

# Webis at TREC 2020: Health Misinformation Track

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# Webis at TREC 2020: Health Misinformation Track

## Overview

- ❑ Baseline retrieval with ChatNoir
  - [Bevendorff et al; ECIR'18]
- ❑ Manual pilot judgments with ChatNoir
- ❑ Query expansion with keyqueries
  - Pilot judgments form explicit relevance feedback
- ❑ Argumentative axiomatic re-ranking
  - Capture argumentative nature of documents
  - Re-ranking with axiomatic pipeline from last year
    - [Bondarenko et al.; TREC'18; Bondarenko et al.; TREC'19]

# Baseline Retrieval with ChatNoir

# Baseline Retrieval with ChatNoir

## Overview

- ❑ ChatNoir is the basis for our submissions

## Indexing

- ❑ Main content extraction
- ❑ Language detection
- ❑ Metadata extraction (keywords, headings, etc.)

## Retrieval

- ❑ BM25F on title, URL, keywords, main content, and the full document



Can vitamin C cure COVID-19?



Search results for *Can vitamin C cure COVID-19?*

Fact check: Could taking **vitamin C cure** — or prevent — **COVID-19?**

[www.goerie.com/news/20200325/fact-check-could-taking-vitamin-c-cure---...](http://www.goerie.com/news/20200325/fact-check-could-taking-vitamin-c-cure---...)

What the experts say: There is no evidence that **Vitamin C** helps treat **COVID-19** There is no scientific research supporting the claim that taking high doses of **vitamin C** could help prevent or **cure COVID-19**.

# Manual Pilot Judgments with ChatNoir

# Manual Pilot Judgments with ChatNoir

## Idea

- ❑ Identify **target documents** for query expansion with keyqueries
- ❑ Goal (Ideal):
  - Target documents are useful, correct, and credible
  - $\geq 2$  target documents per topic

## Labeling of target documents

- ❑ Read the full topic to understand the information need
- ❑ Using the web interface of ChatNoir:
  - Formulate queries
  - Label target documents which provide correct answers

## Budget/Restrictions

- ❑ 6 minutes per topic
- ❑ Inspect only the SERP (Title + URL + Snippet)
- ❑ Further inspection of the documents is not allowed

# Manual Pilot Judgments with ChatNoir

## Results

- ❑ We identified 178 target documents
- ❑ 3 target documents per topic on average
- ❑ Maximum of 11 target documents for topic 41: *Hib vaccine COVID-19*

### Manual Pilot Judgments vs All Runs

	Useful (%)	Correct Answer (%)	Credible (%)
Pilot Judgments	83.9	62.7	84.3
All Runs	34.0	40.6	81.7
+ $\Delta$	49.9	22.1	2.6

# Query Expansion with Keyqueries



# Query Expansion with Keyqueries

What is a keyquery? [Hagen et al.; ECIR'16]

Query  $q$  is a keyquery for a set  $D$  of target documents against a search engine iff

1. Every  $d \in D$  is in the top- $k$  results. (specificity)
2. Query  $q$  has at least  $l$  results. (generality)
3. No subquery  $q' \subset q$  satisfies the above. (minimality)

Remark: For small  $|D| \leq 5$ , typically  $l \geq 10$  and  $k = 10$ .

# Query Expansion with Keyqueries

Example: Keyquery for a paper ( $l \geq 1000$ ,  $k = 3$ )

## Elastic ChatNoir: Search Engine for the ClueWeb and the Common Crawl

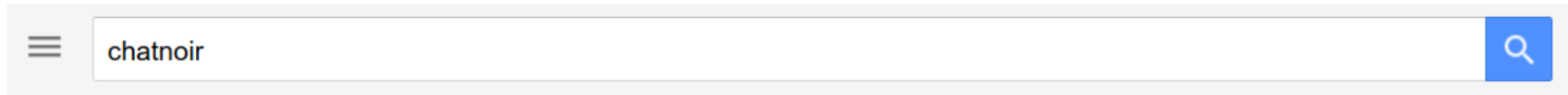
Janek Bevendorff, Benno Stein, Matthias Hagen, and Martin Potthast

