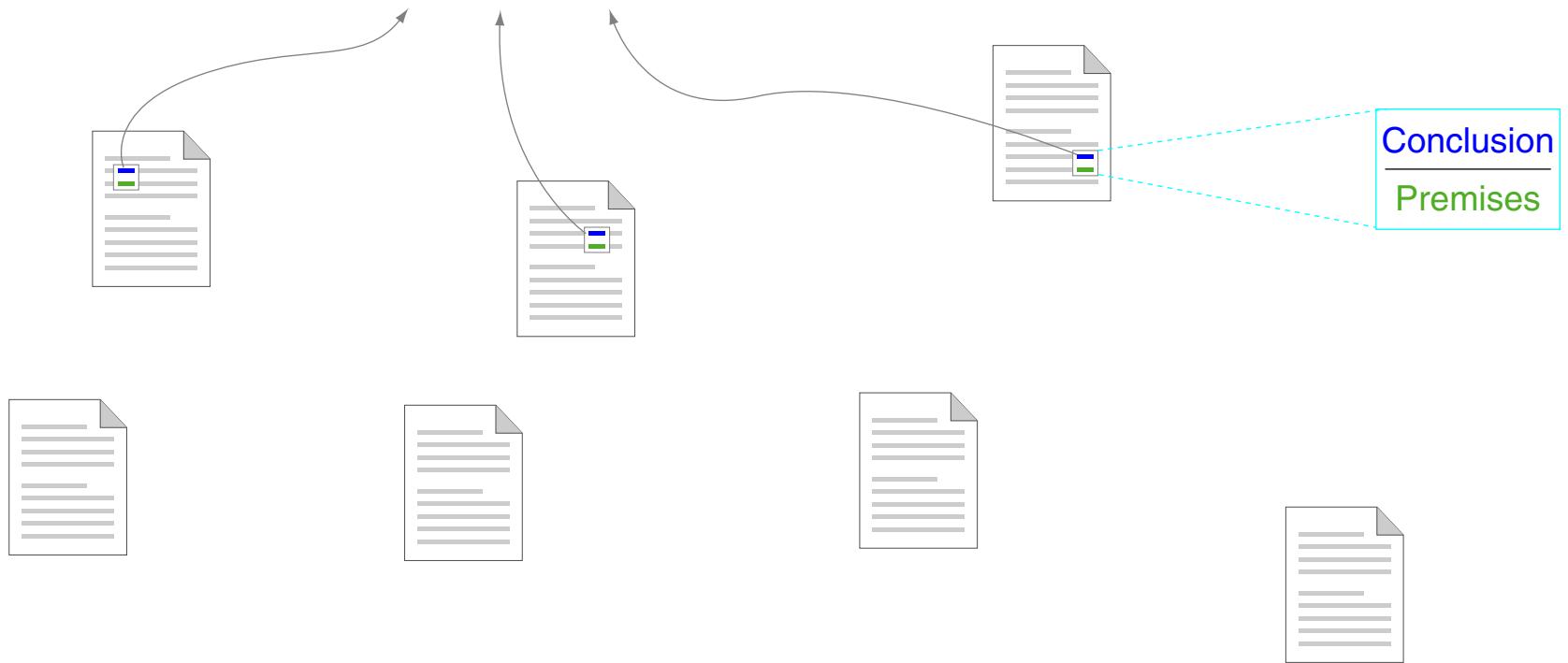


Argument Ranking I

Query *Reintroduce death penalty?*

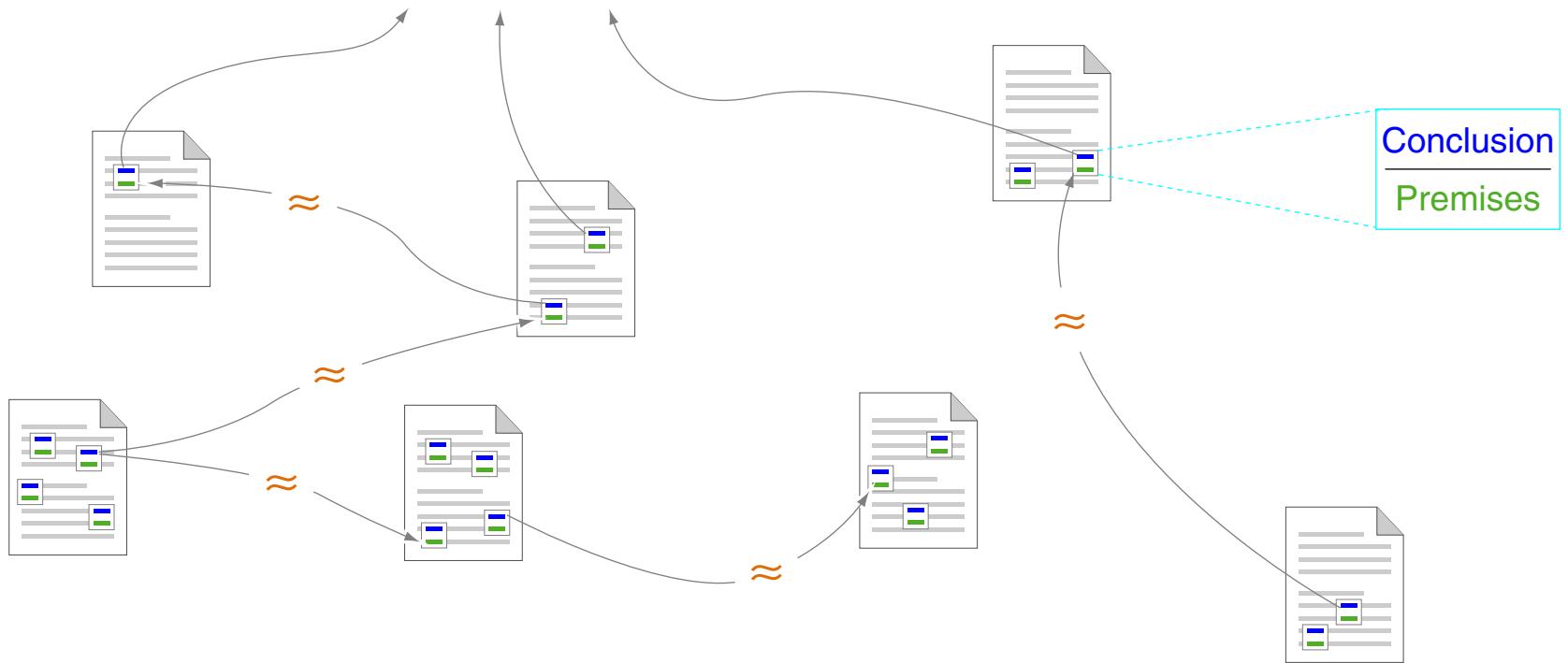
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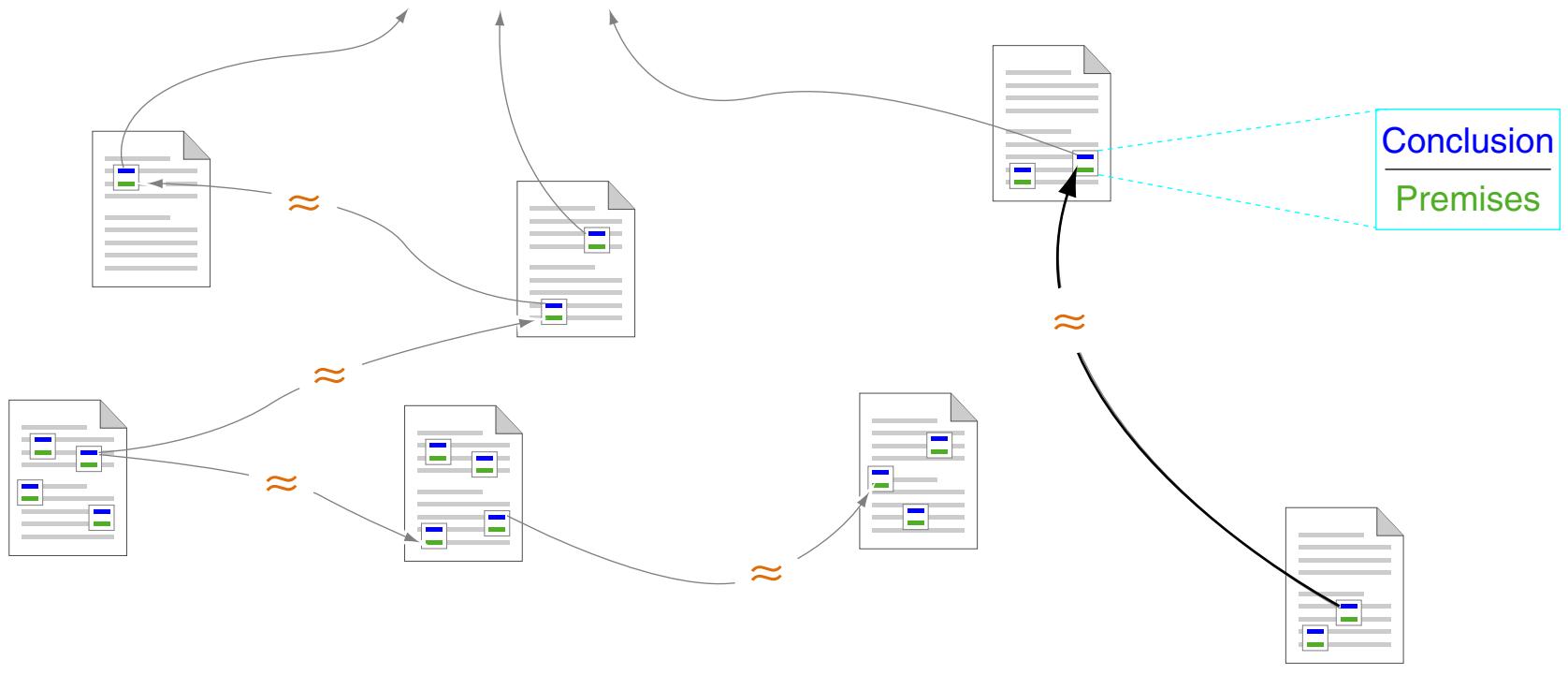
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Death penalty should be abolished.

It does not prevent people from committing crimes.

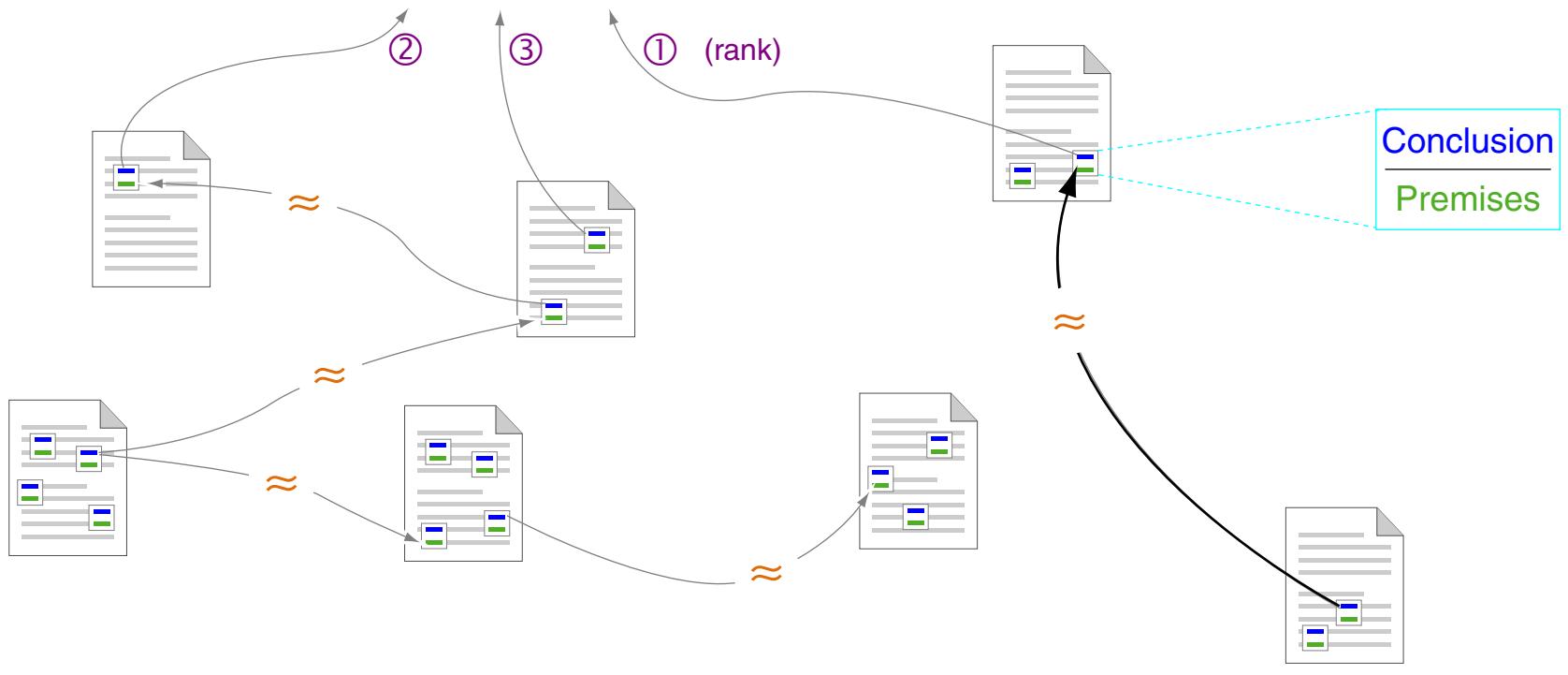


The death penalty doesn't deter people from committing serious violent crimes.

