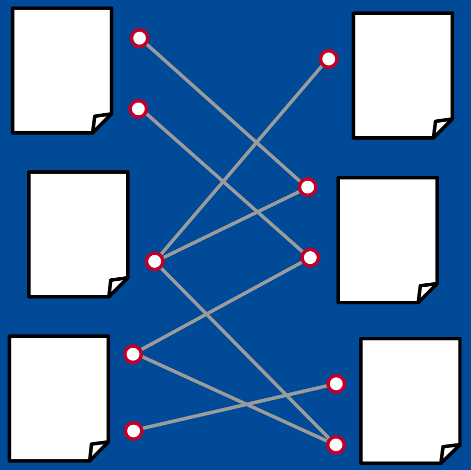
Bibliometric-Enhanced arXiv

A Data Set for Paper-Based and Citation-Based Tasks



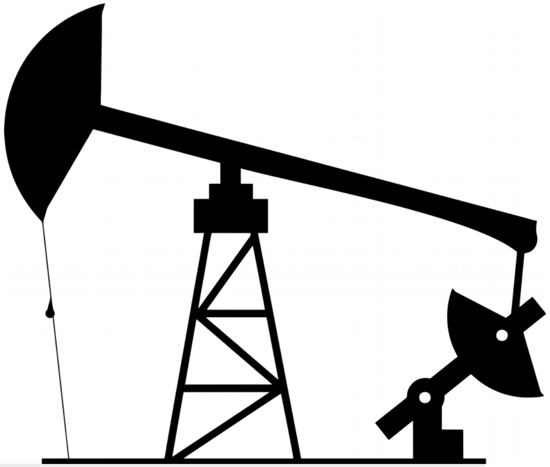
Albert-Ludwigs-Universität Freiburg

Tarek Saier, Michael Färber

BIR Workshop 2019

Background

- Mining scholarly discourse
  - Paper recommendation
  - Citation recommendation
  - Citation context-based document summarization
  - Detection of bias
  - Detection of plagiarism
  - ...



Background

- Lots of valuable information to be harvested

  but ...

- Utilization requires
  - Machine readable formats
  - Sufficient amounts of data
  - Clean data
  - ...

Existing Data Sets

- PDF
  - Scholarly
  - ACL-AAN
  - ACL-ARC*
- JATS XML
  - PMC-OAS
  - PLOS
- Extracted plain text
  - CiteSeer^X
  - arXiv CS

Existing Data Sets

- PDF

Scholarly	200k
ACL-AAN	18k
ACL-ARC*	11k

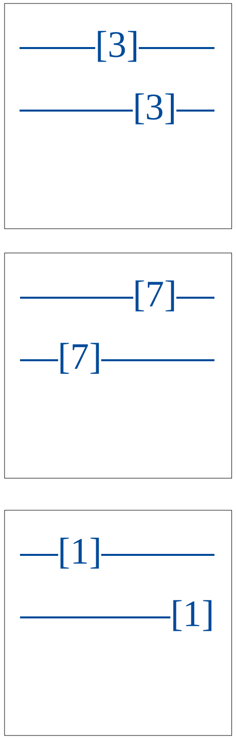
- JATS XML

PMC-OAS	2M
PLOS	200k

- Extracted plain text

CiteSeer^{X}	5M
arXiv CS	90k

Reference Resolution



[3]

[3]

[7]

[7]

[1]

[1]

describing: citing documents

Reference Resolution

——[3]——

———[3]—

[3] V. N. Senoguz and Q. Shafi, arXiv:hep-ph/0412102

———[7]—

—[7]———

[7] V.N. Senoguz and Q. Shafi, Phys. Rev. D 71 (2005) 043514.

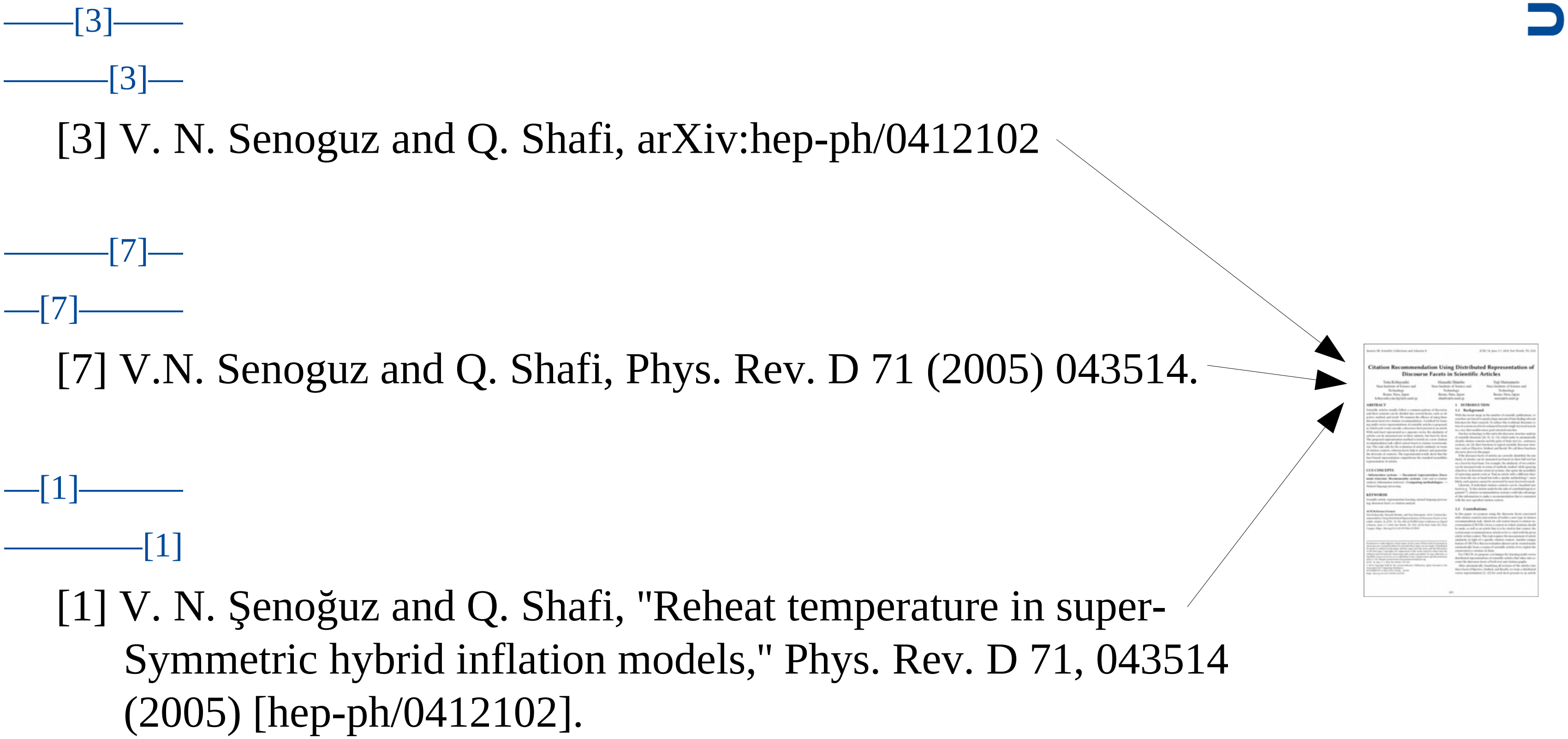
—[1]———

————[1]

[1] V. N. Şenoğuz and Q. Shafi, "Reheat temperature in super-Symmetric hybrid inflation models," Phys. Rev. D 71, 043514 (2005) [hep-ph/0412102].

describing: citing documents

Reference Resolution



——[3]——

———[3]—

[3] V. N. Senoguz and Q. Shafi, arXiv:hep-ph/0412102

———[7]—

—[7]———

[7] V.N. Senoguz and Q. Shafi, Phys. Rev. D 71 (2005) 043514.

—[1]———

————[1]

[1] V. N. Şenoğuz and Q. Shafi, "Reheat temperature in super-Symmetric hybrid inflation models," Phys. Rev. D 71, 043514 (2005) [hep-ph/0412102].