Bauhaus-Universität Weimar and Leipzig University  
<first name>.<last name>@uni-weimar.de and martin.pothast@uni-leipzig.de

**Abstract** Elastic ChatNoir<sup>1</sup> is an Elasticsearch-based search engine offering a freely accessible search interface for the two ClueWeb corpora and the Common Crawl, together about 3 billion web pages. Running across 130 nodes, Elastic ChatNoir features subsecond response times comparable to commercial search engines. Unlike most commercial search engines, it also offers a powerful API that is available free of charge to IR researchers. Elastic ChatNoir's main purpose is to serve as a baseline for reproducible IR experiments and user studies for the coming years, empowering research at a scale not attainable to many labs beforehand, and to provide a platform for experimenting with new approaches to web search.

# Query Expansion with Keyqueries

Example: `chatnoir` is a keyquery for Google Scholar



 Scholar About 9.930 results (0,04 sec)

## ChatNoir: a search engine for the ClueWeb09 corpus

[M Potthast](#), [M Hagen](#), [B Stein](#), [J Graßegger](#)... - [Proceedings of the 35th ...](#), 2012 - [dl.acm.org](#)

We present the **ChatNoir** search engine which indexes the entire English part of the ClueWeb09 corpus. Besides Carnegie Mellon's Indri system, **ChatNoir** is the second publicly available search engine for this corpus. It implements the classic BM25F information ...

☆  Cited by 54 [Related articles](#) [All 7 versions](#) 

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[J Bevendorff](#), [B Stein](#), [M Hagen](#), [M Potthast](#) - [European Conference on ...](#), 2018 - Springer



Abstract Elastic **ChatNoir** (Search: [www.chatnoir.eu](#) Code: [www.github.com/chatnoir-eu](#)) is an Elasticsearch-based search engine offering a freely accessible search interface for the two ClueWeb corpora and the Common Crawl, together about 3 billion web pages. Running ...

☆  Cited by 12 [Related articles](#) [All 3 versions](#) 

## [book] Le Chat Noir: A Montmartre cabaret and its artists in turn-of-the century Paris

[A Fields](#) - 1993 - [openbibart.fr](#)

Help. Search. XML. Title : **Le Chat noir** : a Montmartre cabaret and its artists in turn-of-the-century Paris ... Includes discussion of some of the shadow theater productions. ; Pagination/Size : 54 ; 54 p.; ill. (some col.); Topic : 530 - BIBLIOGRAPHIE D'HISTOIRE DE ...

☆  Cited by 28 [Related articles](#) 

## Generalized Chat Noir is PSPACE-complete

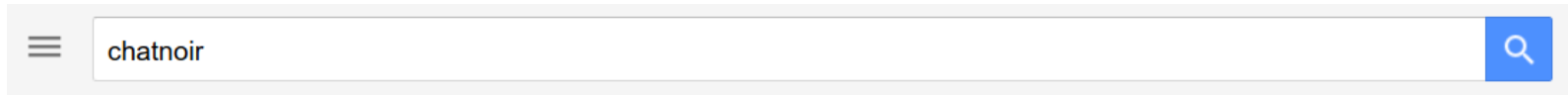
[C Iwamoto](#), [Y Mukai](#), [Y Sumida](#)... - [IEICE transactions on ...](#), 2013 - [search.ieice.org](#)

We study the computational complexity of the following two-player game. The instance is a graph  $G=(V, E)$ , an initial vertex  $s \in V$ , and a target set  $T \subseteq V$ . A "cat" is initially placed on  $s$ . Player 1 chooses a vertex in the graph and removes it and its incident edges from the graph ...