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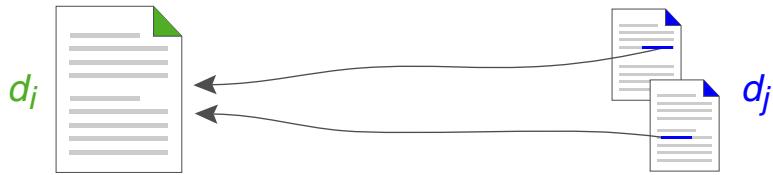
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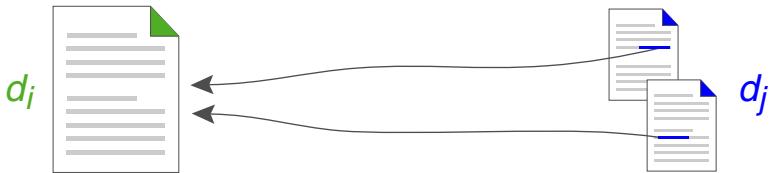
$$p(d_i) = (1 - \alpha) \cdot \frac{1}{|D|} + \alpha \cdot \sum_j \frac{p(d_j)}{|D_j|}$$

Original PageRank [Page et al. 1999]



Argument Ranking I

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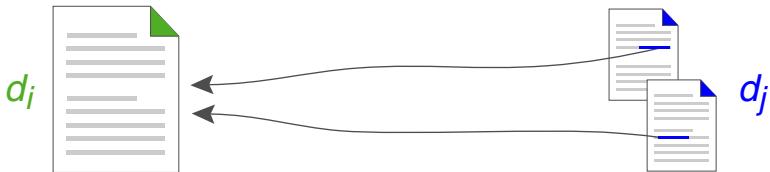


Original PageRank [Page et al. 1999]

1. ground relevance + recursive relevance

Argument Ranking I

$$p(d_i) = (1 - \alpha) \cdot \frac{1}{|D|} + \alpha \cdot \sum_j \frac{p(d_j)}{|D_j|}$$

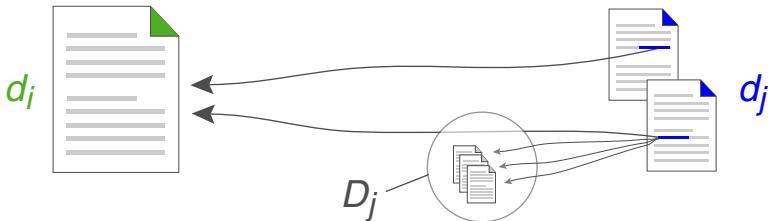


Original PageRank [Page et al. 1999]

1. ground relevance + recursive relevance
2. d_j links to $d_i \rightsquigarrow$ increase $\text{PageRank}(d_i)$

Argument Ranking I

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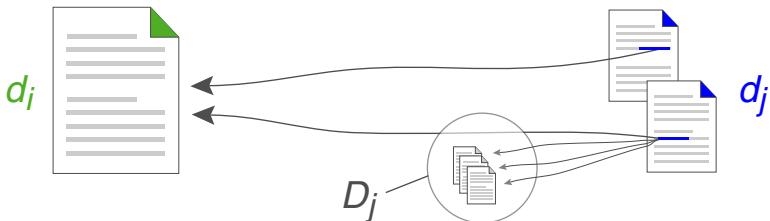


Original PageRank [Page et al. 1999]

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2. d_j links to $d_i \rightsquigarrow$ increase $\text{PageRank}(d_i)$
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Argument Ranking I

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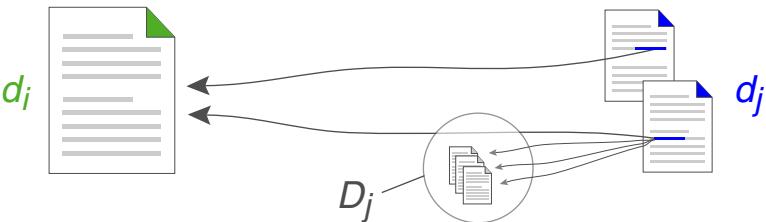


Original PageRank [Page et al. 1999]

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4. uniform ground relevances (sum to 1)

Argument Ranking I

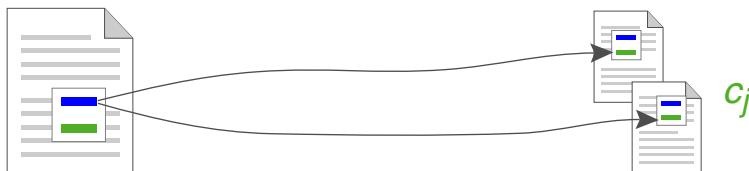
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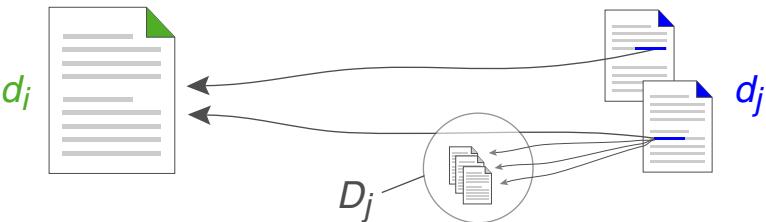
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ArgRank [Wachmuth/Stein, 2017]

Argument Ranking I

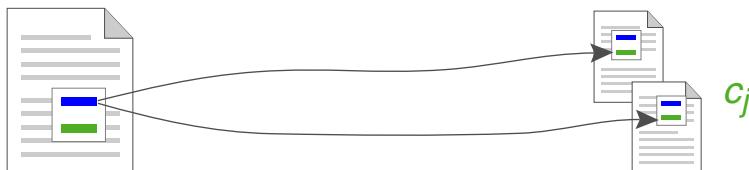
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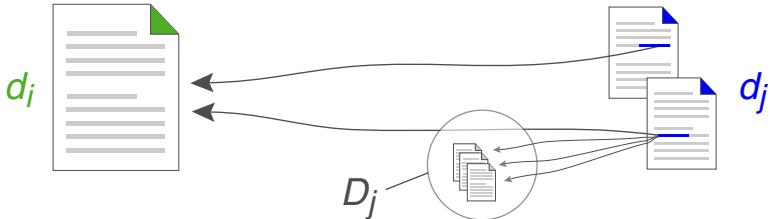


ArgRank [Wachmuth/Stein, 2017]

1. ground strength + recursive relevance

Argument Ranking I

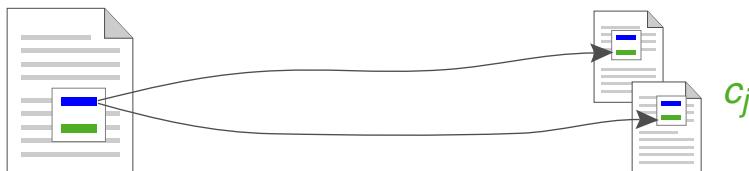
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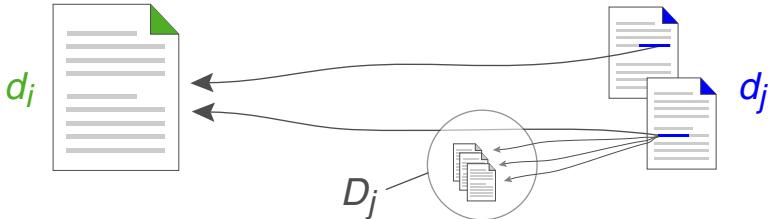


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Argument Ranking I

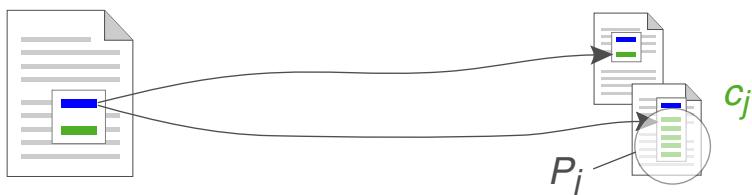
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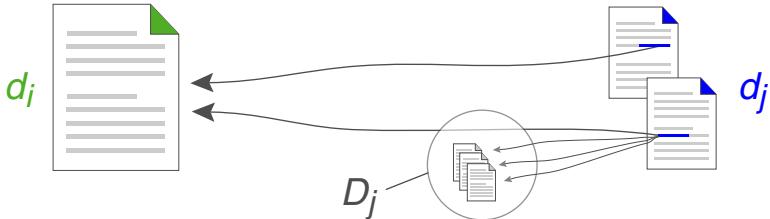


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Argument Ranking I

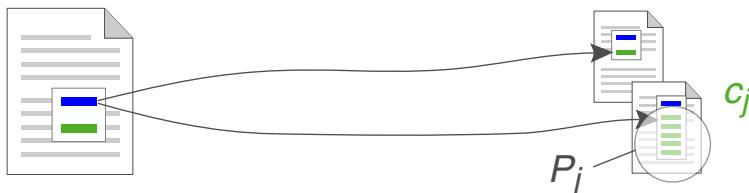
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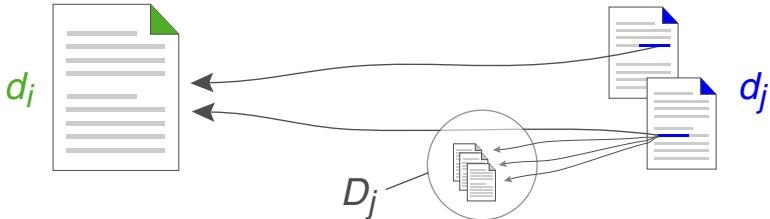


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4. ground strength \sim PageRank

Argument Ranking I

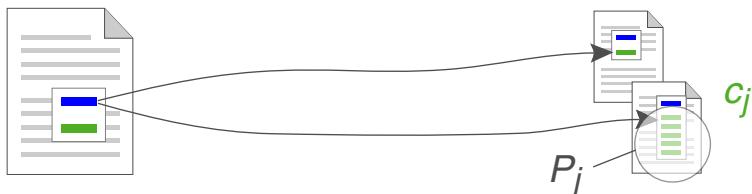
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ArgRank [Wachmuth/Stein, 2017]