Citation Recommendation Using Distributed Representation of Discourse Facets in Scientific Articles

Yuta Kobayashi, Masashi Shimbo, Yuji Matsumoto

describing: citing documents + cited document

Existing Data Sets

- PDF

Scholarly	200k	-
ACL-AAN	18k	-
ACL-ARC*	11k	-

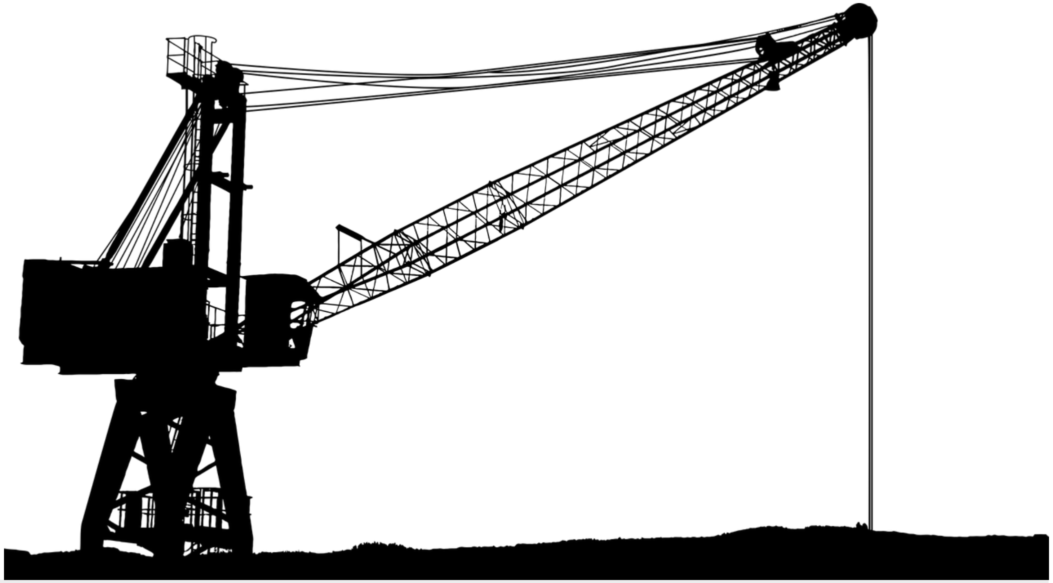
- JATS XML

PMC-OAS	2M	PubMed, MEDLINE, ...
PLOS	200k	-

- Extracted plain text

CiteSeer^{X}	5M	internal
arXiv CS	90k	DBLP

A New Dataset



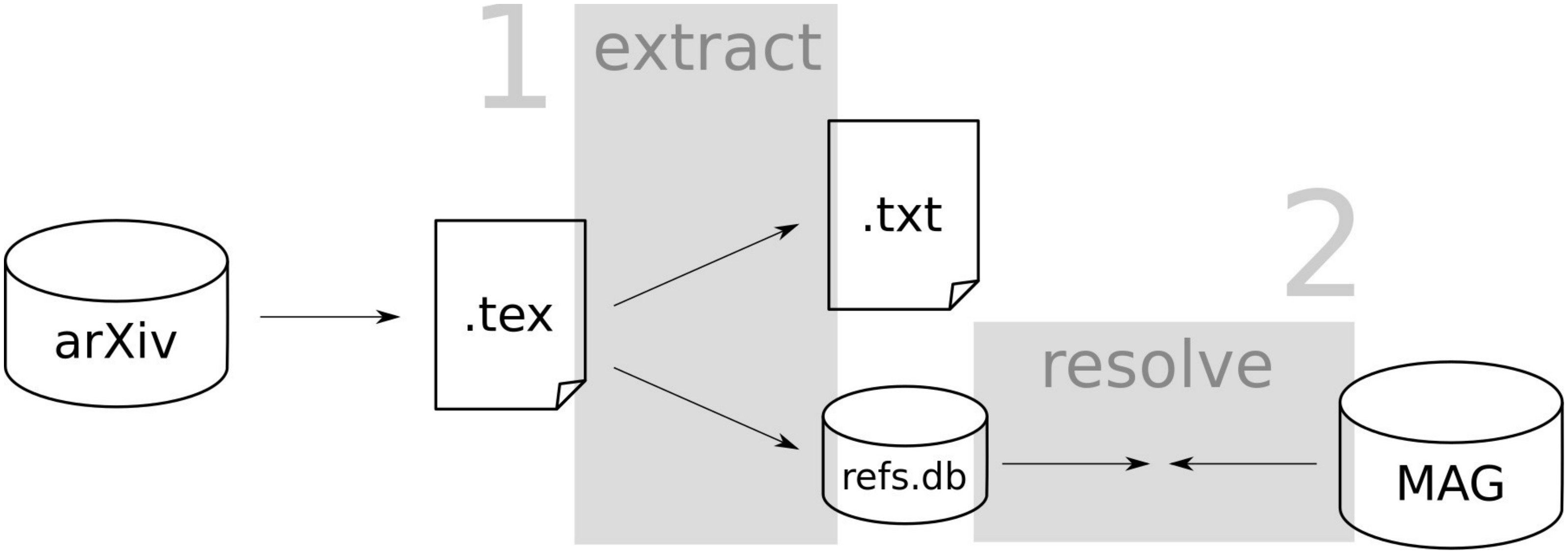
Data Sources

- **arXiv.org**
  - Operates since 1991   (we use 1991-2018)
  - 1.5M papers
  - LaTeX sources of papers available

- **Microsoft Academic Graph (MAG)**
  - Automatically generated
  - Metadata on 213M papers

Creation Process

- Generation process



Creation Process

- Extract (93%)
  - flatten
  - convert to XML
  - extract text + references
- Resolve references (43%)
  - identify title (arXiv ID, DOI, Neural ParsCit)
  - match with MAG

Challenges

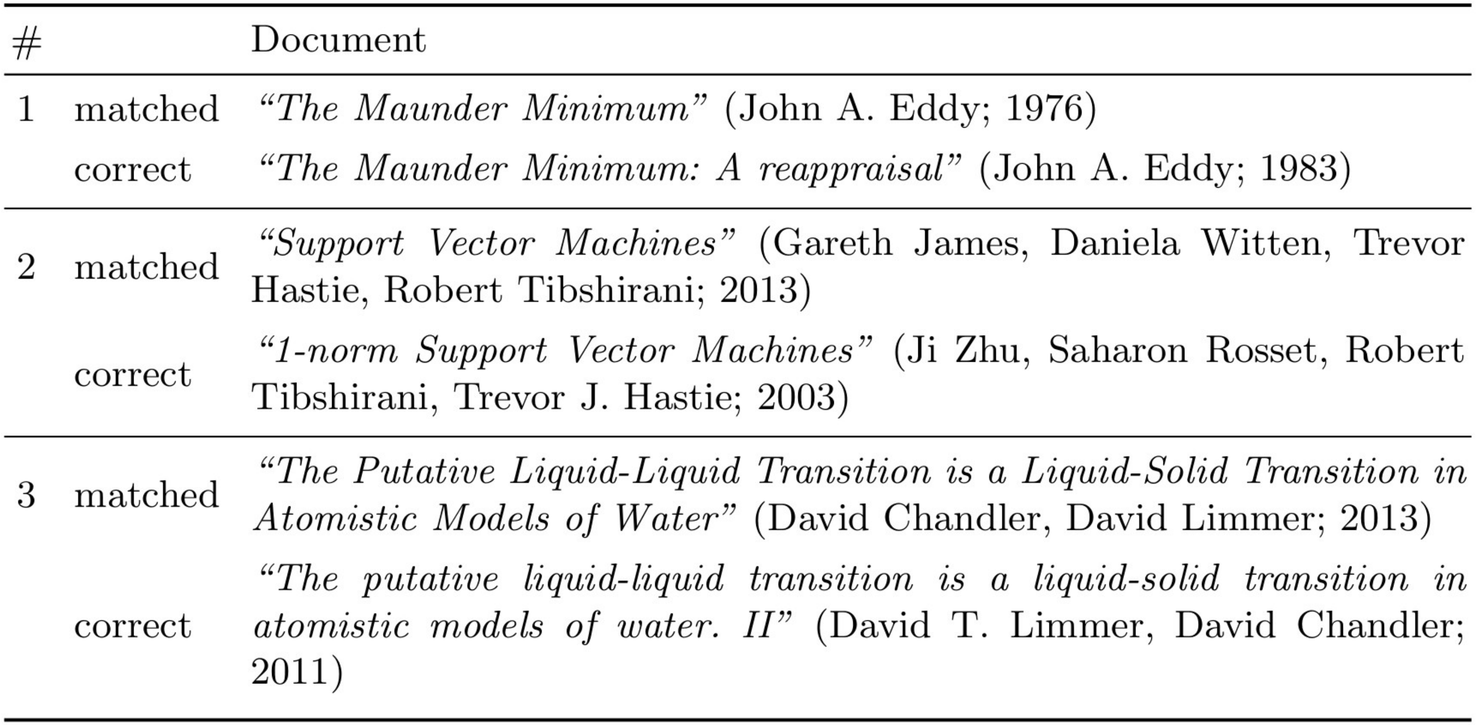
- Extraction
  - .bbl not .bib
  - Free spirited use of LaTeX
  - External packages for citations (e.g. natbib)
- Reference resolution
  - Minimal information
  - Formulas in titles
  - MAG noise