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# Query Expansion with Keyqueries

Example: ... but not for Google

The image shows a Google search interface for the query 'chatnoir'. The search bar contains 'chatnoir' and has a magnifying glass icon on the right. Below the search bar, there are navigation options: 'All', 'Images', 'Maps', 'Shopping', 'Videos', 'More', 'Settings', and 'Tools'. The search results show 'About 216.000.000 results (0,71 seconds)'. The first result is from 'en.wikipedia.org' for 'Le Chat Noir - Wikipedia'. Below this, there is a 'People also ask' section with four questions: 'What does Le Chat Noir mean?', 'Where is the Chat Noir painting?', 'Who made Le Chat Noir?', and 'What happened to Henri Le Chat Noir?'. Below the 'People also ask' section, there is a 'Feedback' link. The second result is from 'de.wikipedia.org' for 'Le Chat Noir – Wikipedia'. Below this, there is a 'Translate this page' link. The third result is from 'www.amazon.de' for 'Close Up Le Chat Noir Poster (61cm x 91,5cm): Amazon.de ...'. Below this, there is a 'Translate this page' link.

chatnoir

All Images Maps Shopping Videos More Settings Tools

About 216.000.000 results (0,71 seconds)

en.wikipedia.org › wiki › Le\_Chat\_Noir

### Le Chat Noir - Wikipedia

Le Chat Noir was a nineteenth-century entertainment establishment, in the bohemian Montmartre district of Paris. It was opened on 18 November 1881 at 84 ...

Second site · Last location · Shadow play · References

People also ask

- What does Le Chat Noir mean?
- Where is the Chat Noir painting?
- Who made Le Chat Noir?
- What happened to Henri Le Chat Noir?

Feedback

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### Le Chat Noir – Wikipedia

Le Chat Noir (deutsch Der schwarze Kater) war von 1881 bis 1897 ein beliebtes Pariser Kabarett auf dem Montmartre, das von Rodolphe Salis gegründet wurde ...

Anfänge am Boulevard ... · Rue Victor-Masse · Die Zeitschrift Le Chat Noir

www.amazon.de › Close-Up-Chat-N...

### Close Up Le Chat Noir Poster (61cm x 91,5cm): Amazon.de ...

Close Up Le Chat Noir Poster (61cm x 91, 5cm) günstig auf Amazon.de: Kostenlose Lieferung an den Aufstellort sowie kostenlose Rückgabe für qualifizierte ...

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# Query Expansion with Keyqueries

## Input

- Target documents  $D$  for a topic

## Query expansion

1. Calculate keyqueries for  $D$ 
  - Candidates: Power set of terms with the highest BM25 scores
2. Greedy selection of keyqueries:
  - Assume  $d \in D$  is relevant
  - Select the keyquery  $k$  with the highest nDCG
  - Remove documents that are covered by  $k$  from  $D$
3. Combine selected keyqueries with team-draft interleaving
4. Move  $d \in D$  to the top of the ranking