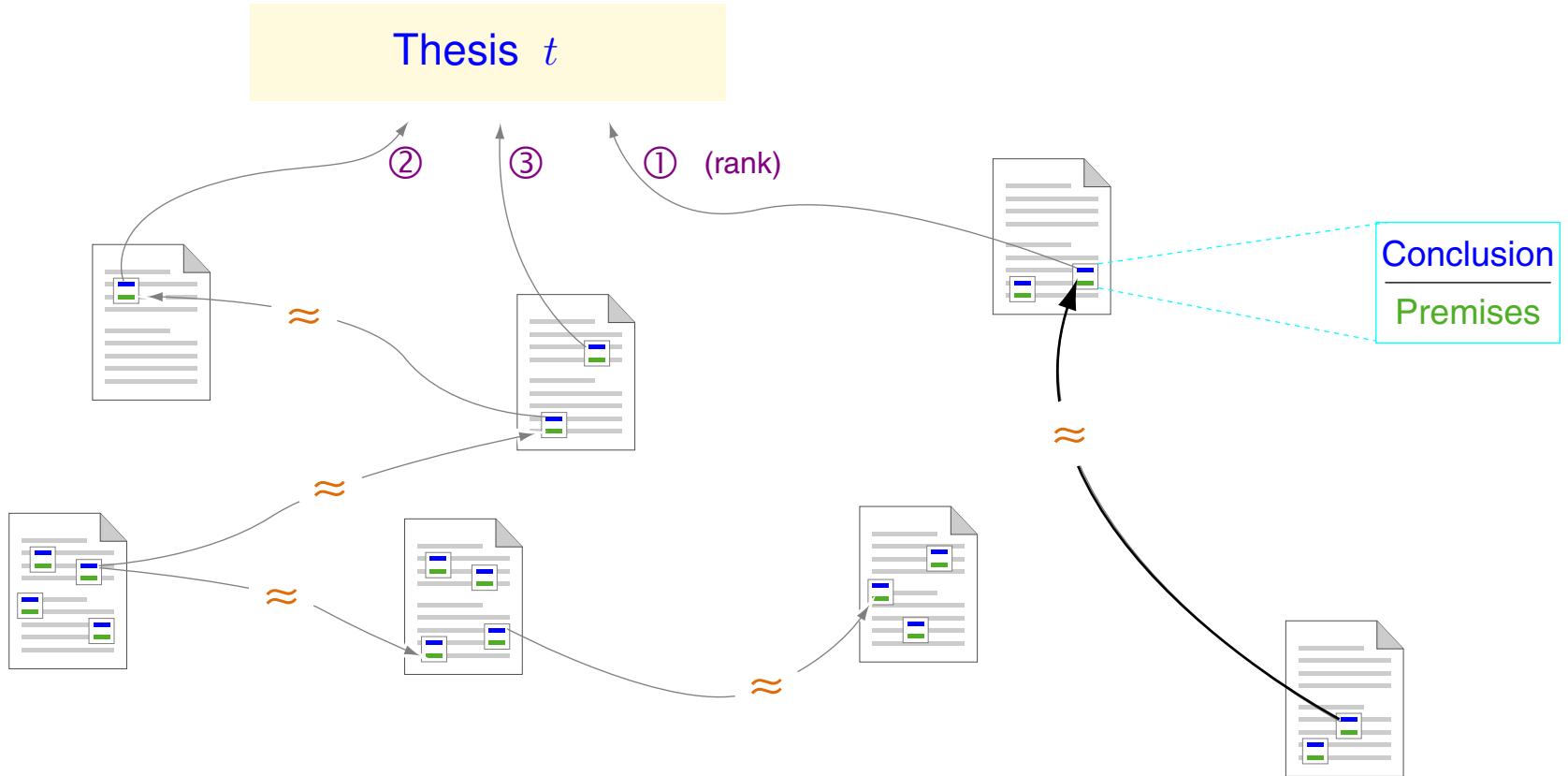
1. ground strength + recursive relevance
2. c_i premise for $c_j \rightsquigarrow$ increase $\text{ArgRank}(c_i)$
3. reward exclusive premises
4. ground strength \sim PageRank

“Reversal of Evidence”

PageRank: Author cannot enforce links to her web page.
ArgRank: Author cannot enforce use of her argument.

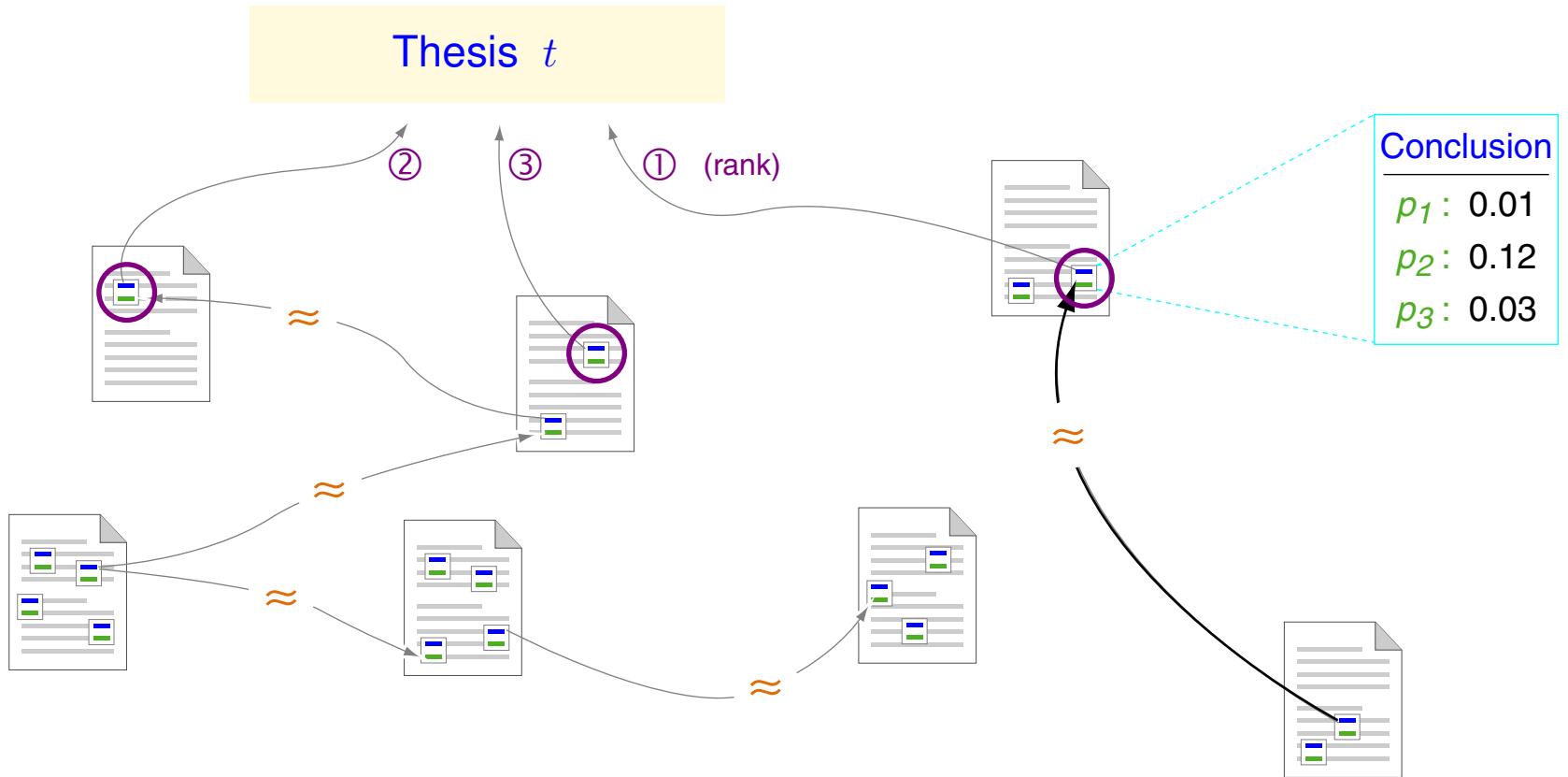
Argument Ranking I

From Premise Scores to Argument Ranks



Argument Ranking I

From Premise Scores to Argument Ranks



How to weigh the premise scores of the matching arguments?
(maximum, average, etc.)

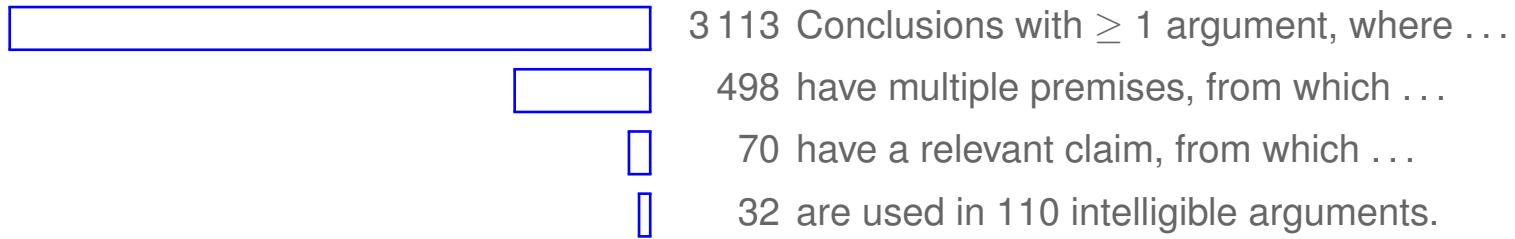
Argument Ranking I

Case Study: Graph Construction

Construction of a raw graph using 57 corpora from the [Argument Web](#):



Processing steps towards an argument graph:



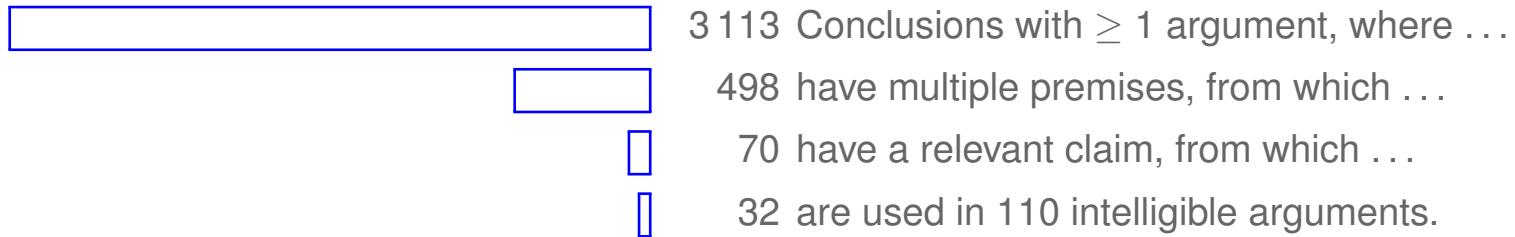
Argument Ranking I

Case Study: Graph Construction

Construction of a raw graph using 57 corpora from the [Argument Web](#):



Processing steps towards an argument graph:



Acquisition of a ranking ground truth:

- 7 experts from NLP and IR ranked all arguments (110) for each conclusion (32)
- $\tau = 0.59$ as highest agreement between two experts (mean: $\tau = 0.36$)

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 1: An argument's relevance corresponds to the ArgRank of its premises.

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 2: An argument's relevance corresponds to the frequency of its premises in the graph.

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 3: An argument's relevance corresponds to the Jaccard similarity of its premises to its conclusion.

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 4: An argument's relevance corresponds to the positivity of its words in the premises according to SentiWordNet.

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 5: An argument's relevance corresponds to its number of premises.

Argument Ranking I

Case Study: Results

Ranking approach	Premise score computation				
	Minimum	Average	Maximum	Sum	Best
1. PageRank	0.01	0.02	0.11	0.28	0.28
2. Frequency	-0.10	-0.03	-0.01	0.10	0.10
3. Similarity	-0.13	-0.05	0.01	0.02	0.02
4. Sentiment	0.01	0.11	0.12	0.12	0.12
5. Most premises	-	-	-	-	0.19
6. Random	-	-	-	-	0.00

Approach 6: The relevance is decided randomly.

Argument Ranking II

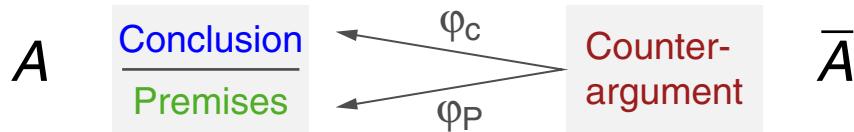
[idebate]

Argument Ranking II

[idebate]

Idea: Given an argument A , the best counterargument \bar{A}^* employs premises that are **similar wrt. topic**, but takes the **opposite stance**.

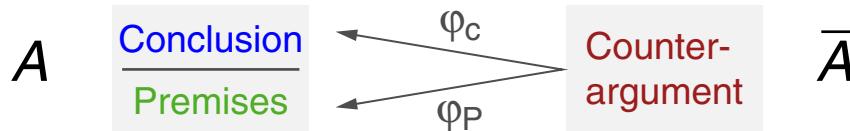
→ Consider both similarities to the premises and conclusion [Walton 2009] :



Argument Ranking II

Idea: Given an argument A , the best counterargument \bar{A}^* employs premises that are **similar wrt. topic**, but takes the **opposite stance**.

→ Consider both similarities to the premises and conclusion [Walton 2009] :



How to compute these similarities?

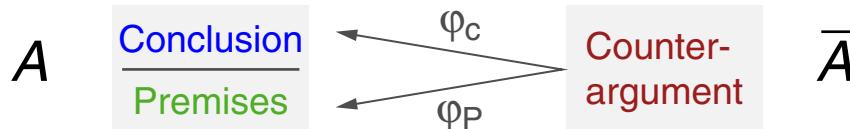
How to combine these similarities?

(= What is a sensible hypothesis space of promising model functions?)

Argument Ranking II

Idea: Given an argument A , the best counterargument \bar{A}^* employs premises that are **similar wrt. topic**, but takes the **opposite stance**.

