Metadata Annotations of Experimental Data with the `ir_metadata` Schema

Timo Breuer, Jüri Keller, Philipp Schaer

https://www.ir-metadata.org/

Dagstuhl Seminar 23031, 16th January 2023

Technology Arts Sciences TH Köln

IR GROUP

SCHLOSS DAGSTUHL
Leibniz-Zentrum für Informatik

Motivation & Contribution

Research goal?

Platform?

Implementation?

Data?

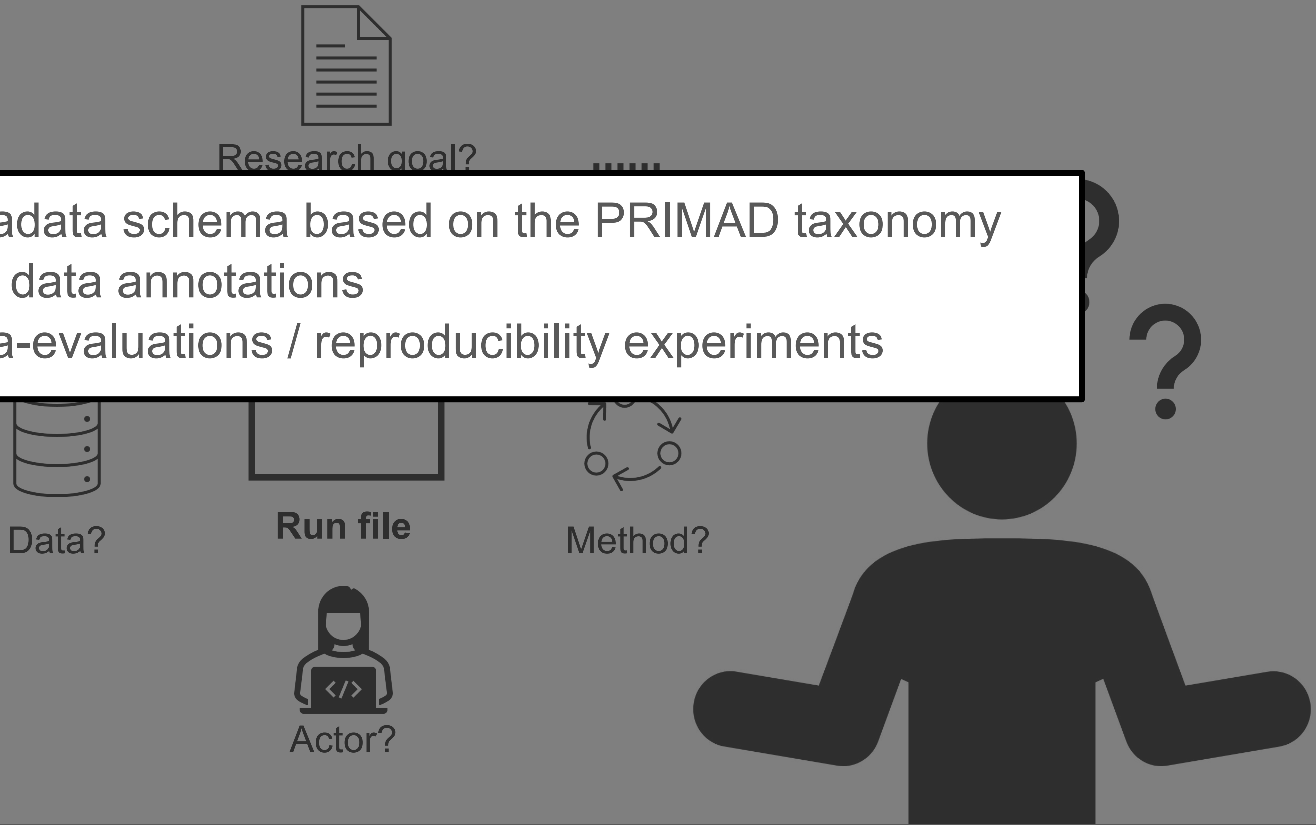
Run file

Method?

Actor?