Result

- Structure
  - arXiv full texts (txt)
  - in-text annotated citations
  - resolved to MAG IDs
- Size
  - citing papers (full text): 1M
    - 663k phys / 237k math / 112k CS / 31k other
  - cited papers (pointer): 2.7M
  - resolved references: 16M
  - citation contexts: 29M

Result

- Quality of reference resolution
  - Manually check 300
  - 3 errors → accuracy estimate: 96%



#		Document
1	matched	*“The Maunder Minimum”* (John A. Eddy; 1976)
	correct	*“The Maunder Minimum: A reappraisal”* (John A. Eddy; 1983)
2	matched	*“Support Vector Machines”* (Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani; 2013)
	correct	*“1-norm Support Vector Machines”* (Ji Zhu, Saharon Rosset, Robert Tibshirani, Trevor J. Hastie; 2003)
3	matched	*“The Putative Liquid-Liquid Transition is a Liquid-Solid Transition in Atomistic Models of Water”* (David Chandler, David Limmer; 2013)
	correct	*“The putative liquid-liquid transition is a liquid-solid transition in atomistic models of water. II”* (David T. Limmer, David Chandler; 2011)

Result

- Format

1412.3684.txt

> […] It has over 79 million images stored at the resolution of FORMULA . Each image is labeled with one of the 75,062 non-abstract nouns in English, as listed in the Wordnet{{cite:9ad20b7d-87d1-47f5-aeed-10a1cf89a2e2}} {{cite:298db7f5-9ebb-4e98-9ecf-0bdda28a42cb}} lexical database. [...]

refs.db

uuid	in_doc	mag_id	reference_string
9ad20b...	1412.3684	2081580037	George A. Miller (1995). Wo...
298db7...	1412.3684	2038721957	Christiane Fellbaum (1998),...

Result

- Format

MAG

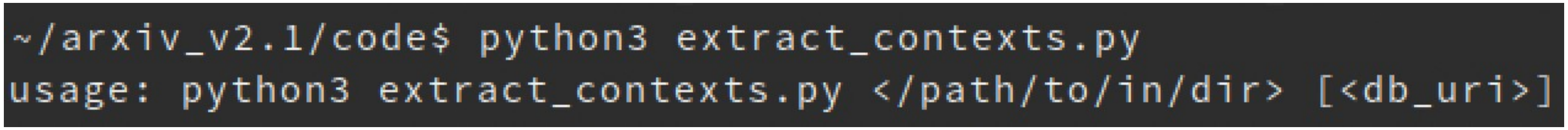
paperid	originaltitle	publisher	
2081580037	WordNet : an electronic lexical database	MIT Press	...
2038721957	WordNet: a lexical database for English	ACM	

extracted_contexts.csv

2038721957 | 2081580037 | 1412.3684 | It has over 79 million images stored at the resolution of FORMULA . Each image is labeled with one of the 75,062 non-abstract nouns in English, as listed in the Wordnet CIT MAINCIT lexical database. It has been noted that many of the labels are not reliable CIT .

Result

- Context export script

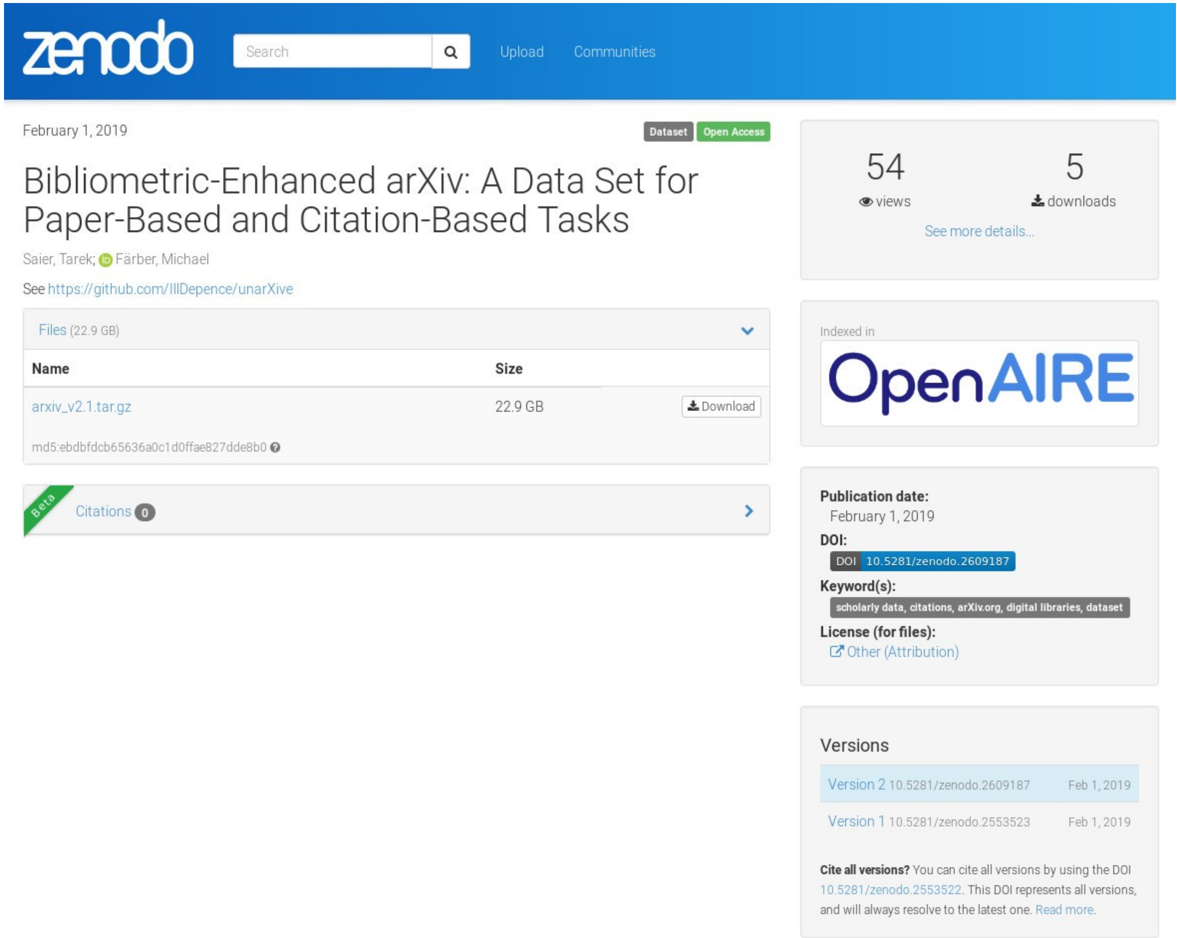


```
~/arxiv_v2.1/code$ python3 extract_contexts.py
usage: python3 extract_contexts.py </path/to/in/dir> [<db_uri>]
```

- `context_size` (in words/sentences)
- `min_contexts`
- `min_citing_docs`
- `sample_size`
- `restrict_fos_citing`

Result

- Data on Zenodo



February 1, 2019

Dataset | Open Access

Bibliometric-Enhanced arXiv: A Data Set for Paper-Based and Citation-Based Tasks

Saier, Tarek; Färber, Michael

See https://github.com/IllDepence/unarXive

Files (22.9 GB)

Name	Size	
arxiv_v2.1.tar.gz md5:ebdbfdcb65636a0c1d0ffae827dde8b0	22.9 GB	Download

Beta Citations 0

54 views | 5 downloads

See more details...