→ Consider both similarities to the premises and conclusion [Walton 2009] :



Proposed model function to rank counterarguments [Wachsmuth et al., 2018] :

$$R(A, \bar{A}) = \alpha \cdot \underbrace{\left(\varphi_{\text{conclusion}} \circ \varphi_{\text{Premises}} \right)}_{\text{topic similarity} \rightarrow \max} - (1 - \alpha) \cdot \underbrace{\left(\varphi_{\text{conclusion}} \circ \varphi_{\text{Premises}} \right)}_{\text{stance similarity} \rightarrow \min}$$

where

φ combines both word and embedding similarities

$\circ \in \{\min, \max, +, *\}$

$\alpha \in [0; 1]$

Argument Ranking II

Corpus and Analysis

Theme	Debates	Points	Counters
Culture	46	278	278
Digital freedoms	48	341	341
Economy	95	590	588
:			
Sport	23	130	130
Σ	1069	6779	6753

Corpus:

- based on the [iDebate.org](#) portal
- Download: [ArguAna Counterargs](#)

Argument Ranking II

Corpus and Analysis

Theme	Debates	Points	Counters
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Corpus:

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- Download: [ArguAna Counterargs](#)

Retrieval experiments (selected results) :

Find the best counterargument within ...	True-to-false ratio	Accuracy*
all counters of the same debate	1 : 3	0.75
all counters of the same theme	1 : 136	0.54
all arguments of the entire portal	1 : 2800	0.32

* The parameters for $R(A, \bar{A})$ were determined by a systematic ranking analysis.

Chapter IR:XI

XI. IR Applications

- Web Technology
- Web Graph
- Web Crawling
- Web Archiving
- Web Content Extraction
- Near-duplicate Detection
- Link Analysis

- The Treachery of Answers
- Argument Retrieval Problems
- Argument Ranking I
- Argument Ranking II
- Argumentation-Related Resources
- Argument Search Engines
- Argument Search Evaluation

Argumentation-Related Resources



argüman

argument interchange

Home of the AIF: Infrastructure for the argument web

CreateDebate

TRUTH MAPPING



convince me
start a debate

ObViz



intelligence² DEBATES

Argumentation-Related Resources

Leverage effort*	Resource type	Examples
very low	Technology	
low	Corpora	
medium	Debate portals	
high	Discussion pages	
very high	Articles	

* Estimated effort / expertise to exploit a resource of the respective type within own research.

Argumentation-Related Resources

Leverage effort*	Resource type	Examples
very low	Technology	Visual inspection Acquisition, Tagging Argument Web Truthmapping
low	Corpora	
medium	Debate portals	
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Argumentation-Related Resources

Leverage effort*	Resource type	Examples
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Leverage effort*	Resource type	Examples
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Argumentation-Related Resources

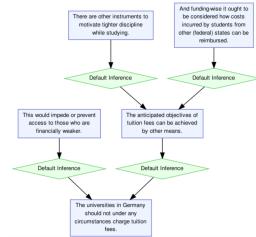
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high	Discussion pages	Focus on persuasion Controversial issues Focus on deliberation
very high	Articles	Editorials, Essays Legal Scientific publications

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Argumentation-Related Resources

The Argument Web [Library]

AlFdb Corpora



Structured argument data
in uniform format

AlFdb Search

tuition fees

Search

Tuition fees should not be charged in Germany.

The universities in Germany should not under any circumstances charge tuition fees.

The anticipated objectives of tuition fees can be achieved by other means.

Tuition fees should not generally be charged by universities.

Therefore universities should not charge tuition fees in Germany.

Show Argument Maps

Search interface
for argument resources

ARG-tech API

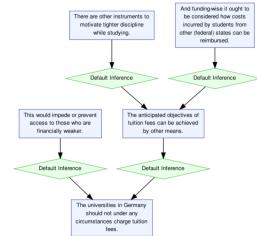
Fields	Type	Example	Notes
arguments	String Array	["A","B","C"]	
attack	String Array	["D,B","E,C"]	
entail	String	"Grounded"	One of: "grounded", "prefirmed", "stable", "semistable"

Several argument
web services

Argumentation-Related Resources

The Argument Web [Library]

AlFdb Corpora



Structured argument data
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AlFdb Search

Search interface
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ARG-tech API

Several argument
web services

Argublogging

Widget for argument
annotation in blogs

OVA

Online visualization and
analysis of arguments

Arvina

Dialogue platform
based on AlFdb

Argument Search Engines

Vision of Argument Search

🔍

About 1.480.000.000 results (0,43 seconds)

Is time travel possible? - NASA Space Place
<https://spaceplace.nasa.gov> › review › dr-marc-space › time-travel ▾
Time travel is one of my favorite topics! I wrote some time travel stories in junior high school that used a machine of my own invention to travel backwards in time, ...

People also ask

Is time travel backwards possible? ▾

Is time travel a paradox? ▾

Are wormholes possible? ▾

Can we travel close to the speed of light? ▾

Feedback

'We can build a real time machine' - BBC News - BBC.com
<https://www.bbc.com> › news › science-environment-44771942 ▾
Jul 11, 2018 - Travelling in time might sound like a flight of fancy, but some physicists think it might really be possible. BBC Horizon looked at some of the ...

Is Time Travel Possible?| Explore | physics.org
www.physics.org › article-questions ▾
Travelling forwards in time is surprisingly easy. Einstein's special theory of relativity, developed in 1905, shows that time passes at different rates for people who ...

Is time travel possible? | Tomorrow Today - The Science ... - DW
<https://www.dw.com> › is-time-travel-possible ▾
5 hours ago - This week's viewer question comes from Richard Mack'olo in Dar es Salaam, Tanzania.

Time travel - Wikipedia
<https://en.wikipedia.org> › wiki › Time_travel ▾

Argument Search Engines*

Vision of Argument Search

Arguments in future web search:

- support forming opinions
- make it easy to find relevant arguments
- deliberation: learn about other views
- education: learn to debate

Search results should ...

- rank the best arguments highest
- cover diverse aspects
- cover reliable and heterogeneous sources
- be up-to-the-minute
- be traceable and evaluable

Is time travel possible 🔍

About 1.480.000.000 results (0,43 seconds)

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<https://spaceplace.nasa.gov/review/dr-marc-space/time-travel> ▾
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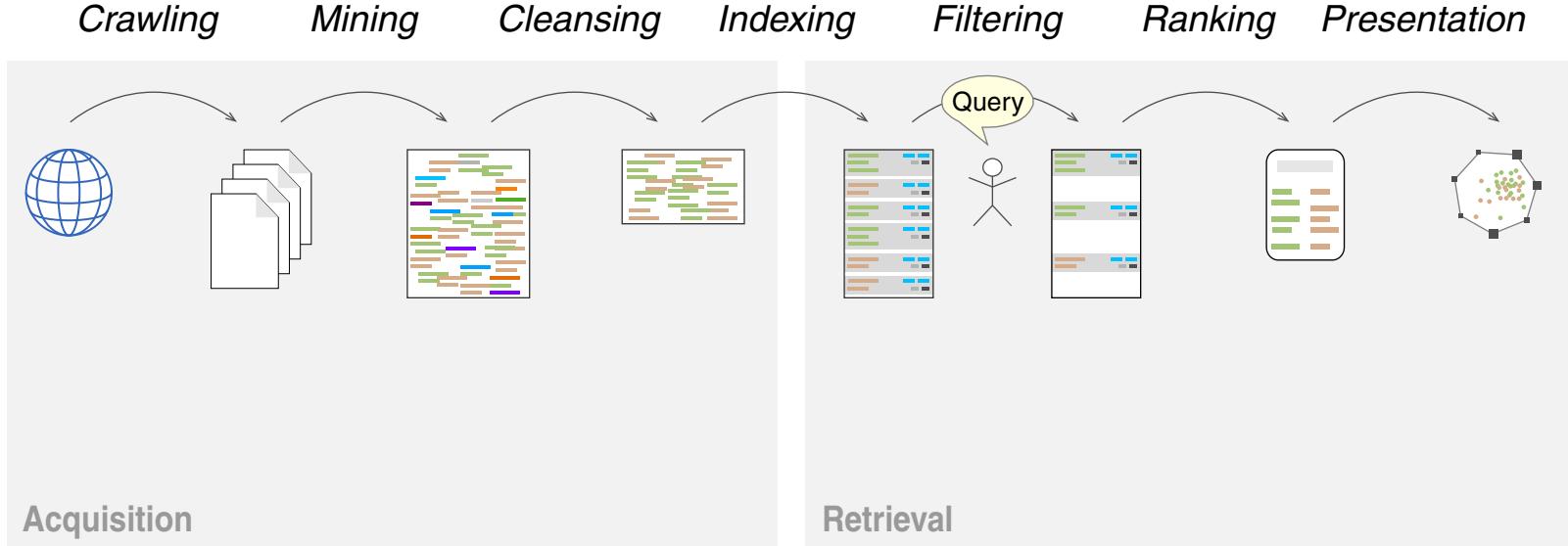
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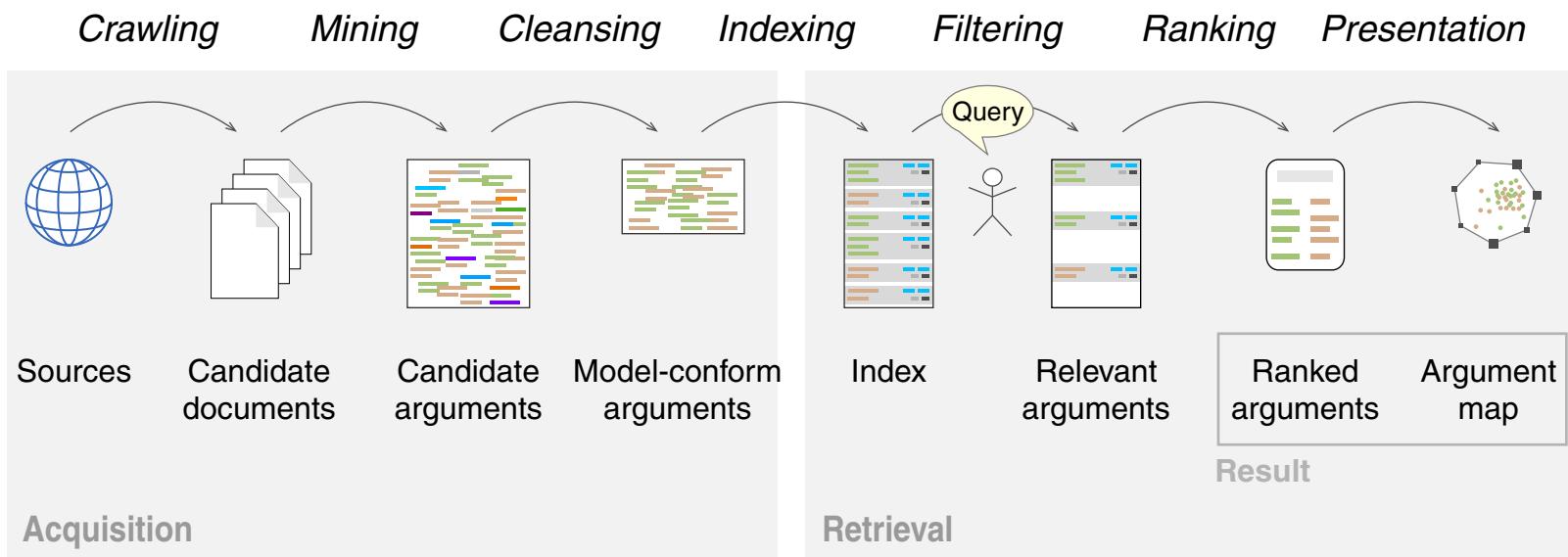
Argument Search Engines