Motivation & Contribution

- Metadata schema based on the PRIMAD taxonomy
- Run data annotations
- Meta-evaluations / reproducibility experiments



PRIMAD - the logical plan of the metadata schema

Report from Dagstuhl Seminar 16041

Reproducibility of Data-Oriented Experiments in e-Science

Edited by
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Abstract

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WORKSHOP REPORT

Increasing Reproducibility in IR: Findings from the Dagstuhl Seminar on "Reproducibility of Data-Oriented Experiments in e-Science"

Nicola Ferro[1] Norbert Fuhr[2] Kalervo Järvelin[3]
Noriko Kando[4] Matthias Lippold[2] Justin Zobel[5]

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[4] National Institute of Informatics, Japan, kando@nii.ac.jp
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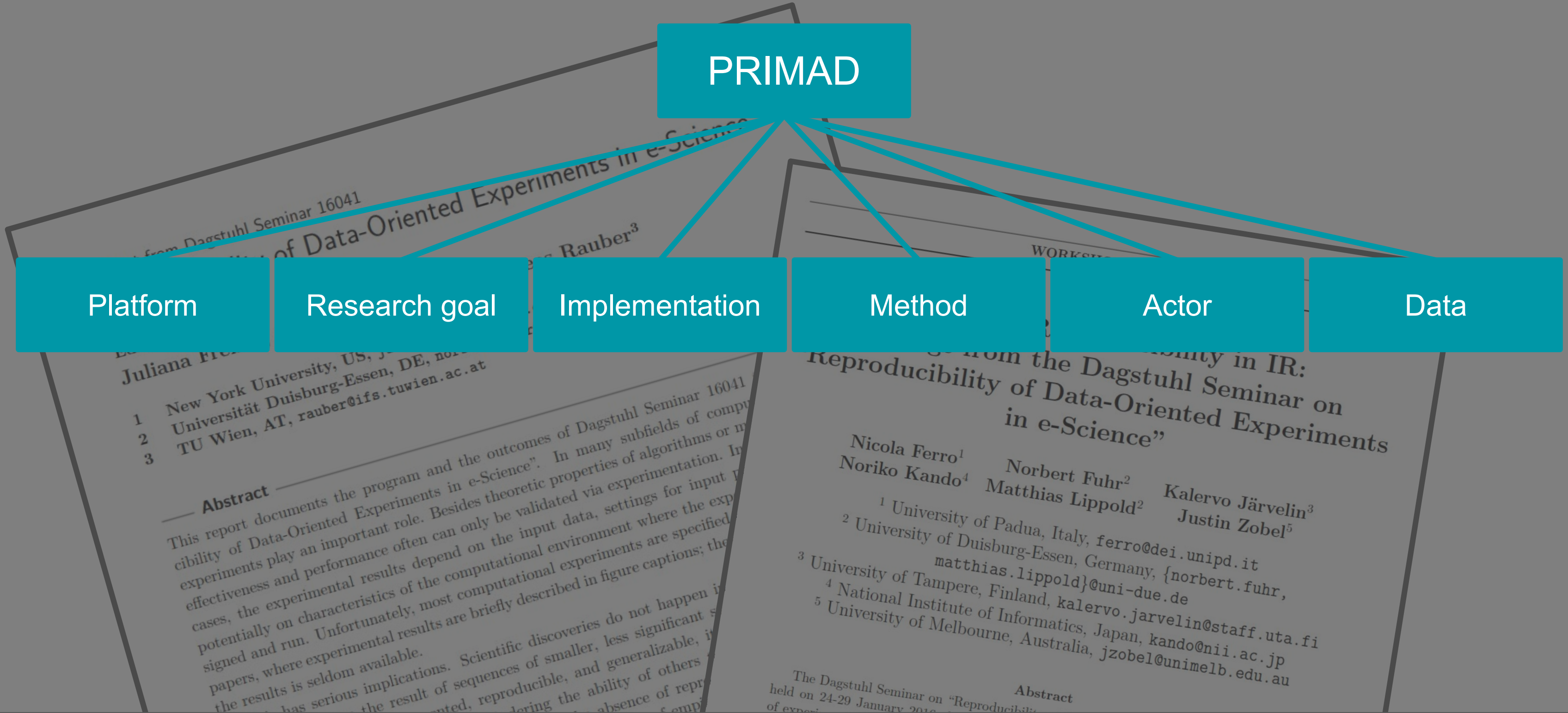