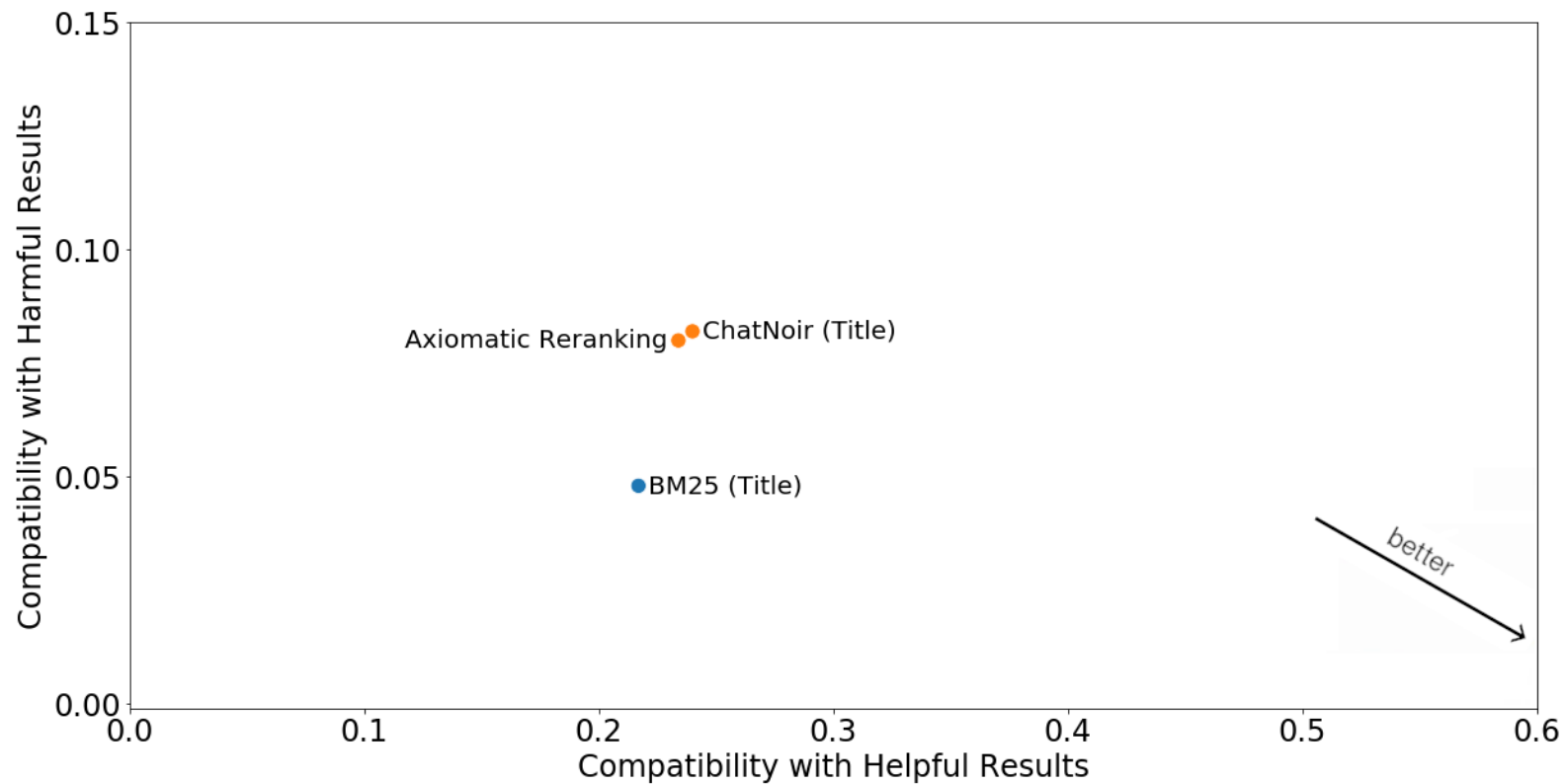
# Evaluation



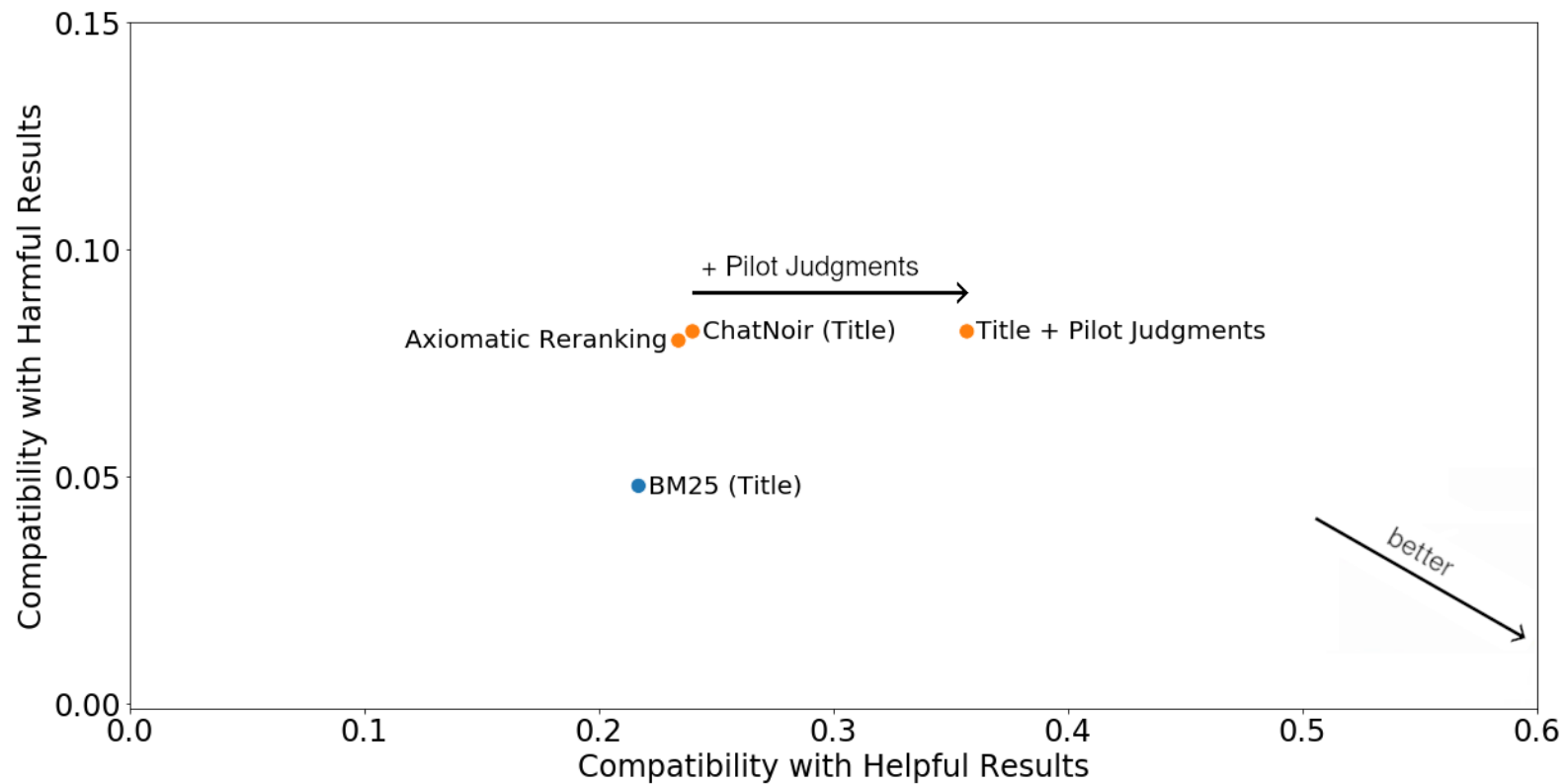
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