Indexed in

OpenAIRE

Publication date: February 1, 2019

DOI: DOI 10.5281/zenodo.2609187

Keyword(s): scholarly data, citations, arXiv.org, digital libraries, dataset

License (for files): Other (Attribution)

Versions

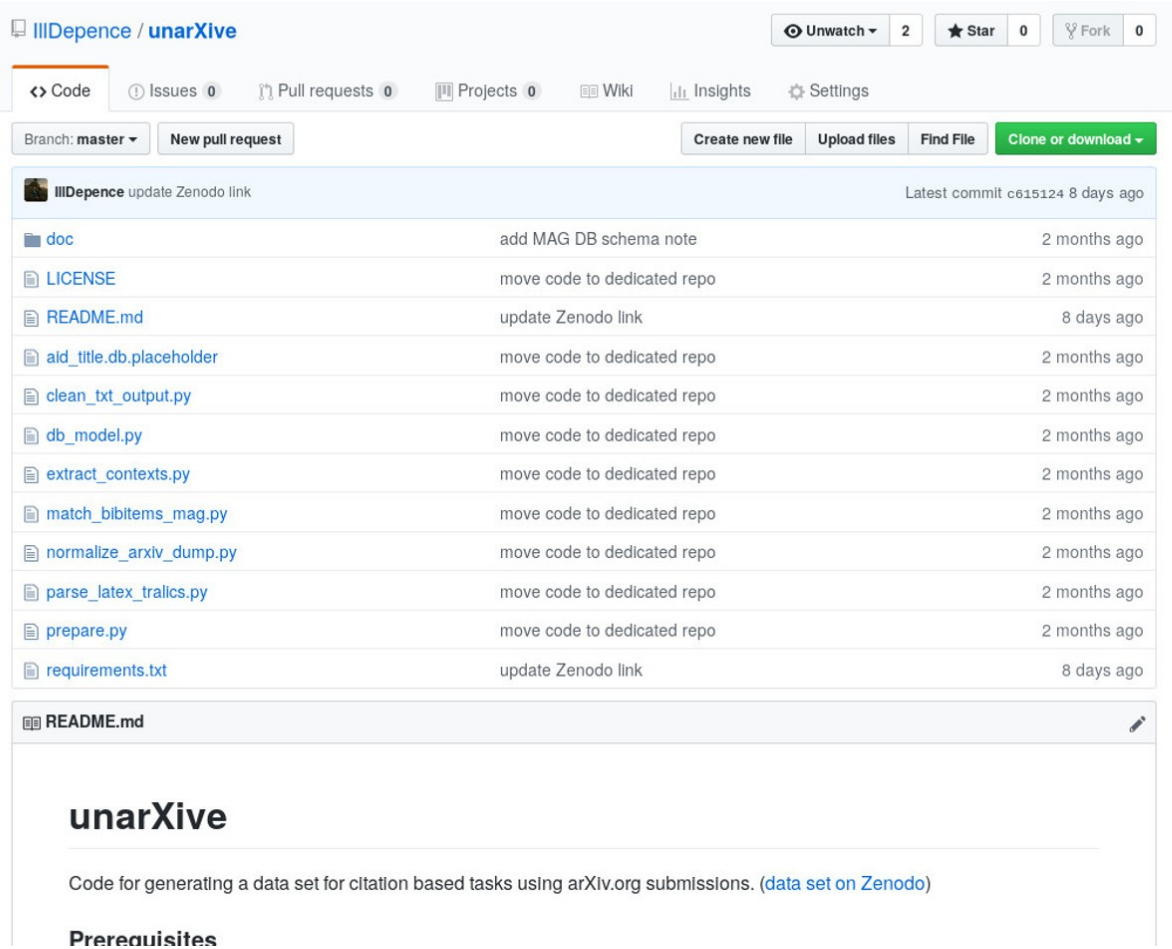
Version 2 10.5281/zenodo.2609187		Feb 1, 2019
Version 1 10.5281/zenodo.2553523		Feb 1, 2019

Cite all versions? You can cite all versions by using the DOI 10.5281/zenodo.2553522. This DOI represents all versions, and will always resolve to the latest one. Read more.

doi.org/10.5281/zenodo.2609187

Result

- Implementation on GitHub



IllDepence update Zenodo link — Latest commit c615124 8 days ago

doc	add MAG DB schema note	2 months ago
LICENSE	move code to dedicated repo	2 months ago
README.md	update Zenodo link	8 days ago
aid_title.db.placeholder	move code to dedicated repo	2 months ago
clean_txt_output.py	move code to dedicated repo	2 months ago
db_model.py	move code to dedicated repo	2 months ago
extract_contexts.py	move code to dedicated repo	2 months ago
match_bibitems_mag.py	move code to dedicated repo	2 months ago
normalize_arxiv_dump.py	move code to dedicated repo	2 months ago
parse_latex_tralics.py	move code to dedicated repo	2 months ago
prepare.py	move code to dedicated repo	2 months ago
requirements.txt	update Zenodo link	8 days ago

README.md

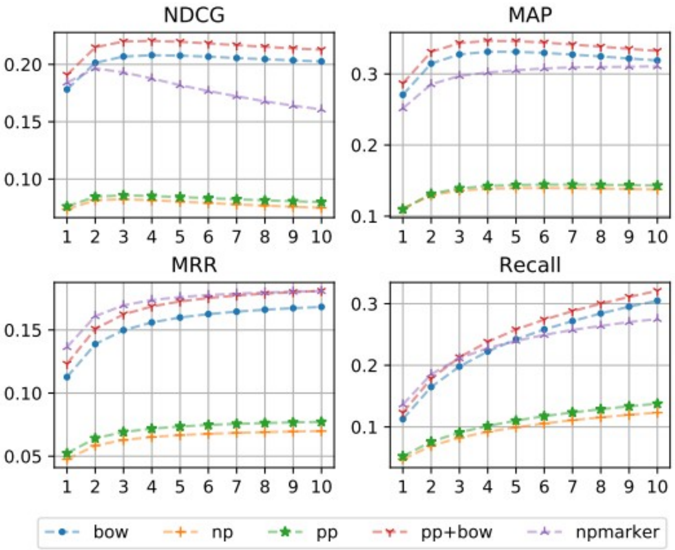
unarXive

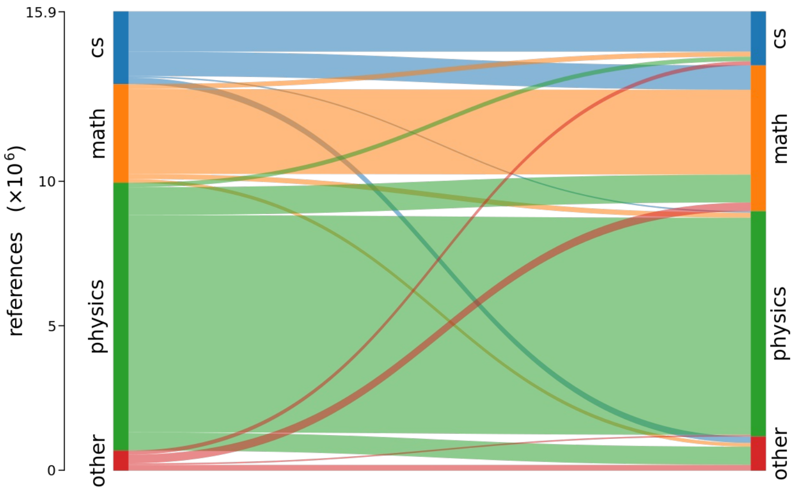
Code for generating a data set for citation based tasks using arXiv.org submissions. (data set on Zenodo)