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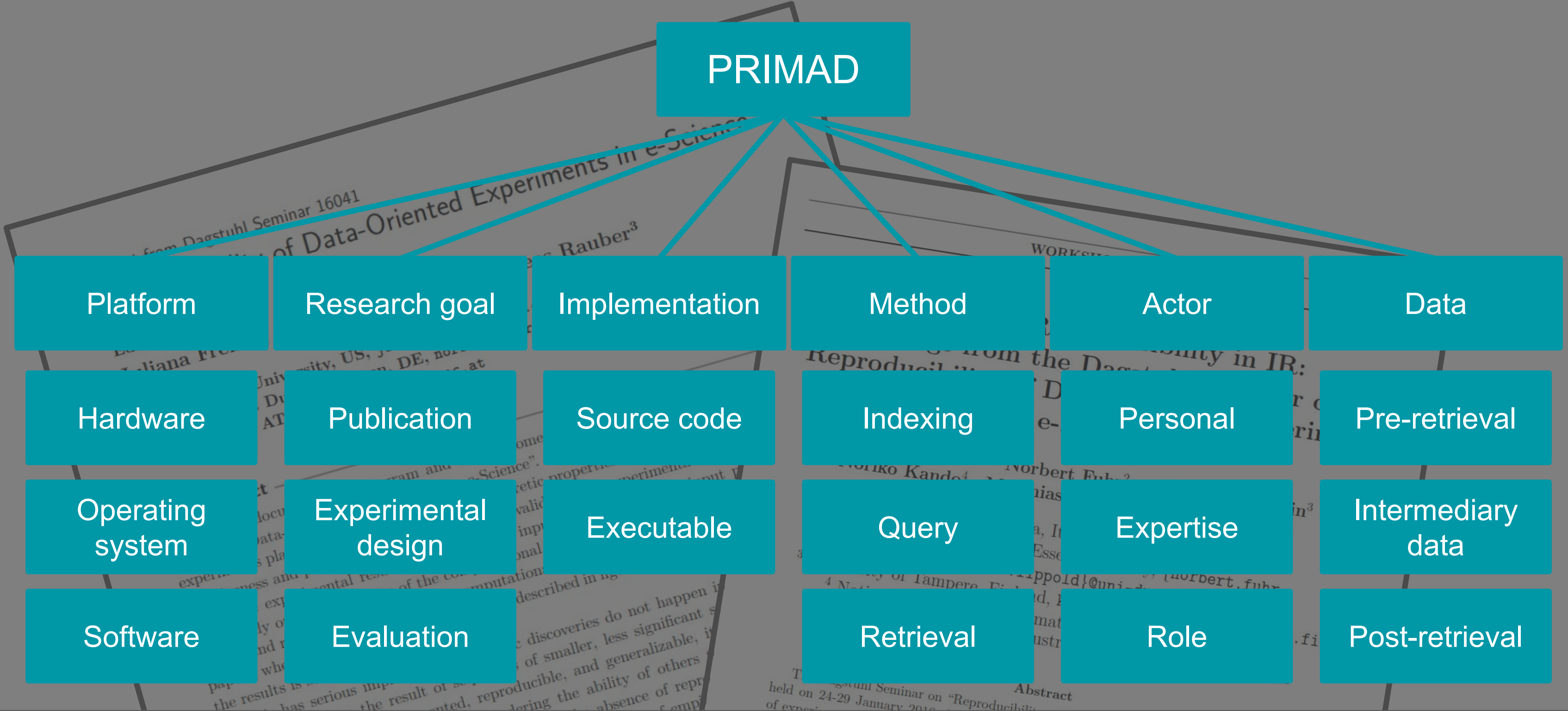


- PRIMAD
  - Platform
    - Hardware
    - Operating system
    - Software
  - Research goal
    - Publication
    - Experimental design
    - Evaluation
  - Implementation
    - Source code
    - Executable
  - Method
    - Indexing
    - Query
    - Retrieval
  - Actor
    - Personal
    - Expertise
    - Role
  - Data
    - Pre-retrieval
    - Intermediary data
    - Post-retrieval

Metadata annotations of run files

```
307       Q0        497476        1         0.9931        bm25
307       Q0        469928        2         0.9674        bm25
307       Q0        125806        3         0.9623        bm25
307       Q0        504815        4         0.9453        bm25
307       Q0        392547        5         0.9223        bm25
...
```