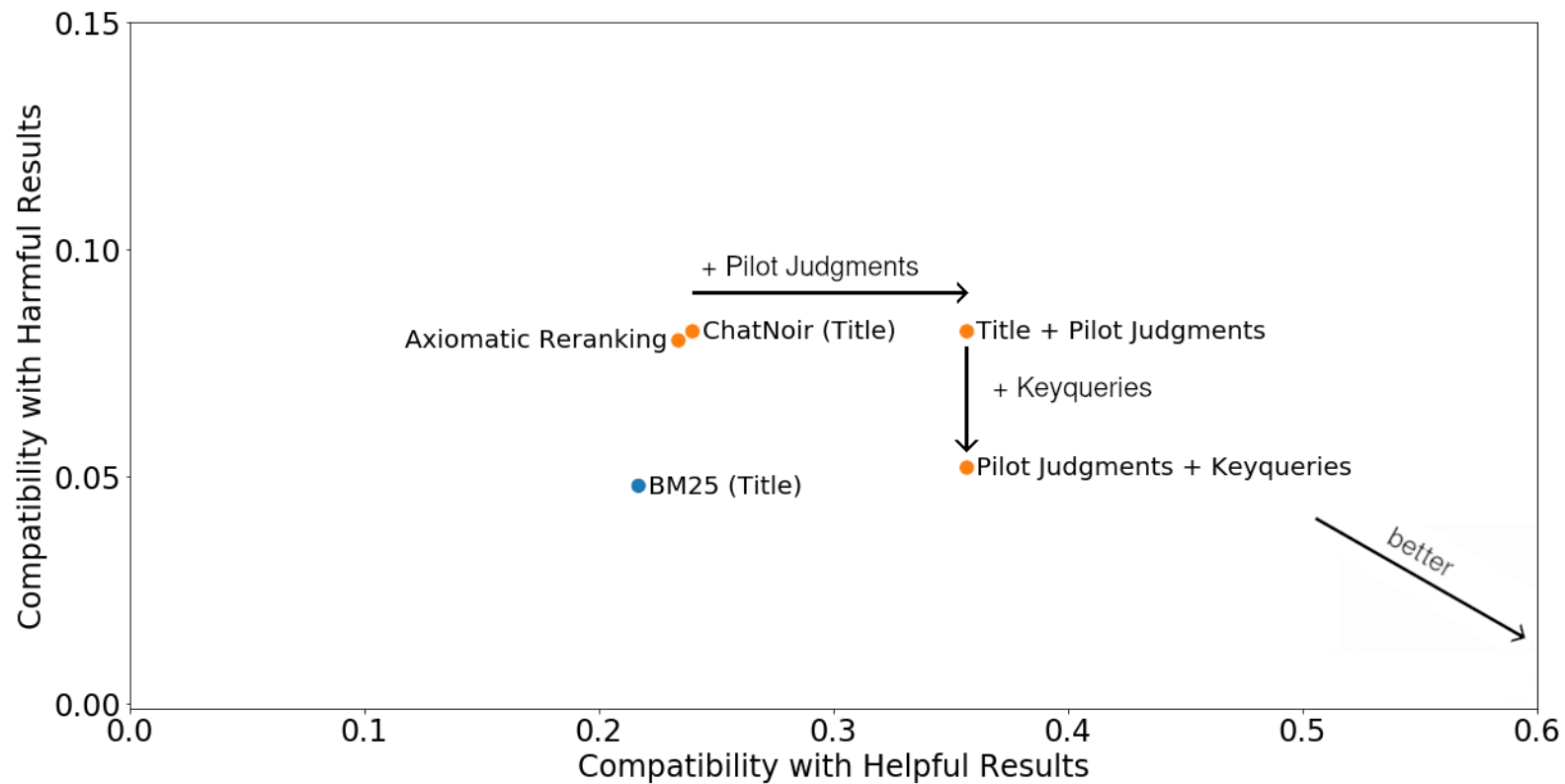
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# Evaluation