Basic Elements and Process



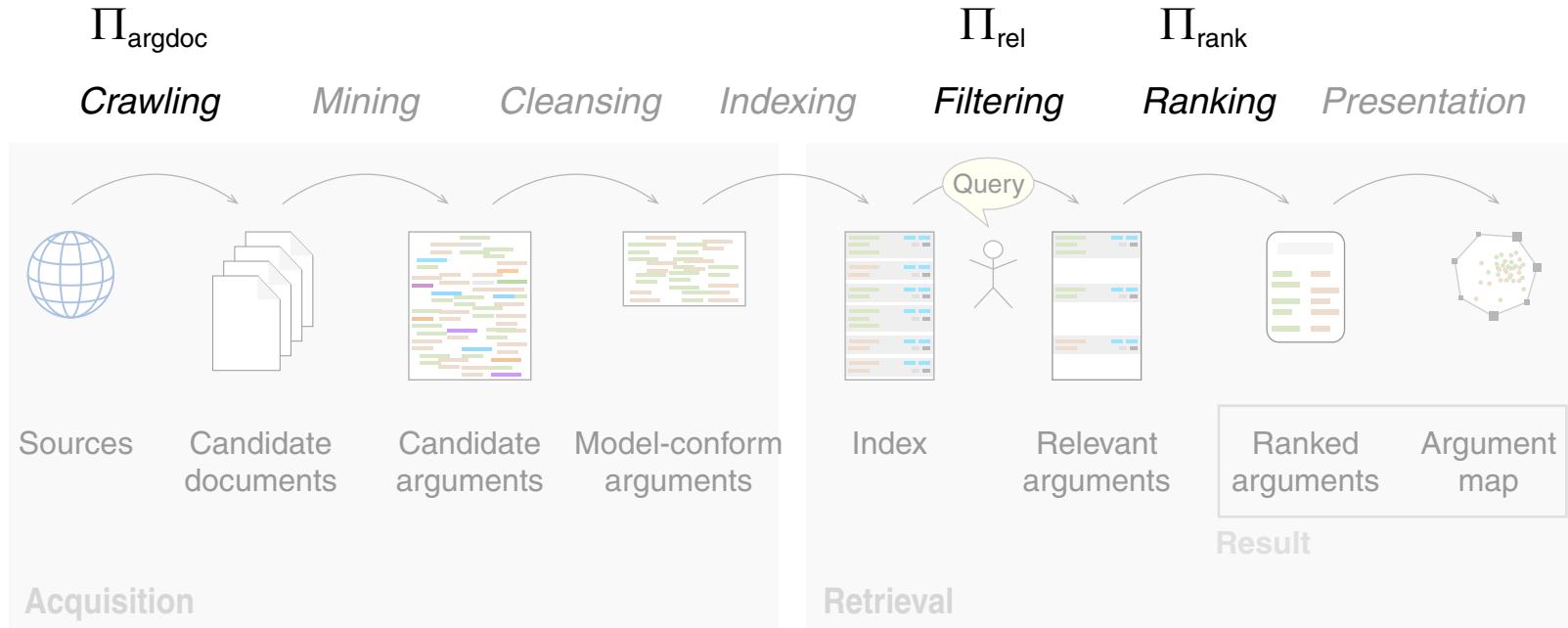
Argument Search Engines

Basic Elements and Process



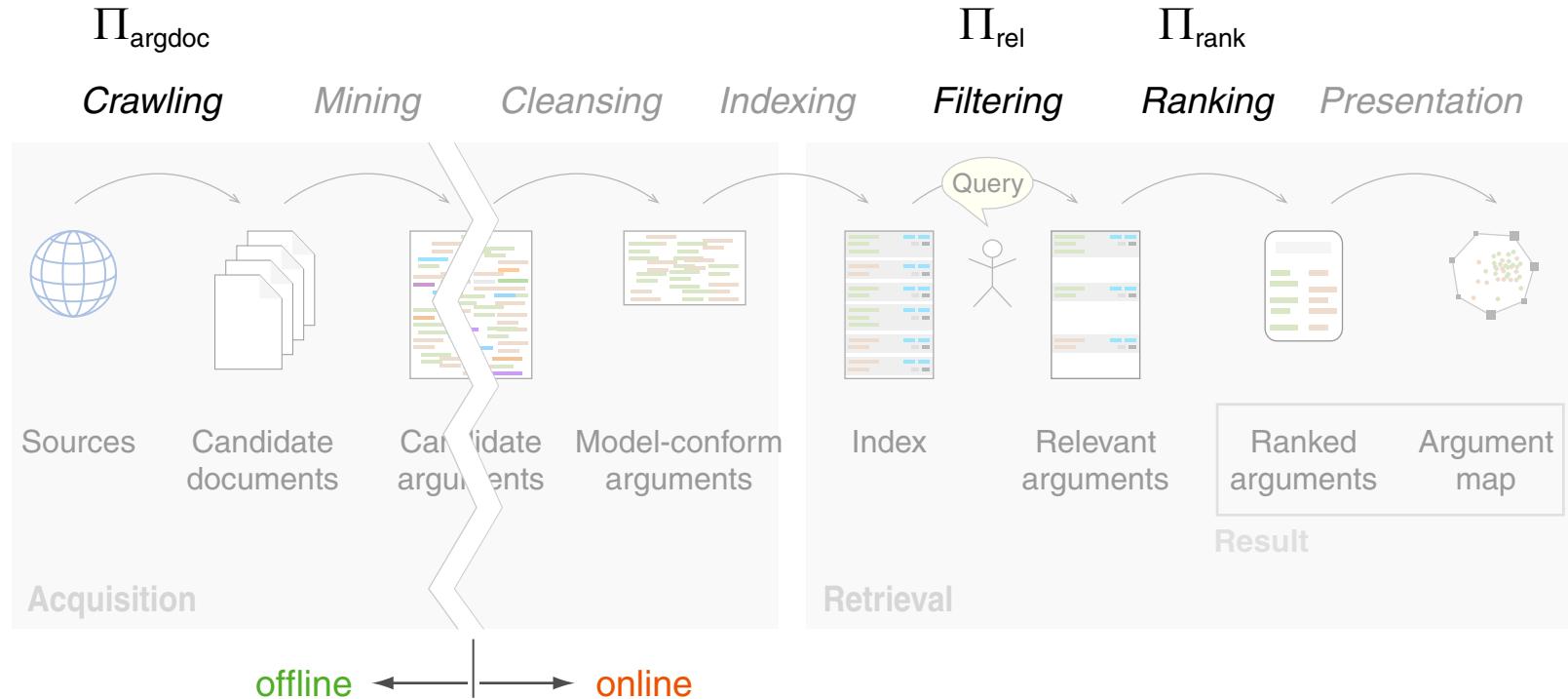
Argument Search Engines

Basic Elements and Process



Argument Search Engines

Basic Elements and Process



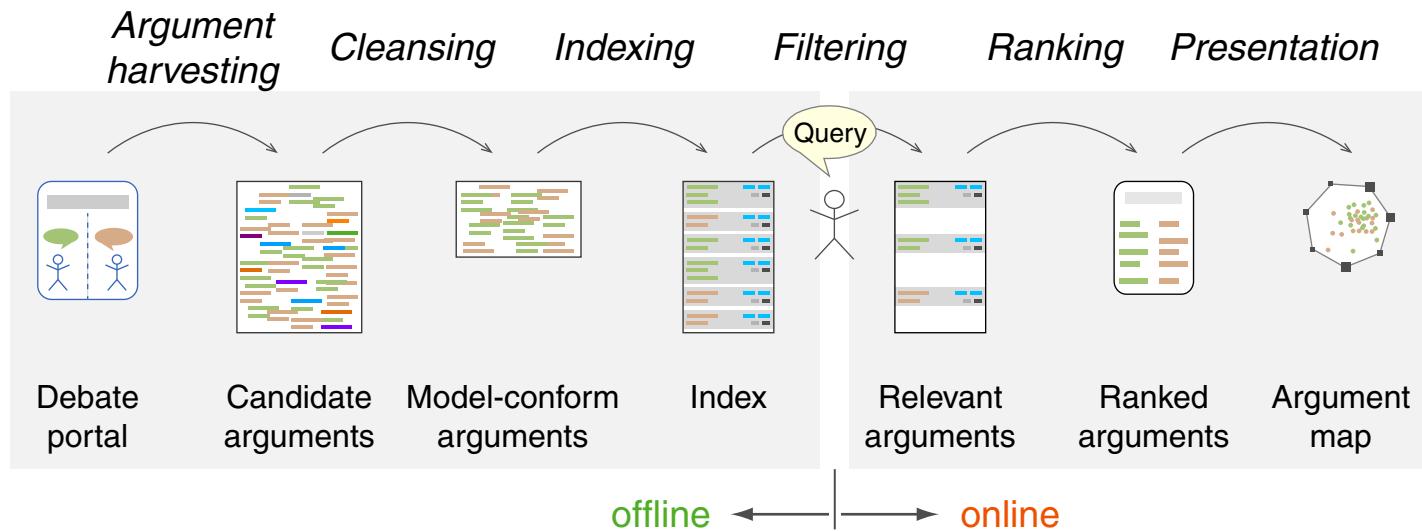
Acquisition paradigm [Ajjour et al., KI 2019] :

- ❑ distribution of processing steps regarding offline time and online time
- ❑ tradeoff between precision, recall, and topicality



Argument Search Engines

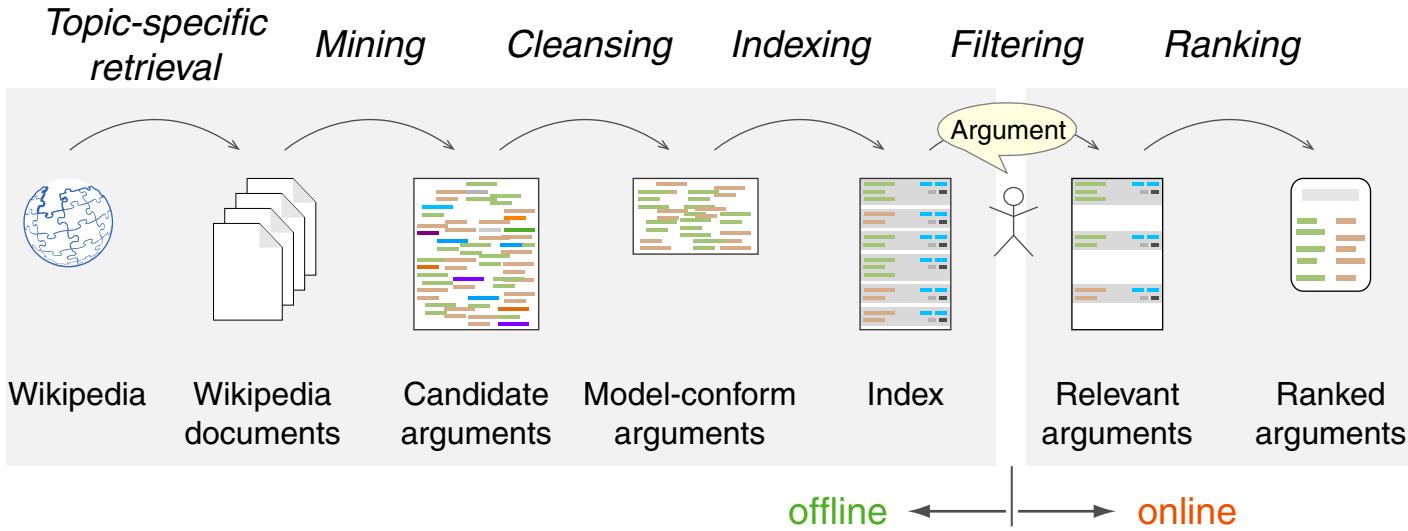
Acquisition Paradigms: (a) args.me [\[Demo\]](#)



- Research focus: argument ranking
- Supervision level: medium (distantly supervised)
- Effectiveness profile: high precision, low recall
- Stance balance: guaranteed
- Efficiency: high

Argument Search Engines

Acquisition Paradigms: (b) IBM Debater [Project]



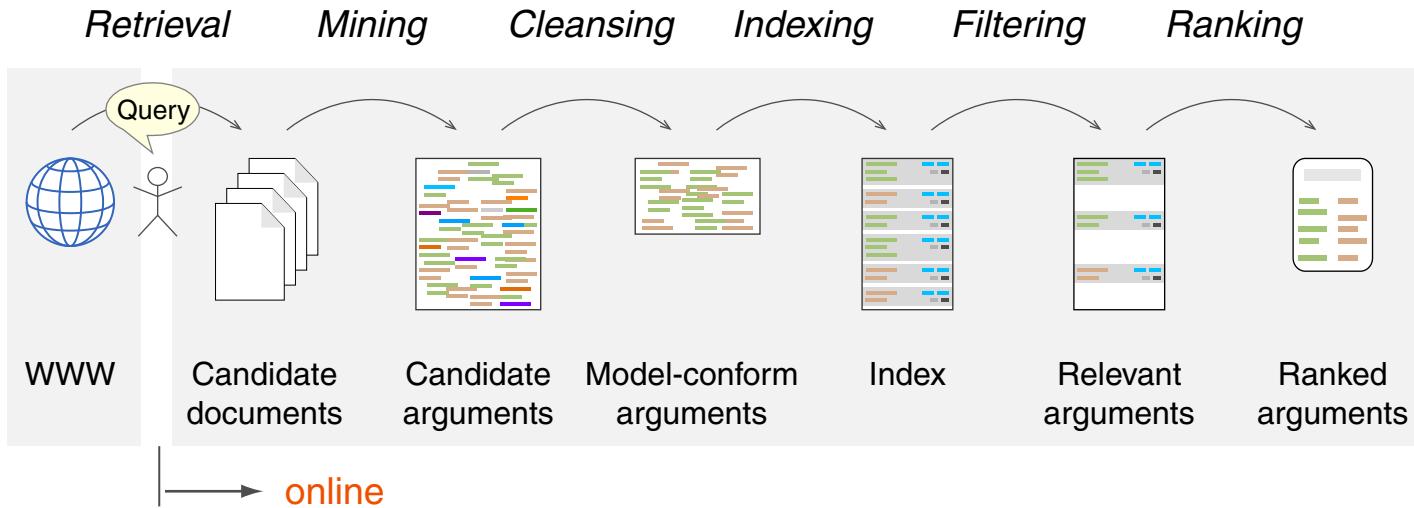
- Research focus: debating technology
- Supervision level: medium (recognized source)

- Effectiveness profile: high precision, high recall on topic
- Stance balance: guaranteed
- Efficiency: high