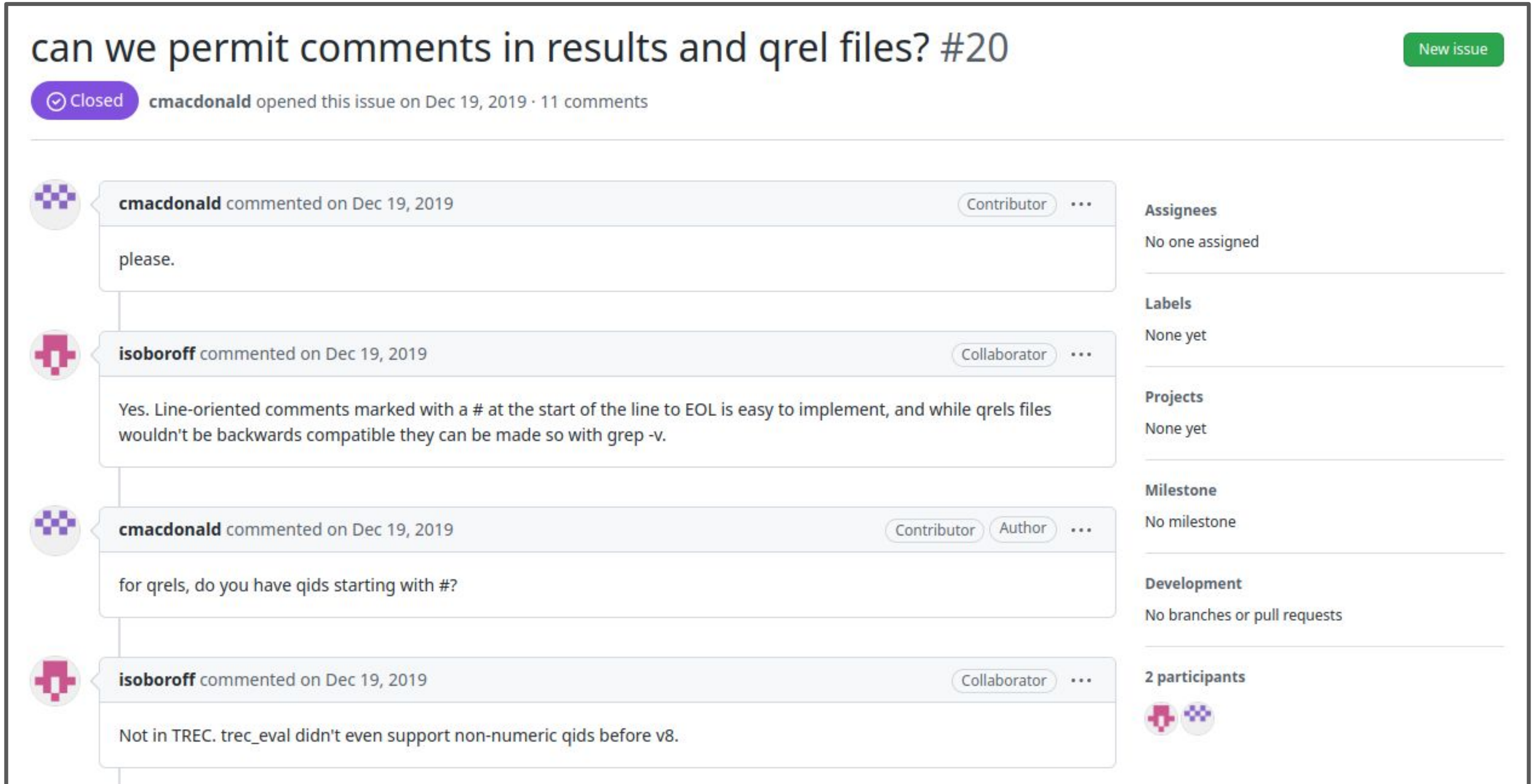
Metadata annotations of run files

```
# ir_metadata.start
# platform:
#    ...
# research goal:
#    ...
# implementation:
#    ...
# method:
#    ...
# actor:
#    ...
# data:
#    ...
# ir_metadata.end
307     Q0      497476      1       0.9931      bm25
307     Q0      469928      2       0.9674      bm25
307     Q0      125806      3       0.9623      bm25
307     Q0      504815      4       0.9453      bm25
307     Q0      392547      5       0.9223      bm25
...
```