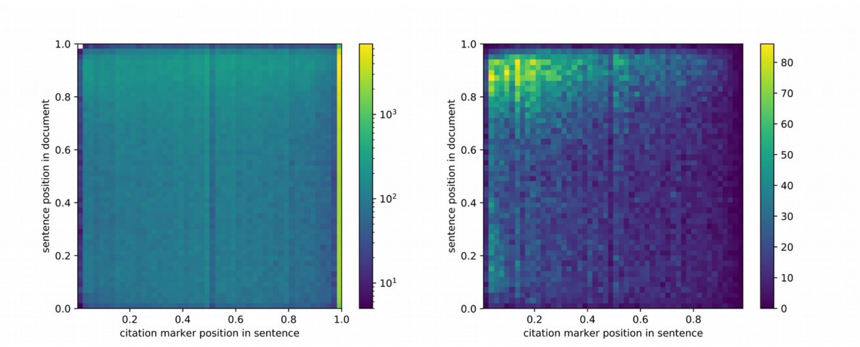
Prerequisites

github.com/IllDepence/unarXive

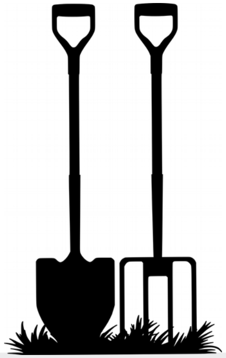
Application







Thank you.



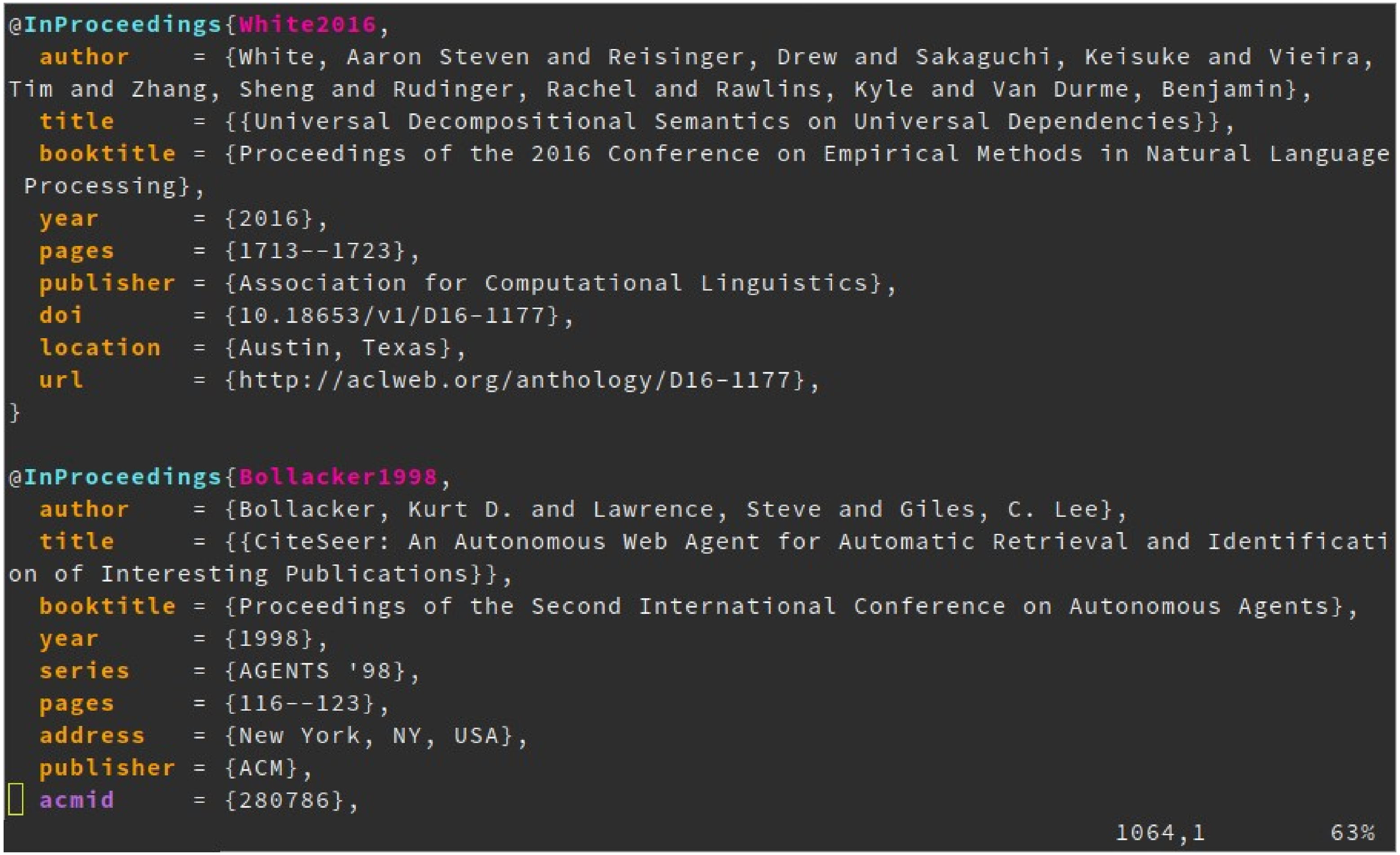
References

- **Scholarly** Sugiyama, K., Kan, M.: A Comprehensive Evaluation of Scholarly Paper Recommendation Using Potential Citation Papers. International Journal on Digital Libraries 16(2) (2015) 91–109
- **ACL-AAN** Radev, D.R., Muthukrishnan, P., Qazvinian, V., Abu-Jbara, A.: The ACL anthology network corpus. Language Resources and Evaluation 47(4) (2013) 919–944
- **ACL-ARC** Bird, S., Dale, R., Dorr, B.J., Gibson, B.R., Joseph, M.T., Kan, M., Lee, D., Powley, B., Radev, D.R., Tan, Y.F.: The ACL Anthology Reference Corpus: A Reference Dataset for Bibliographic Research in Computational Linguistics. In: Proceedings of the Sixth International Conference on Language Resources and Evaluation. LREC’08 (2008)
- **PMC-OAS** https://www.ncbi.nlm.nih.gov/pmc/tools/openftlist/
- **PLOS** https://www.plos.org/text-and-data-mining
- **CiteSeer^x** Caragea, C., Wu, J., Ciobanu, A.M., Williams, K., Ramı́rez, J.P.F., Chen, H., Wu, Z., Giles, C.L.: CiteSeer x : A Scholarly Big Dataset. In: Proceedings of the 36th European Conference on IR Research. ECIR’14 (2014) 311–322
- **arXiV CS** Färber, M., Thiemann, A., Jatowt, A.: A High-Quality Gold Standard for Citation-based Tasks. In: Proceedings of the 11th International Conference on Language Resources and Evaluation. LREC’18 (2018)
- **MAG** Sinha, A., Shen, Z., Song, Y., Ma, H., Eide, D., Hsu, B.P., Wang, K.: An Overview of Microsoft Academic Service (MAS) and Applications. In: Proceedings of the 24th International Conference on World Wide Web. WWW’15 (2015) 243–246
- **Tralics** https://www-sop.inria.fr/marelle/tralics/
- **Neural ParsCit** Prasad, A., Kaur, M., Kan, M.Y.: Neural ParsCit: A Deep Learning Based Reference String Parser. International Journal on Digital Libraries 19 (2018) 323–337

Challenges - extended

- Extraction
- Reference resolution

Challenges



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@InProceedings{White2016,
  author    = {White, Aaron Steven and Reisinger, Drew and Sakaguchi, Keisuke and Vieira,
Tim and Zhang, Sheng and Rudinger, Rachel and Rawlins, Kyle and Van Durme, Benjamin},
  title     = {{Universal Decompositional Semantics on Universal Dependencies}},
  booktitle = {Proceedings of the 2016 Conference on Empirical Methods in Natural Language
 Processing},
  year      = {2016},
  pages     = {1713--1723},
  publisher = {Association for Computational Linguistics},
  doi       = {10.18653/v1/D16-1177},
  location  = {Austin, Texas},
  url       = {http://aclweb.org/anthology/D16-1177},
}