Argument Search Engines

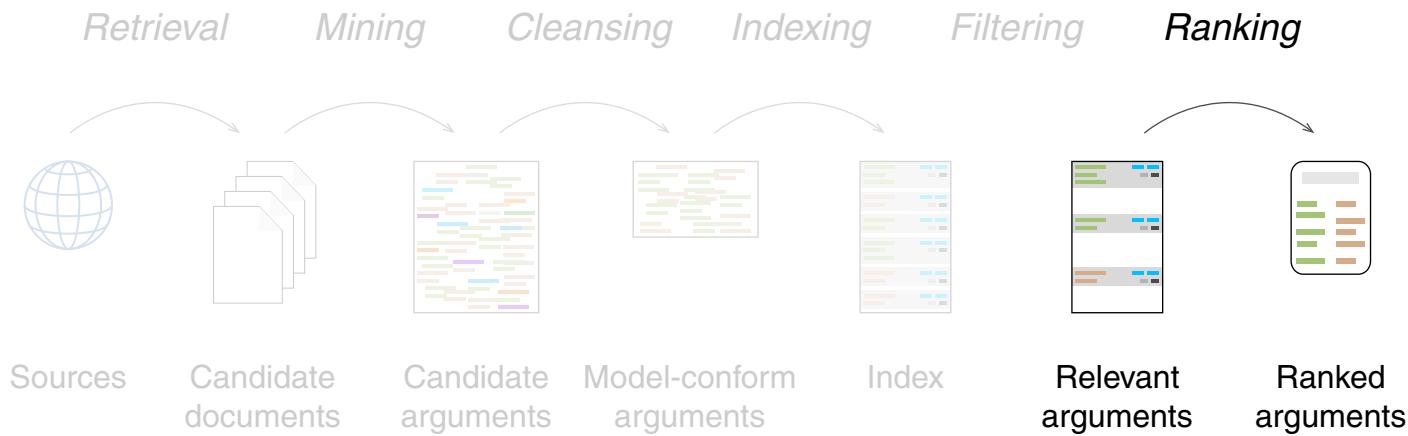
Acquisition Paradigms: (c) ArgumenText [\[Demo\]](#)



- Research focus: argument mining
- Supervision level: low
- Effectiveness profile: low precision, high recall
- Stance balance: cannot be guaranteed
- Efficiency: low

Argument Search Engines

Ranking Paradigms in IR

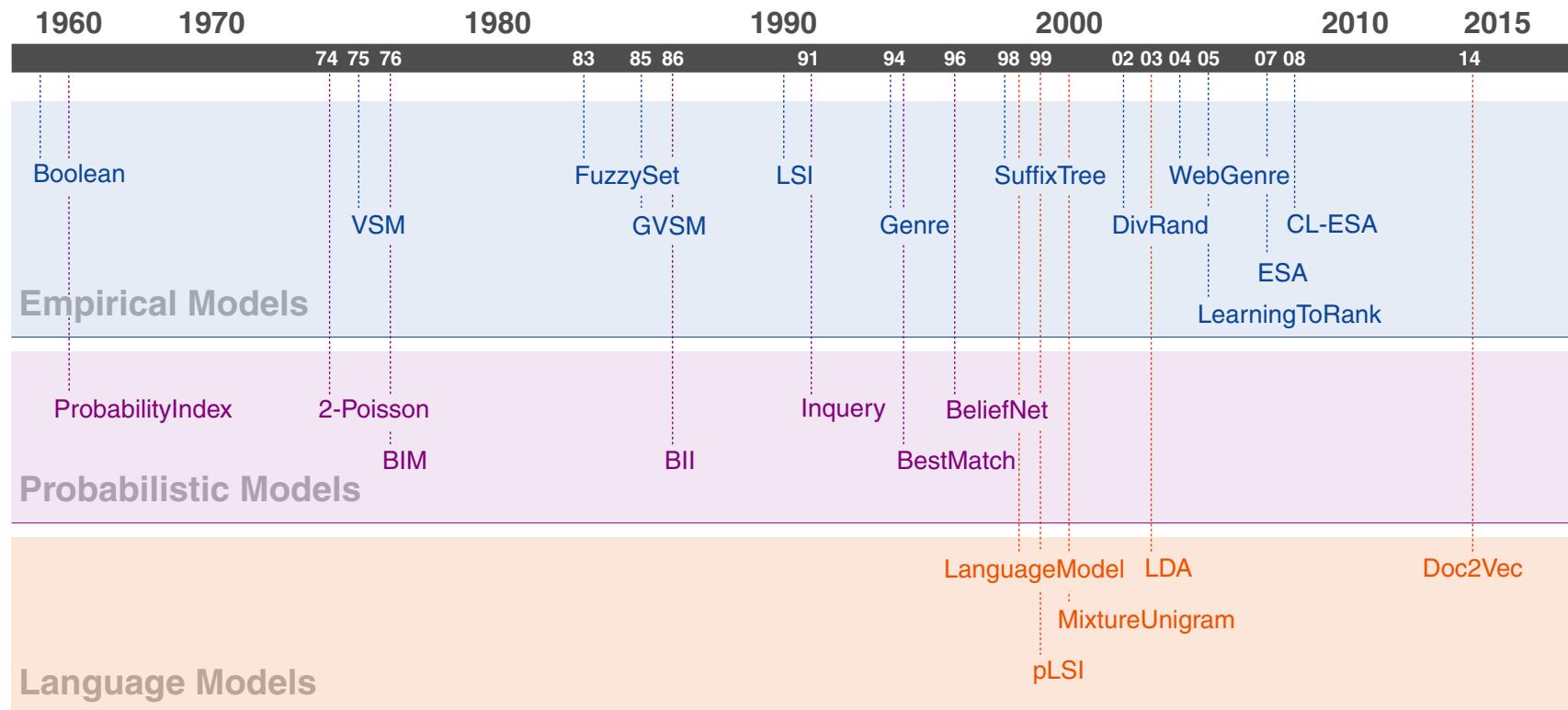


Designing a ranking algorithm:

- Analyze conclusions, premises, or both?
 - Use fulltext or elite terms only?
 - Exploit metadata and sentiment?
 - Analyze relations between arguments?
- ...

Argument Search Engines

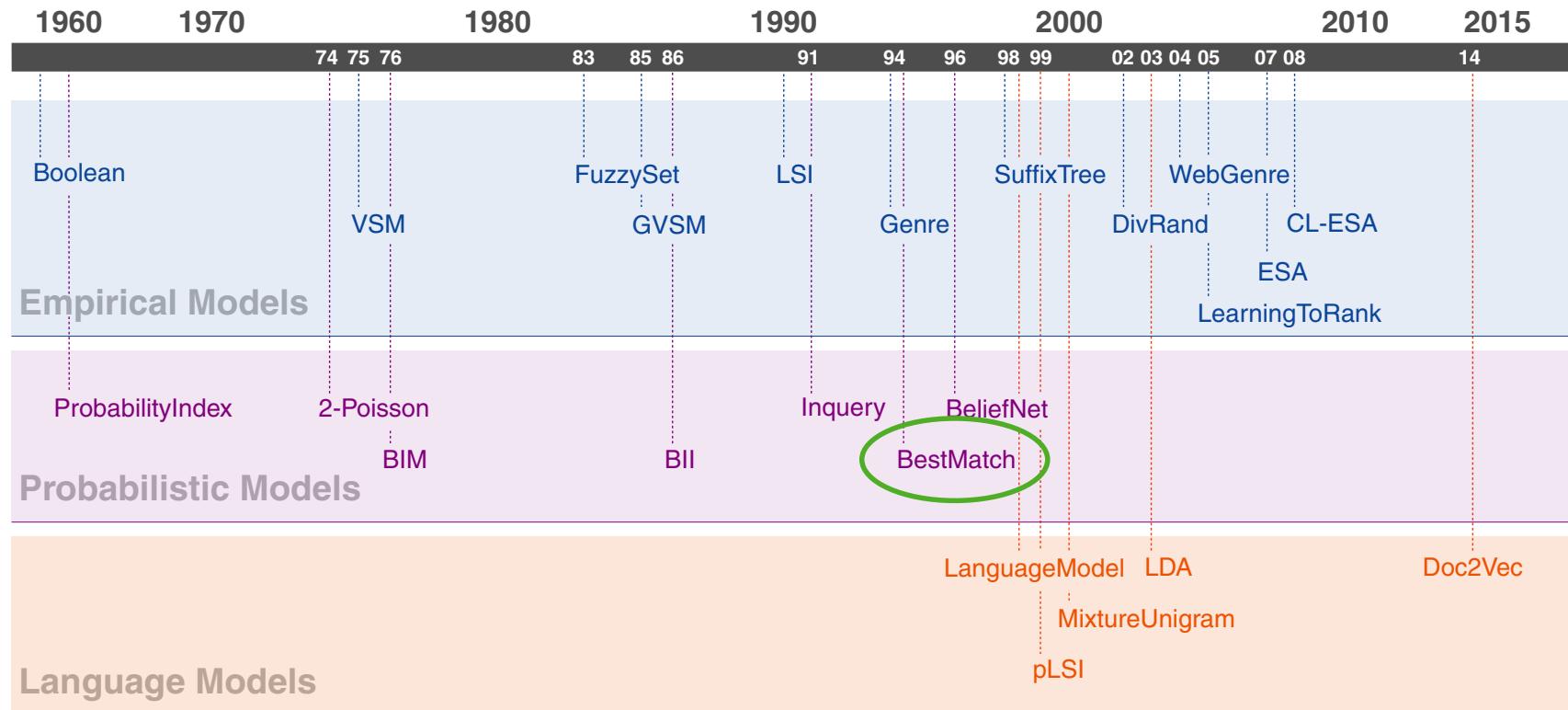
Ranking Paradigms in IR



[Stein et al., 2017]

Argument Search Engines

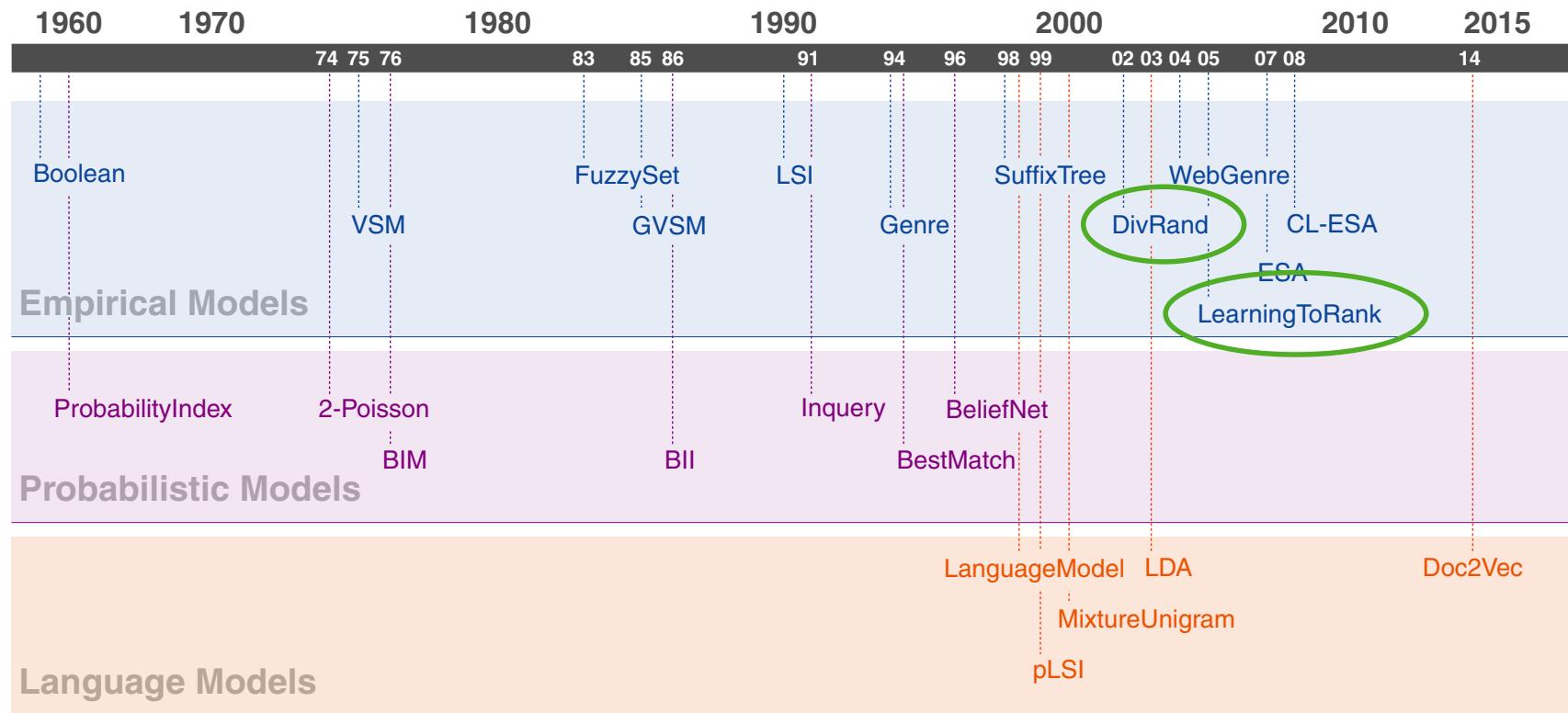
Ranking Paradigms in IR



$$\rho(q, A) \equiv \text{BM25}(q, A) = \sum_{i=1}^{|q|} \frac{\text{IDF}(t_i) \cdot \text{TF}(t_i, A) \cdot (k_1 + 1)}{\text{TF}(t_i, A) + k_1 \cdot \left(1 - b + b \cdot \frac{\text{LEN}(A)}{\text{avdl}}\right)}$$