# Conclusions

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## Summary

- ❑ Low-budget judgments improved the performance (despite their noise)
  - Increased help, decreased harm
- ❑ Separating credible and non-credible documents on the SERP is difficult
- ❑ Try ChatNoir at `chatnoir.eu` ;)

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## Future work

- ❑ Use pilot judgments with other query expansion approaches
- ❑ Improve the axiomatic re-ranking
  - Weighting scheme for axioms
  - Formulate new and adjust the existing axioms

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*thank you!*



# Backup

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## Bibliography

J. Bevendorff, B. Stein, M. Hagen, M. Potthast. Elastic ChatNoir: Search Engine for the ClueWeb and the Common Crawl. *In ECIR 2020*.

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# Argumentative Axiomatic Re-ranking

## Identifying Argumentative Queries and Text Units

- ❑ Queries for which retrieved documents contain argumentation

- ❑ Examples:

“Normal” query:    What is COVID-19?

Relevant:    Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus.

Argumentative query:    Can ibuprofen worsen COVID-19?

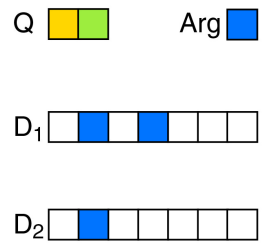
Relevant:    [Claim] Ibuprofen might increase the entrance of COVID-19 into the cells. [Premise] We found no corresponding human study.

- ❑ We marked all tracks’ queries as argumentative
- ❑ Our own TARGER, based on BiLSTM-CNN-CRF [Chernodub et al.; ACL 2019]

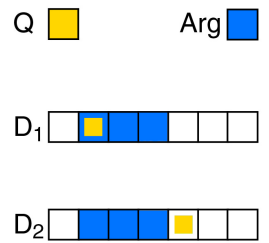
# Argumentative Axiomatic Re-ranking

## Argumentative Axioms

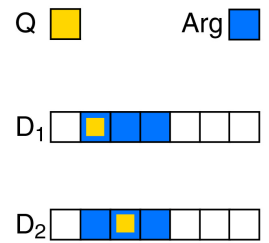
- ArgUC: Argumentative units count  
Favor documents which contain more argumentative units
- QTArg: Query term occurrence in argumentative units  
Favor documents with the query terms close to argumentative units
- QTPArg: Query term position in argumentative units  
Favor documents where the first appearance of a query term in an argumentative unit is closer to the beginning of the document