@InProceedings{Bollacker1998,
  author    = {Bollacker, Kurt D. and Lawrence, Steve and Giles, C. Lee},
  title     = {{CiteSeer: An Autonomous Web Agent for Automatic Retrieval and Identificati
on of Interesting Publications}},
  booktitle = {Proceedings of the Second International Conference on Autonomous Agents},
  year      = {1998},
  series    = {AGENTS '98},
  pages     = {116--123},
  address   = {New York, NY, USA},
  publisher = {ACM},
  acmid     = {280786},
                                                                           1064,1          63%
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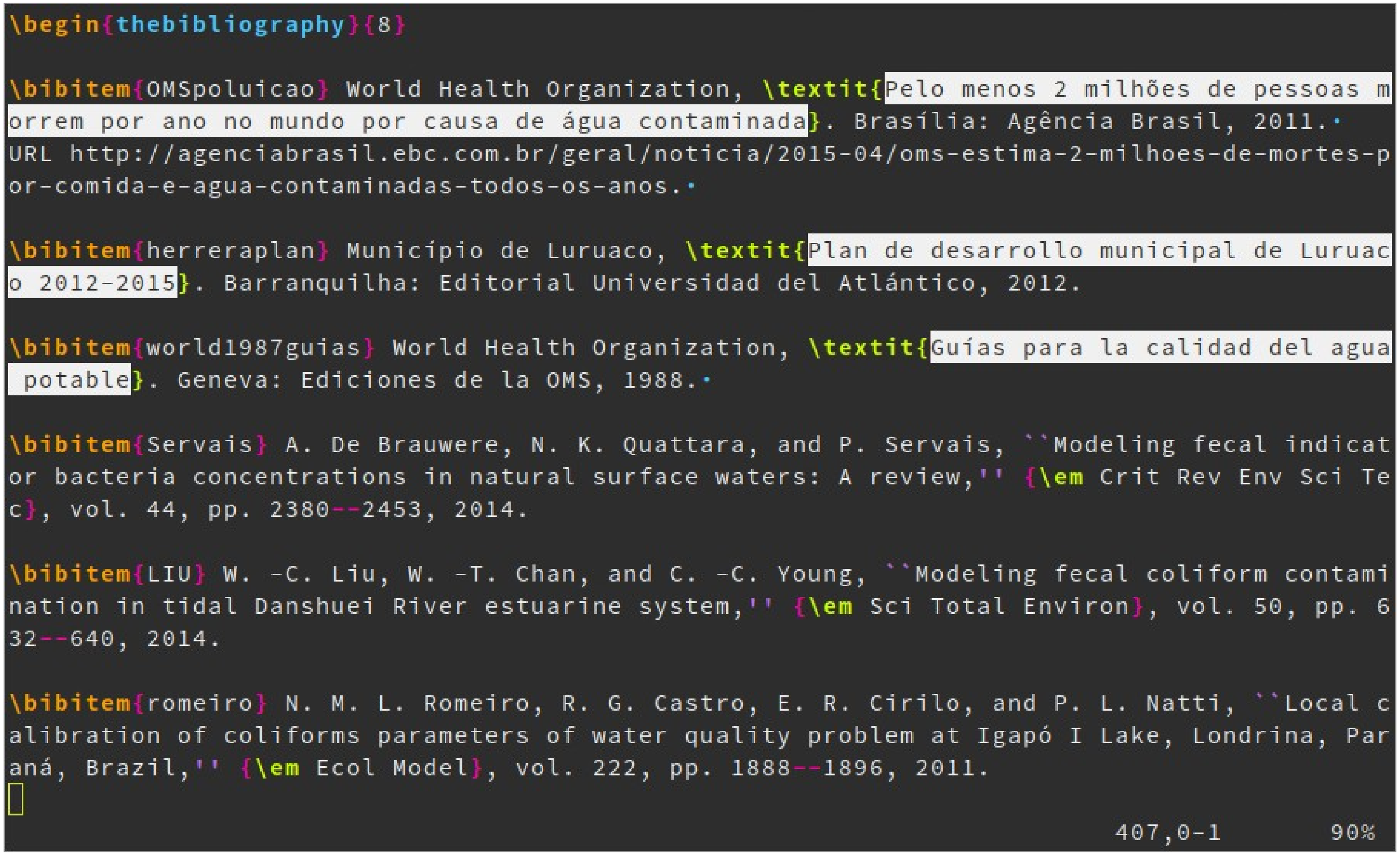
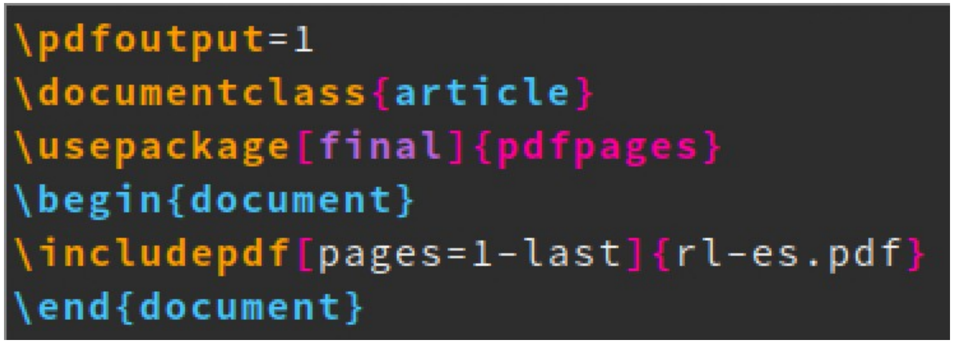
Challenges



```
\begin{thebibliography}{8}

\bibitem{OMSpoluicao} World Health Organization, \textit{Pelo menos 2 milhões de pessoas m
orrem por ano no mundo por causa de água contaminada}. Brasília: Agência Brasil, 2011.·
URL http://agenciabrasil.ebc.com.br/geral/noticia/2015-04/oms-estima-2-milhoes-de-mortes-p
or-comida-e-agua-contaminadas-todos-os-anos.·

\bibitem{herreraplan} Município de Luruaco, \textit{Plan de desarrollo municipal de Luruac
o 2012-2015}. Barranquilha: Editorial Universidad del Atlántico, 2012.

\bibitem{world1987guias} World Health Organization, \textit{Guías para la calidad del agua
 potable}. Geneva: Ediciones de la OMS, 1988.·

\bibitem{Servais} A. De Brauwere, N. K. Quattara, and P. Servais, ``Modeling fecal indicat
or bacteria concentrations in natural surface waters: A review,'' {\em Crit Rev Env Sci Te
c}, vol. 44, pp. 2380--2453, 2014.

\bibitem{LIU} W. -C. Liu, W. -T. Chan, and C. -C. Young, ``Modeling fecal coliform contami
nation in tidal Danshuei River estuarine system,'' {\em Sci Total Environ}, vol. 50, pp. 6
32--640, 2014.

\bibitem{romeiro} N. M. L. Romeiro, R. G. Castro, E. R. Cirilo, and P. L. Natti, ``Local c
alibration of coliforms parameters of water quality problem at Igapó I Lake, Londrina, Par
aná, Brazil,'' {\em Ecol Model}, vol. 222, pp. 1888--1896, 2011.

                                                                    407,0-1          90%
```