Metadata annotations of run files

```
platform:
     hardware:
          cpu:
               model: 'Intel Xeon Gold 6144 CPU @ 3.50GHz'
               architecture: 'x86_64'
               operation mode: '64-bit'
               number of cores: 16
          ram: '64 GB'
     operating system:
          kernel: '5.4.0-90-generic'
          distribution: 'Ubuntu 20.04.3 LTS'
     software:
          libraries:
               python:
                    - 'scikit-learn==0.20.1'
                    - 'numpy==1.15.4'
               java:
                    - 'lucene==7.6'
          retrieval toolkit:
               - 'anserini==0.3.0'
```

Software support - trec_eval



can we permit comments in results and qrel files? #20

cmacdonald opened this issue on Dec 19, 2019 · 11 comments

cmacdonald commented on Dec 19, 2019

please.

isoboroff commented on Dec 19, 2019

Yes. Line-oriented comments marked with a # at the start of the line to EOL is easy to implement, and while qrels files wouldn't be backwards compatible they can be made so with grep -v.

cmacdonald commented on Dec 19, 2019

for qrels, do you have qids starting with #?

isoboroff commented on Dec 19, 2019

Not in TREC. trec_eval didn't even support non-numeric qids before v8.

Assignees
No one assigned

Labels
None yet

Projects
None yet

Milestone
No milestone

Development
No branches or pull requests

2 participants

Software support - repro_eval

- repro_eval==0.4.0 https://github.com/irgroup/repro_eval
- Metadata handling and (semi-)automatic annotations
- Meta-analysis based on metadata fields

Software support - repro_eval

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- **Metadata handling and (semi-)automatic annotations**
- Meta-analysis based on metadata fields

```
from repro_eval.metadata import MetadataHandler

run_path='./run.txt',
metadata_path='./metadata.yaml'
metadata_handler = MetadataHandler(run_path, metadata_path)
metadata_handler.write_metadata(complete_metadata=True)
```

Software support - repro_eval

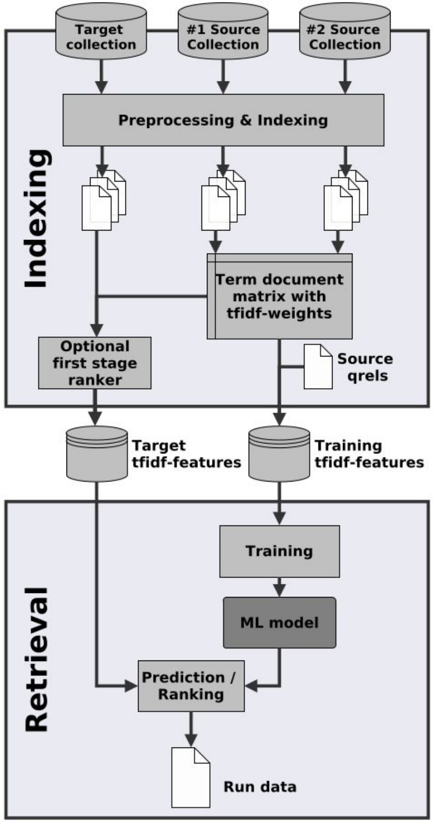
- repro_eval==0.4.0 https://github.com/irgroup/repro_eval
- Metadata handling and (semi-)automatic annotations
- **Meta-analysis based on metadata fields**

```
from repro_eval.metadata import MetadataAnalyzer, PrimadExperiment

run_path ='./run.txt'
dir_path ='./runs/'

metadata_analyzer = MetadataAnalyzer(run_path)
experiments = metadata_analyzer.analyze_directory(dir_path)

primad_type = 'priMad'
run_candidates = experiments.get(primad_type)

primad_experiment = PrimadExperiment(primad=primad_type,rep_base=run_candidates,...)
primad_experiment.evaluate()
```

Meta-evaluations / reproducibility experiments

Cross-collection relevance feedback
by Grossman and Cormack:

1. Derive tfidf training samples from source collection(s)
2. Train topic-based relevance classifier
3. Rank target collection