Argument Search Engines

Ranking Paradigms in IR



- ❑ New research indicates that *Divergence from Randomness* and *Learning to Rank* are significantly more effective retrieval models to address Π_{rank} .
[Pottast et al., SIGIR 2019]

Argument Search Engines

More on args.me [\[args.me\]](#)

Argument sources:

#	Debate Portal	Argument Units	Arguments	Debates
1	idebate.org	16 084	15 384	698
2	debatepedia.org	34 536	33 684	751
3	debatewise.org	39 576	33 950	2 252
4	debate.org	210 340	182 198	28 045
5	forandagainst.com	29 255	26 224	3 038
Σ		329 791	291 440	34 784

Design decisions:

- Argument model: conclusion + 1 premise with stance information
- Query: free text phrase, interpreted as AND query
- Retrieval: exact matching against conclusion
- Ranking: BM25F based on conclusion (1.0), premise (0.5), and debate (0.2)

Argument Search Engines

More on args.me [\[args.me\]](#)

Top queries (Sep.'17 – Apr.'19) :

	Query	Absolute	Relative
1	climate change	251	3.5%
2	feminism	193	2.7%
3	abortion	158	2.2%
4	trump	146	2.0%
5	brexit	128	1.8%
6	death penalty	73	1.0%
7	google	58	0.8%
8	vegan	57	0.8%
9	nuclear energy	56	0.8%
10	donald trump	47	0.7%

Coverage of 1082 [Wikipedia controversial issues](#) :

- 78% match with ≥ 1 argument
- 42% match with ≥ 1 conclusion

Argument Search Engines

Presentation and Analytics

args abortion

All Discussions People

Pro vs. con view • 9238 arguments retrieved in 1.0ms

PRO

abortion is the ending of pregnancy by the removal or...

Show full argument
Abortion is the ending of pregnancy by the removal or forcing out from the womb of a fetus or embryo before it is able to survive on its own. An **abortion** can occur spontaneously, in which ...
<https://www.debate.org/debates/abortion/350/> score +

Great, another forfeiter. As someone who has debated...

Show full argument
Great, another forfeiter. As someone who has debated **abortion** before, I will put a link to my original **abortion** debate right here: <http://www.debate.org...> I will be using arguments that ...
<https://www.debate.org/debates/Abortion/320/> score +

This should be fun :) The legalisation of abortion has...

Show full argument
This should be fun :) The legalisation of **abortion** has been a big issue worldwide for a long period of time, not only politically but also on social and religious fronts. **Abortion** can be ...
<https://www.debate.org/debates/Abortion/156/> score +

There are many good and bad sides to abortion. But just...

Show full argument
There are many good and bad sides to **abortion**. But just like everything, there is no black and white. Just a whole range of gray. **Abortion** is one way that poverty can decrease. Most unplanned ...
<https://www.debate.org/debates/Abortion/741/> score +

Although I oppose abortion in most cases, I accepted this...

Show full argument
Although I oppose **abortion** in most cases, I accepted this debate because Con's position is that **abortion** "can never be justified regardless of circumstances." That is the point I want to ...
<https://www.debate.org/debates/abortion/309/> score +

Abortion is needed to control the population so that the...

Show full argument
Abortion is needed to control the population so that the population doesn't get too excess. By the 22 century, the population estimated to be 11.2 billion people and if **abortion** were illegal, ...
<https://www.debate.org/debates/Abortion/543/> score +

CON

In 2011 there were about 730,322 abortions reported to...

Show full argument
In 2011 there were about 730,322 abortions reported to the centers for disease control. There are about 1.7% of **abortion** of women's ages from 15-44 each year. Women who already had **abortion** ...
<https://www.debate.org/debates/Abortion/545/> score +

The greatest destroyer of peace is abortion because if a...

Show full argument
The greatest destroyer of peace is **abortion** because if a mother can kill her own child, what is left for me to kill you and to kill me? There is nothing between "says Mother Teresa" ...
<https://www.debate.org/debates/Abortion/507/> score +

Yes the government has the obligation to protect the...

Show full argument
Yes the government has the obligation to protect the rights of people, in general. Women have a right to decide whether and when to become a parent. But not **abortion**, it's an ending life ...
<https://www.debate.org/debates/abortion/348/> score +

Thank you, Pro. Negative CaseA1: False equivalence in the...

Show full argument
Thank you, Pro. Negative CaseA1: False equivalence in the first round, in order to clarify the single word "**abortion**" into a resolution, my opponent elaborates: "If **abortion** is murder, so ...
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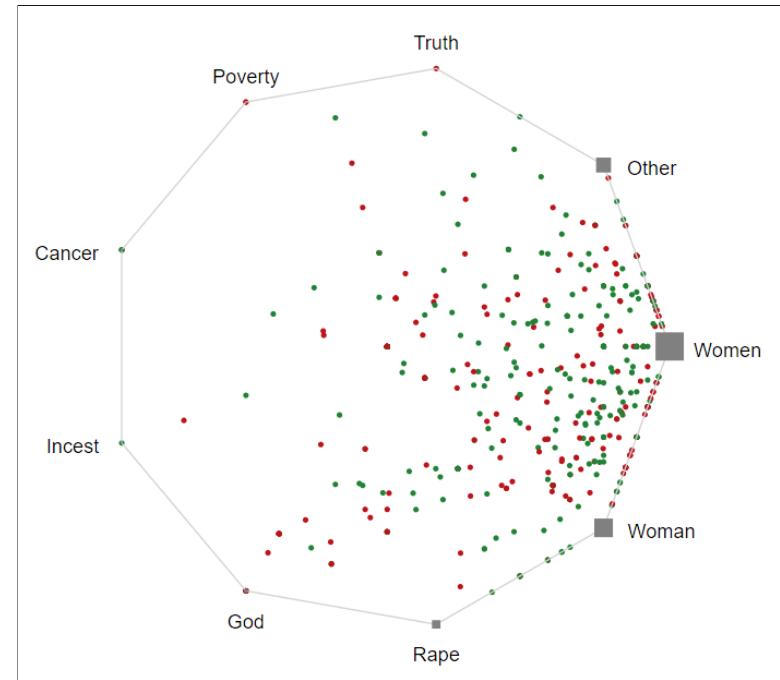
Abortion is wrong! Abortion Is gross! Abortion is...

Abortion is wrong! Abortion Is gross! Abortion IS MURDER!!!!

Attacks: Abortion
<https://www.debate.org/debates/Abortion/469/> score +

Thank you to both the audience and my opponent for yet...

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Argument Search Engines

Presentation and Analytics

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"The greatest destroyer of peace is **abortion** because if a mother can kill her own child, what is left for me to kill you and to kill me? There is nothing between," says Mother Teresa ...

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<https://www.debate.org/debates/Abortion/332/> score +

Abortion is wrong! Abortion Is gross! Abortion is...

Abortion is wrong! Abortion Is gross! Abortion is MURDER!!!!

Attacks: Abortion

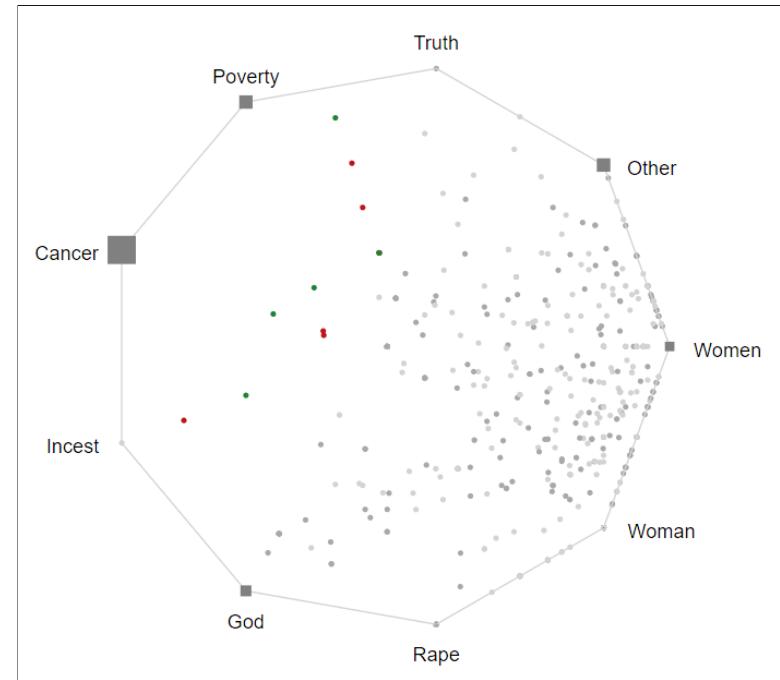
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Argument Search Engines

Presentation and Analytics

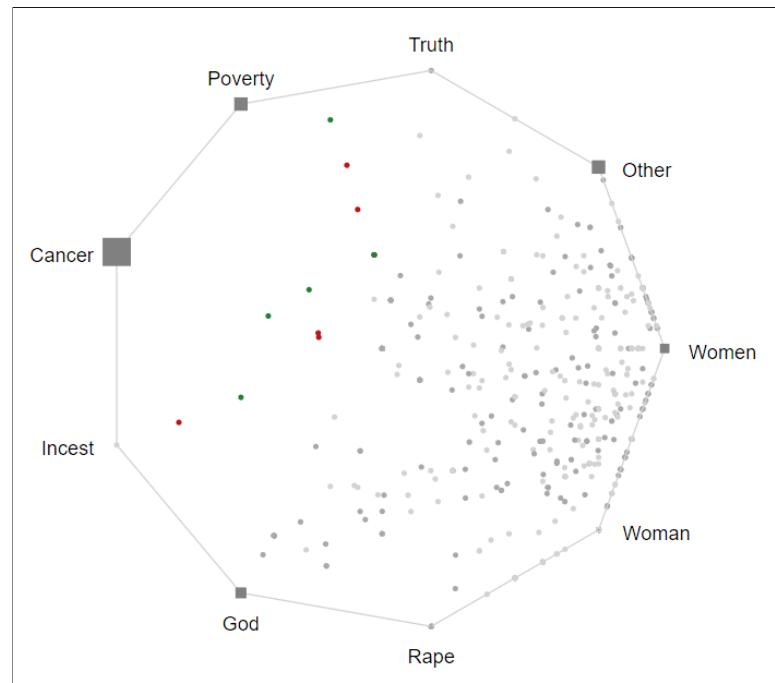
The screenshot shows the args search engine interface. At the top, there is a search bar with the query "abortion". Below the search bar, there are filters: "All", "Discussions", "People", "Any age", "Any gender", "Any nationality", and "Any reputation". A search button and a progress indicator "3 arguments retrieved in 1.0ms" are also present.

The results are categorized into "PRO" and "CON".

- PRO:**
 - Irene Mathyssen • New Democratic Party
▶ Show full argument
This Friday, Canada will undergo its third universal periodic review at the United Nations. This is an important moment when Canada will be held accountable by other UN member states on ...
score ▾
 - Eric C. Lowther • Reform
▶ Show full argument
It has been 29 years since **abortion** was legalized in this country. In those days **abortion** was used only where a mother's life or health was endangered. But today I think it has gone too ...
score ▾
- CON:**
 - January 28 was the 20th anniversary of the Supreme Court.
Irene Mathyssen • New Democratic Party
▶ Show full argument
January 28 was the 20th anniversary of the Supreme Court of Canada's Morgentaler decision, which decriminalized **abortion** in Canada. The legal decision was a victory for Canadian women. ...
score ▾

A page number "1" is visible at the bottom left.

At the bottom of the page, there are links for "Terms", "API", "About", "Copyright © 2019 Webis Group", "Contact", and "Impressum / Privacy Policy".