Challenges

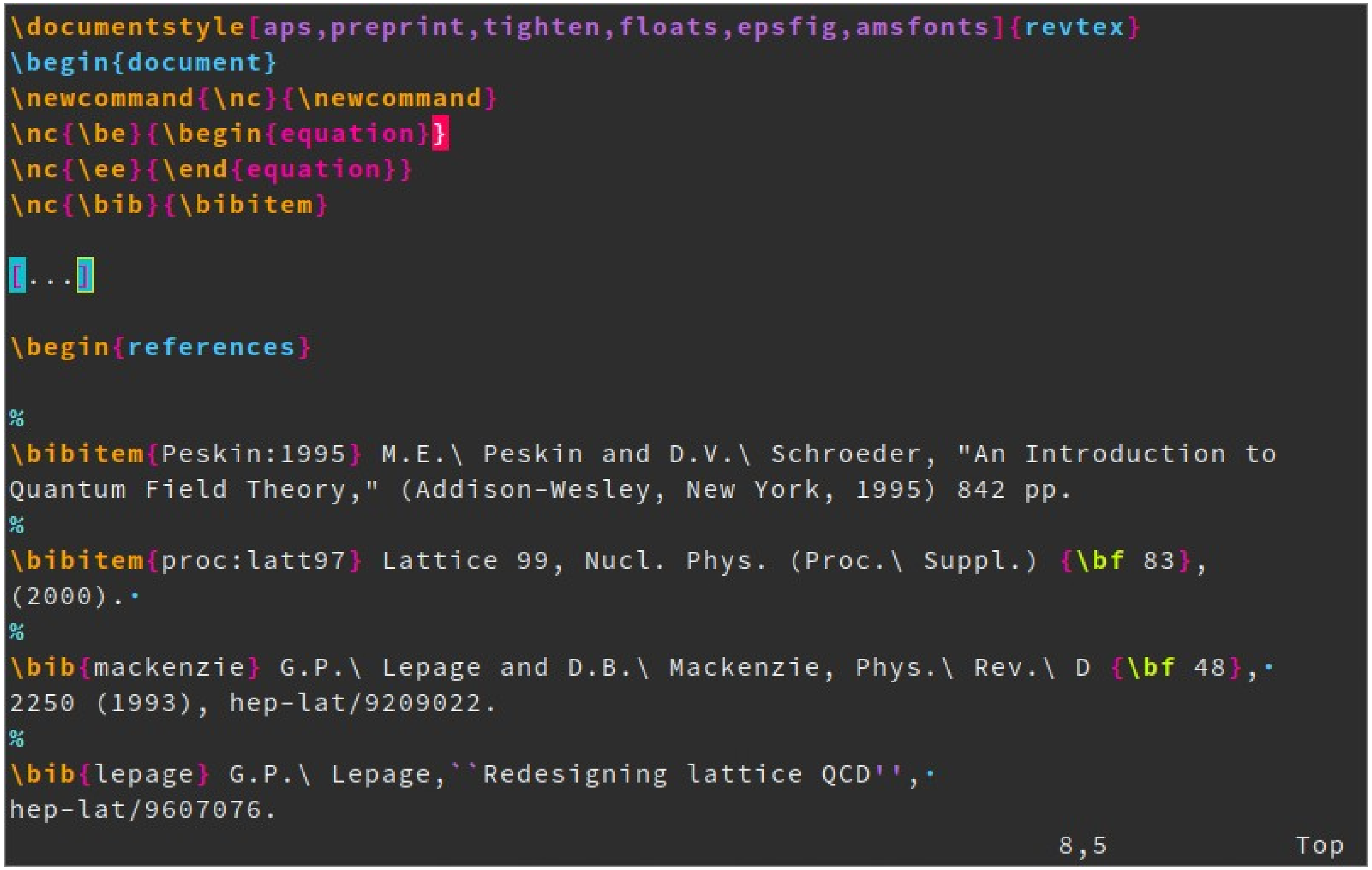
- “LaTeX sources”



```
\pdfoutput=1
\documentclass{article}
\usepackage[final]{pdfpages}
\begin{document}
\includepdf[pages=1-last]{rl-es.pdf}
\end{document}
```

Challenges

- newcommand for newcommand



```
\documentstyle[aps,preprint,tighten,floats,epsfig,amsfonts]{revtex}
\begin{document}
\newcommand{\nc}{\newcommand}
\nc{\be}{\begin{equation}}
\nc{\ee}{\end{equation}}
\nc{\bib}{\bibitem}

[...]

\begin{references}

%
\bibitem{Peskin:1995} M.E.\ Peskin and D.V.\ Schroeder, "An Introduction to
Quantum Field Theory," (Addison-Wesley, New York, 1995) 842 pp.
%
\bibitem{proc:latt97} Lattice 99, Nucl. Phys. (Proc.\ Suppl.) {\bf 83},
(2000).
%
\bib{mackenzie} G.P.\ Lepage and D.B.\ Mackenzie, Phys.\ Rev.\ D {\bf 48},
2250 (1993), hep-lat/9209022.
%
\bib{lepage} G.P.\ Lepage,``Redesigning lattice QCD'',
hep-lat/9607076.
                                                            8,5           Top
```

Challenges

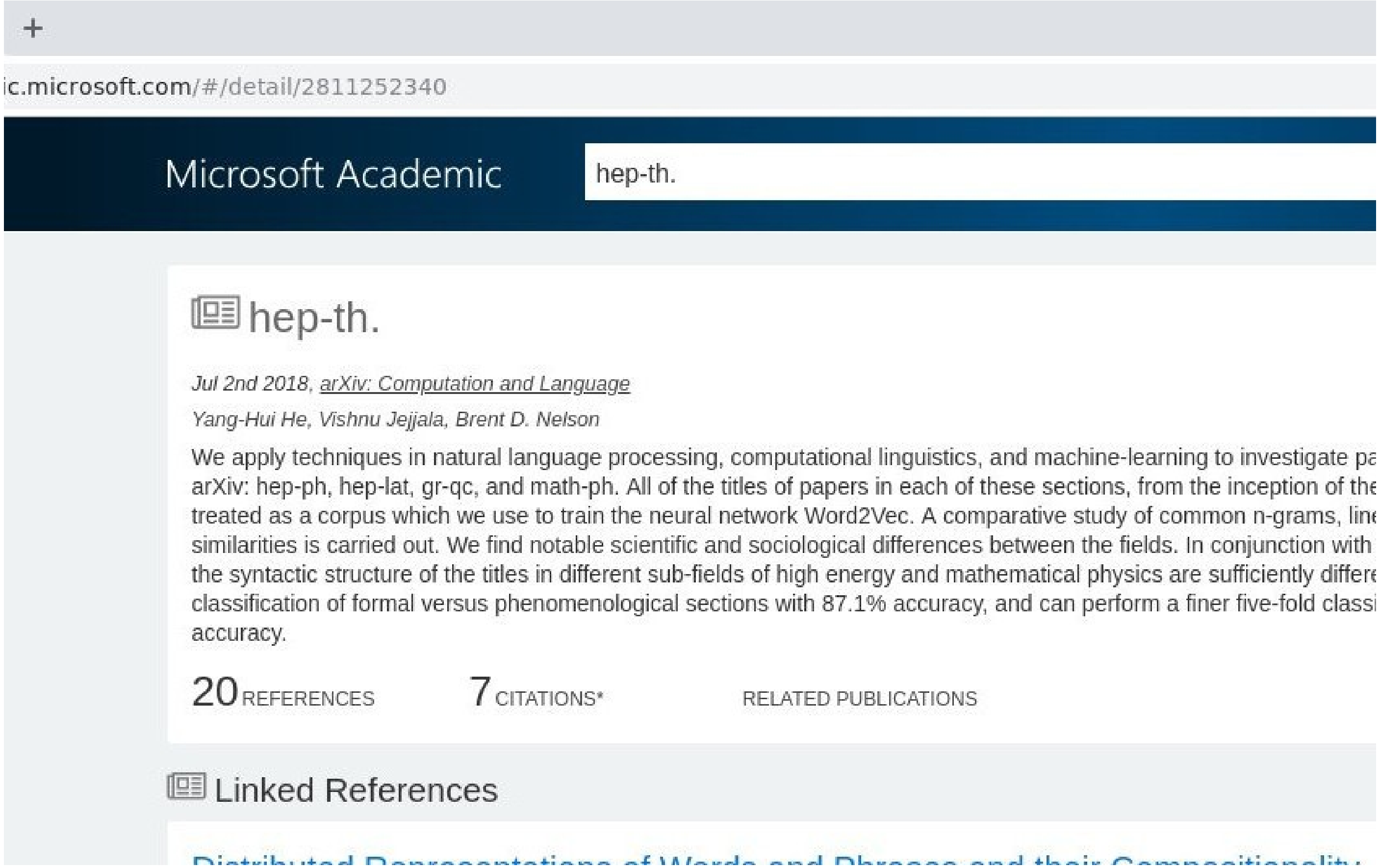
- Extraction
  - .bbl not .bib
  - Free spirited use of LaTeX
  - External packages (e.g. natbib)
- Reference resolution

Challenges

- Only minimal information
  - V.Sauli, JHEP 02, 001 (2003).
- Formulas in titles
  - Aaij, Roel, et al. "Search for the $B^{0}_{s} \to \eta^{\prime}\phi$ decay" Journal of High Energy Physics 2017.5 (2017): 158.