***MRG_UWaterloo and WaterlooCormack Participation in the TREC 2017 Common Core Track**;*
Grossman and Cormack; TREC Common Core 2017
***Simple techniques for cross-collection relevance feedback**;*
Yu, Xie, and Lin; ECIR 2019
***How to measure the reproducibility of system-oriented IR experiments**;*
Breuer, Ferro, Fuhr, Maistro, Sakai, Schaer, Soboroff; SIGIR 2020

Meta-evaluations / reproducibility experiments

Researchers	Type	Venue
GC	Original experiment	TREC 2017
YXL	Reproduction	ECIR 2019
BFFMSSS		SIGIR 2020

Run dataset: https://zenodo.org/record/5997491

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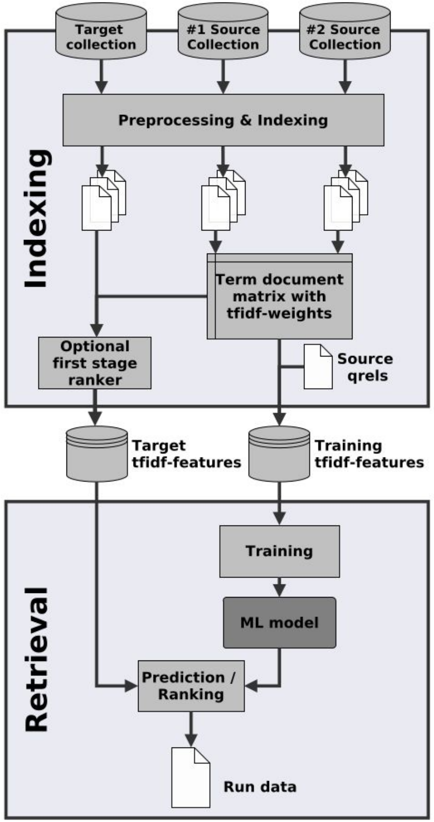

Meta-evaluations / reproducibility experiments

P’R’I’M’A’D

Measure	GC	YXL	BFFMSSS
AP	0.3711	0.4018	0.3612
KTU	1.0000	0.0086	0.0051
RBO	1.0000	0.1630	0.5747
RMSE	0.0000	0.1911	0.1071
p-value	1.0000	0.1009	0.7885

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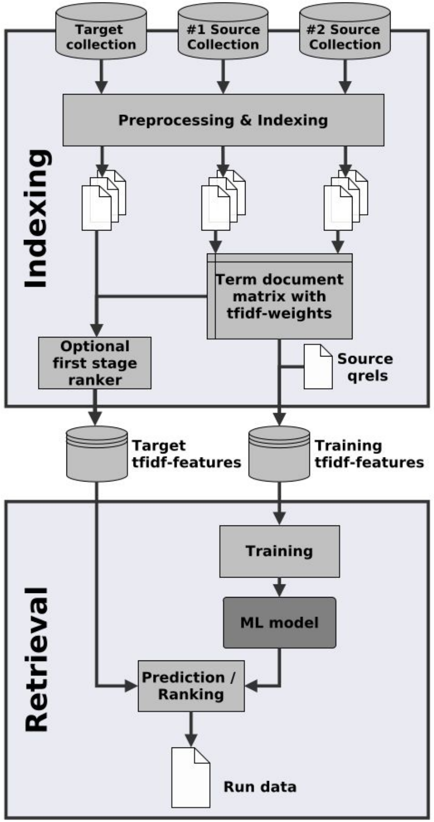

Future work

- Reduce labeling effort
  - Automatic run annotations
  - Integration into existing retrieval toolkits
- Sanity checks; prioritizing important fields
  - Verification of checksums, completeness, …
  - Assign requirement levels according to RFC2119
- Public database
  - Find baselines, conduct meta-evaluations, …
- How can we make it a community standard?
  - Collaborations with shared task organizers?
  - How can we motivate IR practitioners to annotate their experimental data? Reward?
  - TREC Deep Learning track as pioneering example

Thank you!

Website:	https://www.ir-metadata.org/
arXiv:	https://arxiv.org/abs/2207.08922
ACM DL:	https://dl.acm.org/doi/10.1145/3477495.3531738