Chapter IR:XI

XI. IR Applications

- Web Technology
- Web Graph
- Web Crawling
- Web Archiving
- Web Content Extraction
- Near-duplicate Detection
- Link Analysis

- The Treachery of Answers
- Argument Retrieval Problems
- Argument Ranking I
- Argument Ranking II
- Argumentation-Related Resources
- Argument Search Engines
- Argument Search Evaluation**

Argument Search Evaluation

Same Side Stance Classification [\[sameside.webis.de\]](http://sameside.webis.de)

Task: Given two arguments regarding a certain topic,
decide whether or not the two arguments have the same stance.

Topic: "Gay marriage should be legalized."

Argument 1

Marriage is a commitment to love and care for your spouse till death. This is what is heard in all wedding vows. Gays can clearly qualify for marriage according to these vows, and any definition of marriage deduced from these vows.

Argument 2

Marriage is the institution that forms and upholds for society, its values and symbols are related to procreation. To change the definition of marriage to include same-sex couples would destroy its function.

Argument Search Evaluation

Same Side Stance Classification [\[sameside.webis.de\]](http://sameside.webis.de)

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Argument 2

Gay marriage should be legalized since denying some people the option to marry is discriminatory and creates a second class of citizens.

Argument Search Evaluation

Same Side Stance Classification [\[sameside.webis.de\]](http://sameside.webis.de)

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Argument 2

Marriage is the institution that forms and upholds for society, its values and symbols are related to procreation. To change the definition of marriage to include same-sex couples would destroy its function.

○ ≠ ○
different side

Argument 1

Marriage is a commitment to love and care for your spouse till death. This is what is heard in all wedding vows. Gays can clearly qualify for marriage according to these vows, and any definition of marriage deduced from these vows.

Argument 2

Gay marriage should be legalized since denying some people the option to marry is discriminatory and creates a second class of citizens.

○ = ○
same side

Argument Search Evaluation

Same Side Stance Classification: Task Rationale

Same side classification needs not to distinguish topic-specific pro- / con-vocabulary.

- "Only" argument similarity within a stance needs to be assessed.
- Same side classification may be solved in a **topic-agnostic** fashion.

Applications:

- ❑ measure the bias strength within argumentation
- ❑ structure a discussion
- ❑ find out who or what is challenging me in a discussion
- ❑ filter wrongly labeled stances in a large argument corpus
- ❑ ...

Argument Search Evaluation

Same Side Stance Classification: Tasks Details

Two topics (domains):

1. Should gay marriage be legalized?
2. Should abortion be legalized?

Within domain setting:

Training. Instances from both domains.
Test. Instances from both domains.

Cross domain setting:

Training. Instances from abortion.
Test. Instances from gay marriage.

Argument Search Evaluation

Same Side Stance Classification: Tasks Details

Two topics (domains):

1. Should gay marriage be legalized?
2. Should abortion be legalized?

Within domain setting:

Training. Instances from both domains.

Test. Instances from both domains.

Cross domain setting:

Training. Instances from abortion.

Test. Instances from gay marriage.

Form of an instance:

1. Name of the topic (domain) d .
2. Argument 1 from A_d .
3. Argument 2 from A_d .
4. One of $\{ \bigcirc = \bigcirc, \bigcirc \neq \bigcirc \}$.

Timeline:

- 8.6. 2019: Training data online.
- 14.6. 2019: Submission open.
- 21.7. 2019: Submission closed.
- 1.8. 2019: 6th ArgMining workshop.

Argument Search Evaluation

Same Side Stance Classification: Results “Within Domain”

Team	Gay marriage			Abortion			All		
	Pre	Rec	Acc	Pre	Rec	Acc	Pre	Rec	Acc
Trier University	0.90	0.73	0.83	0.79	0.59	0.71	0.85	0.66	0.77
Leipzig University	0.80	0.78	0.79	0.78	0.68	0.75	0.79	0.73	0.77
IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
TU Darmstadt	0.74	0.56	0.68	0.63	0.48	0.60	0.68	0.52	0.64
Düsseldorf University	0.76	0.35	0.62	0.65	0.32	0.57	0.70	0.33	0.60
LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55
...									

Argument Search Evaluation

Same Side Stance Classification: Results “Within Domain”

Team	Gay marriage			Abortion			All		
	Pre	Rec	Acc	Pre	Rec	Acc	Pre	Rec	Acc
Trier University	0.90	0.73	0.83	0.79	0.59	0.71	0.85	0.66	0.77
Leipzig University	0.80	0.78	0.79	0.78	0.68	0.75	0.79	0.73	0.77
IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
TU Darmstadt	0.74	0.56	0.68	0.63	0.48	0.60	0.68	0.52	0.64
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...									

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IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
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...									

Argument Search Evaluation

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IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
TU Darmstadt	0.74	0.56	0.68	0.63	0.48	0.60	0.68	0.52	0.64
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...									

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LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55
...									

Trier University. BERT (large, uncased, sequence length 512), tuning for 3 epochs.

Argument Search Evaluation

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	Pre	Rec	Acc	Pre	Rec	Acc	Pre	Rec	Acc
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LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55
...									

Leipzig University. BERT (uncased, sequence length 512, tuning for 5 epochs), loss function: sigmoid_binary_crossentropy.

Argument Search Evaluation

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...									

IBM Research. Two BERT models fine-tuned in cascade starting from the vanilla BERT model.

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Trier University	0.90	0.73	0.83	0.79	0.59	0.71	0.85	0.66	0.77
Leipzig University	0.80	0.78	0.79	0.78	0.68	0.75	0.79	0.73	0.77
IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
TU Darmstadt	0.74	0.56	0.68	0.63	0.48	0.60	0.68	0.52	0.64
Düsseldorf University	0.76	0.35	0.62	0.65	0.32	0.57	0.70	0.33	0.60
LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55
...									

TU Darmstadt. Microsoft’s Multi-Task Deep Neural Network mt-dnn. Basis for the mt-dnn is BERT (large). No hyper-parameter tuning, 4 epochs.

Argument Search Evaluation

Same Side Stance Classification: Results “Within Domain”

Team	Gay marriage			Abortion			All		
	Pre	Rec	Acc	Pre	Rec	Acc	Pre	Rec	Acc
Trier University	0.90	0.73	0.83	0.79	0.59	0.71	0.85	0.66	0.77
Leipzig University	0.80	0.78	0.79	0.78	0.68	0.75	0.79	0.73	0.77
IBM Research	0.73	0.63	0.70	0.64	0.54	0.62	0.69	0.59	0.66
TU Darmstadt	0.74	0.56	0.68	0.63	0.48	0.60	0.68	0.52	0.64
Düsseldorf University	0.76	0.35	0.62	0.65	0.32	0.57	0.70	0.33	0.60
LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55
...									

Düsseldorf University. Manhattan LSTM – a siamese network – which measures the similarity of both arguments. Document embeddings via BERT (base, uncased, not fine-tuned, sequence length 512 tokens).

Argument Search Evaluation

Same Side Stance Classification: Results “Within Domain”

Team	Gay marriage			Abortion			All		
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LMU	0.53	1.00	0.55	0.53	1.00	0.55	0.53	1.00	0.55

...

LMU. Bert (base). Arguments organized as graph: edges are weighted with the confidence that arguments agree and confidence that they disagree. If known from training set that the arguments agree or disagree the confidence is 0 and 1 or 1 and 0 accordingly.

Argument Search Evaluation

Same Side Stance Classification: Results “Cross Domain”

Team	Gay marriage (large)			Gay marriage (small)		
	Pre	Rec	Acc	Pre	Rec	Acc
LMU	0.67	0.53	0.63	0.78	0.61	0.72
TU Darmstadt	0.64	0.59	0.63	0.71	0.63	0.68
IBM Research	0.62	0.49	0.60	0.74	0.43	0.64
Paderborn University	0.60	0.38	0.56	0.79	0.33	0.62
Trier University	0.69	0.16	0.54	1.00	0.20	0.60
Düsseldorf University	0.72	0.53	0.66	0.68	0.37	0.60
...						

Argument Search Evaluation

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...						

Argument Search Evaluation

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Argument Search Evaluation

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Düsseldorf University	0.72	0.53	0.66	0.68	0.37	0.60
...						

Most of the submitted classifiers are robust regarding:

- imbalances between domain proportions in training and test
- imbalances between domain proportions within test
- imbalances between same side / different side proportions

Argument Search Evaluation

Argument Retrieval Task @ CLEF 2020 [\[touche.webis.de\]](http://touche.webis.de)

Argument Search Evaluation

Argument Retrieval Task @ CLEF 2020 [touche.webis.de]

Task 1: Supporting argumentative conversations

- ❑ Scenario: Users search for arguments on controversial topics
- ❑ Task: Retrieve “strong” pro/con arguments on the topic
- ❑ Data: 300,000 “arguments” (short text passages)

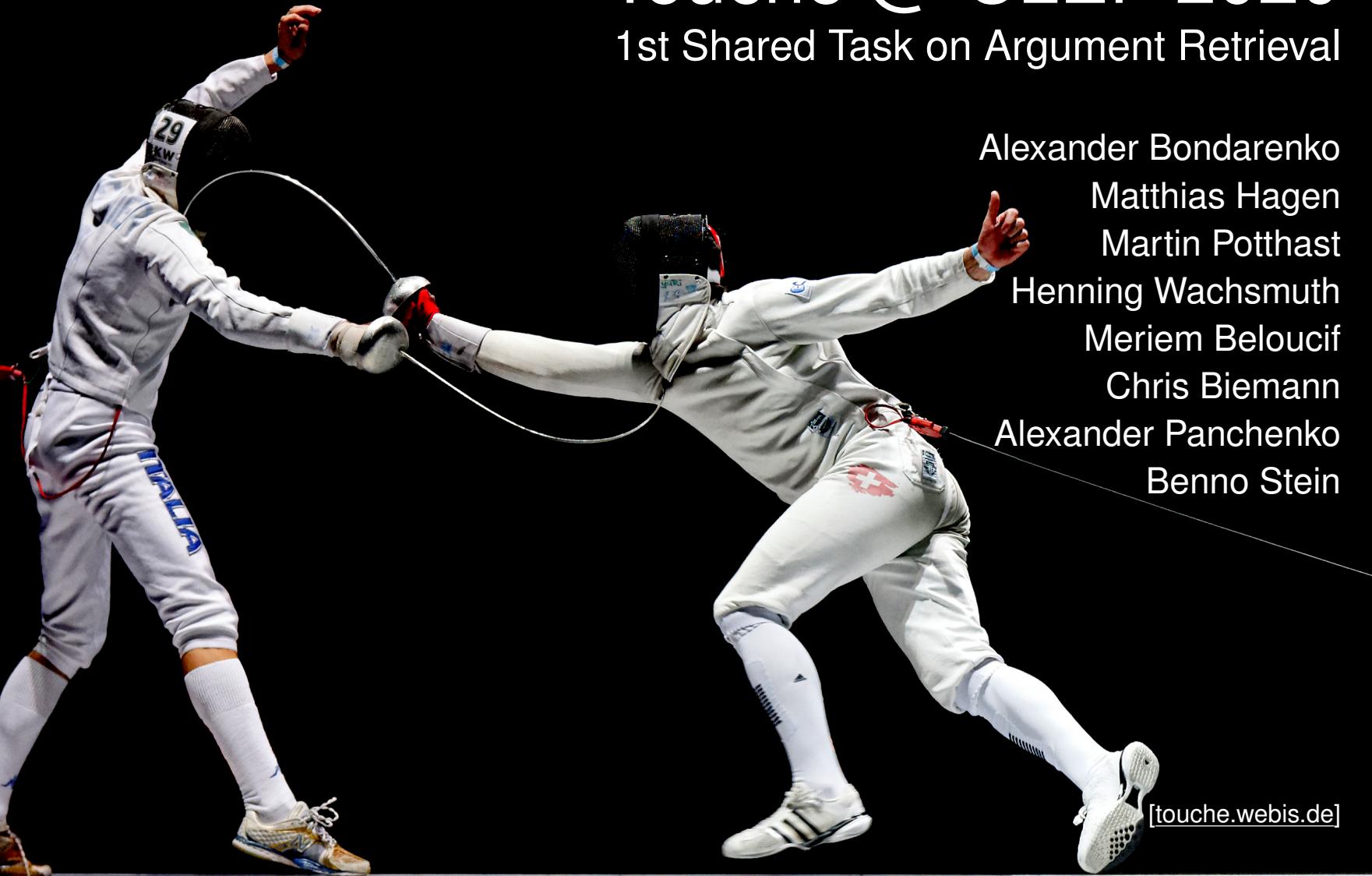
Task 2: Answering comparative questions with arguments

- ❑ Scenario: Users face personal decisions from everyday life
- ❑ Task: Retrieve arguments for “Is X better than Y for Z?”
- ❑ Data: ClueWeb12 or ChatNoir [chatnoir.eu]

- ❑ Run submissions similar to “classical” TREC tracks
- ❑ Software submissions via TIRA [tira.io]

Touché @ CLEF 2020

1st Shared Task on Argument Retrieval



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