Challenges

- “hep-th.”



ic.microsoft.com/#/detail/2811252340

hep-th.

hep-th.

Jul 2nd 2018, arXiv: Computation and Language

Yang-Hui He, Vishnu Jejjala, Brent D. Nelson

We apply techniques in natural language processing, computational linguistics, and machine-learning to investigate pa
arXiv: hep-ph, hep-lat, gr-qc, and math-ph. All of the titles of papers in each of these sections, from the inception of the
treated as a corpus which we use to train the neural network Word2Vec. A comparative study of common n-grams, line
similarities is carried out. We find notable scientific and sociological differences between the fields. In conjunction with
the syntactic structure of the titles in different sub-fields of high energy and mathematical physics are sufficiently differe
classification of formal versus phenomenological sections with 87.1% accuracy, and can perform a finer five-fold classi
accuracy.

20 REFERENCES 7 CITATIONS* RELATED PUBLICATIONS

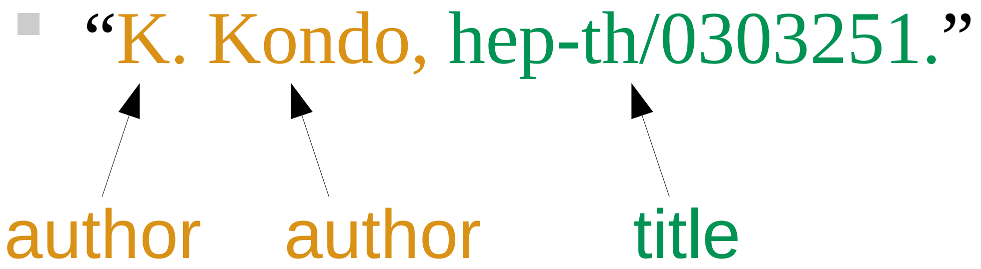
Linked References

Distributed Representations of Words and Phrases and their Compositionality

Challenges

- “K. Kondo, hep-th/0303251.”

Challenges



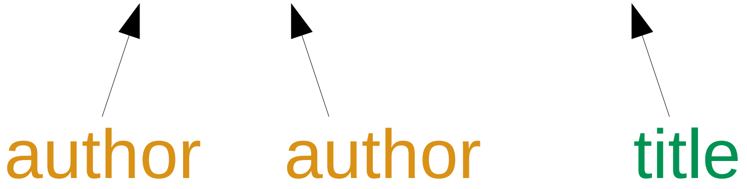
- “K. Kondo, hep-th/0303251.”

author author title

Neural ParsCit

Challenges

- “K. Kondo, hep-th/0303251.”



author author title

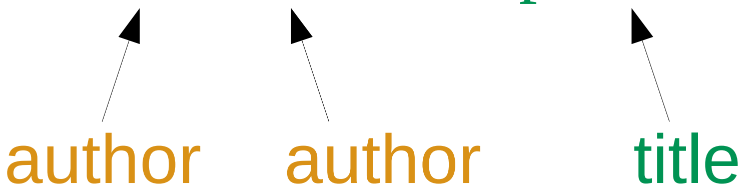
Neural ParsCit

- “hep th 0303251”

normalize

Challenges

- “K. Kondo, hep-th/0303251.”

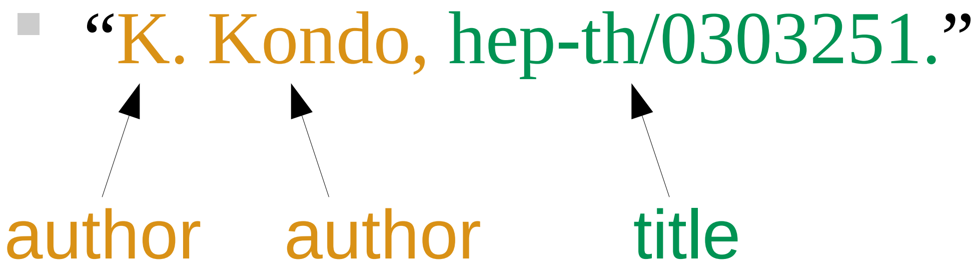


author author title

Neural ParsCit

- “hep th 0303251” normalize
- “hep th” try substrings

Challenges

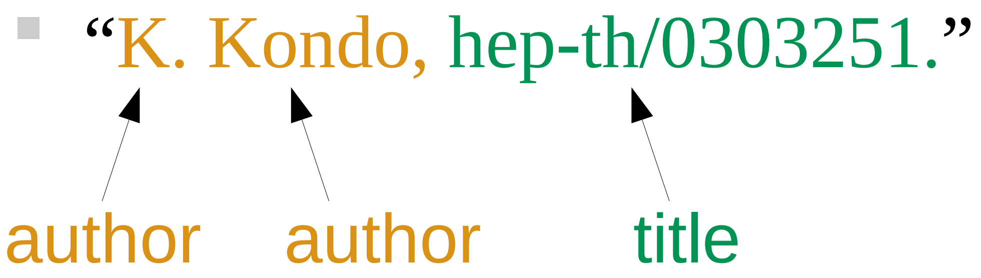


- “K. Kondo, hep-th/0303251.”

author author title

	Neural ParsCit
- “hep th 0303251”	normalize
- “hep th”	try substrings
- 2341106557 ✔	title match

Challenges



- “K. Kondo, hep-th/0303251.”

author author title

Neural ParsCit

- “hep th 0303251”
- “hep th”
- 2341106557 ✔
- Yang-Hui He, ✔
  Vishnu Jejjala,
  Brent D. Nelson

normalize

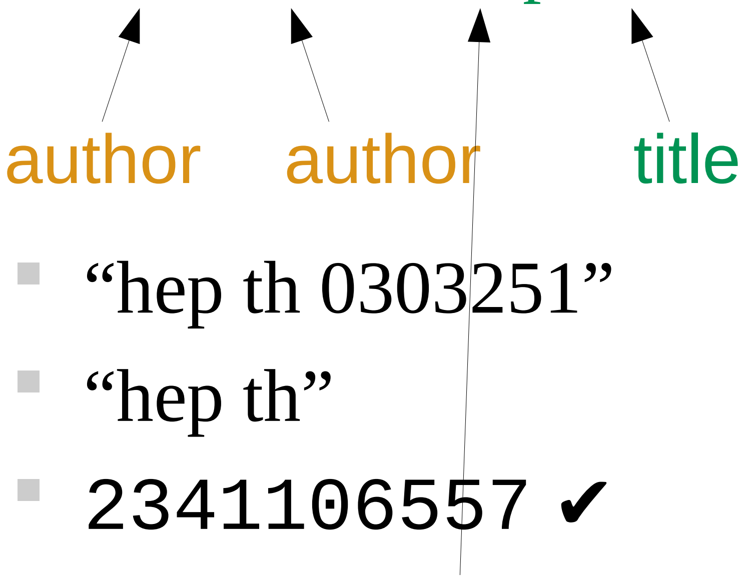
try substrings

title match

author match

Challenges

- “K. Kondo, **he**p-th/0303251.”



author author title

Neural ParsCit

- “hep th 0303251”

normalize

- “hep th”

try substrings

- `2341106557` ✔

title match

- Yang-Hui **he**, ✔
Vishnu Jejjala,
Brent D. Nelson

author match