ArgUC

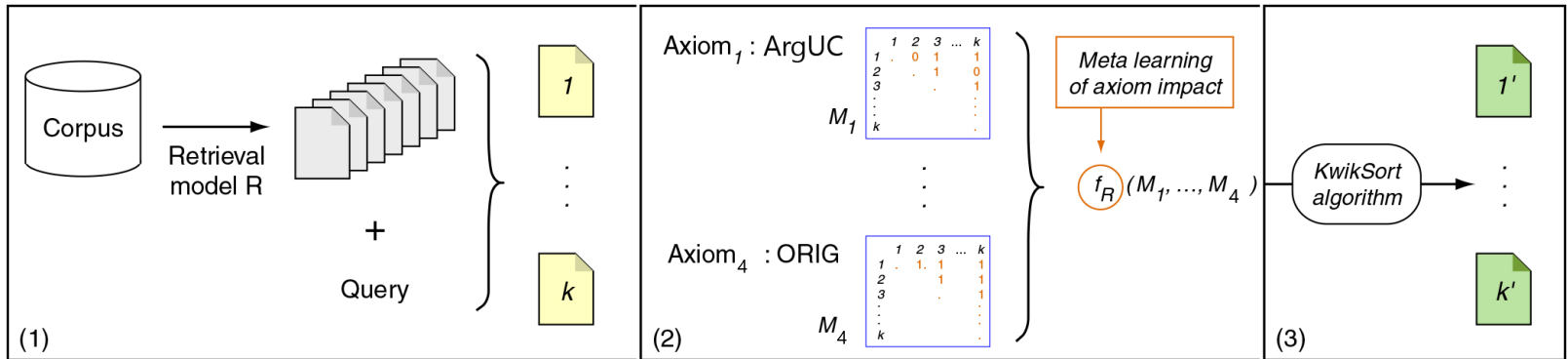


QTArg



QTPArg

# Argumentative Axiomatic Re-ranking



- ❑ Retrieve an initial top-1000 result set with BM25
- ❑ Include ORIG axiom
- ❑ Derive the re-ranking preferences of the axioms
- ❑ Aggregate the re-ranking preferences
- ❑ Re-rank the initial top-20 result set

# A Brief Tour of Axiomatic IR

## Basic Ideas

Purpose	Acronyms	Source
Term frequency	TFC1–TFC3	[Fang, Tao, Zhai; SIGIR'04]
	TDC	[Fang, Tao, Zhai; SIGIR'04]
Document length	LNC1 + LNC2	[Fang, Tao, Zhai; SIGIR'04]
	TF-LNC	[Fang, Tao, Zhai; SIGIR'04]
	QLNC	[Cummins, O'Riordan; CIKM'12]
Lower bound	LB1 + LB2	[Lv, Zhai; CIKM'11]
Query aspects	REG	[Zheng, Fang; ECIR'10]
	DIV	[Gollapurdi, Sharma; WWW'09]
Semantic similarity	STMC1 + STMC2	[Fang, Zhai; SIGIR'06]
	STMC3	[Fang, Zhai; SIGIR'06]
	TSSC1 + TSSC2	[Fang, Zhai; SIGIR'06]
Term proximity	PHC + CCC	[Tao, Zhai; SIGIR'07]

# A Brief Tour of Axiomatic IR

## Term Frequency Constraints

- TFC1 Give a higher score to a document with more occurrences of a query term.
- TFC2 The amount of increase in the score due to adding a query term must decrease as we add more terms.
- TFC3 Favor a document with more distinct query terms.

## Length Normalization Constraints

- LNC1 Penalize long documents.
- LNC2 Avoid over-penalizing long documents.
- TF-LNC Regularize the interaction of TF and document length.

## Lower-bounding Term Frequency Constraints

- LB1 The presence-absence gap shouldn't be closed due to length normalization.
- LB2 Repeated occurrence isn't as important as first occurrence.

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