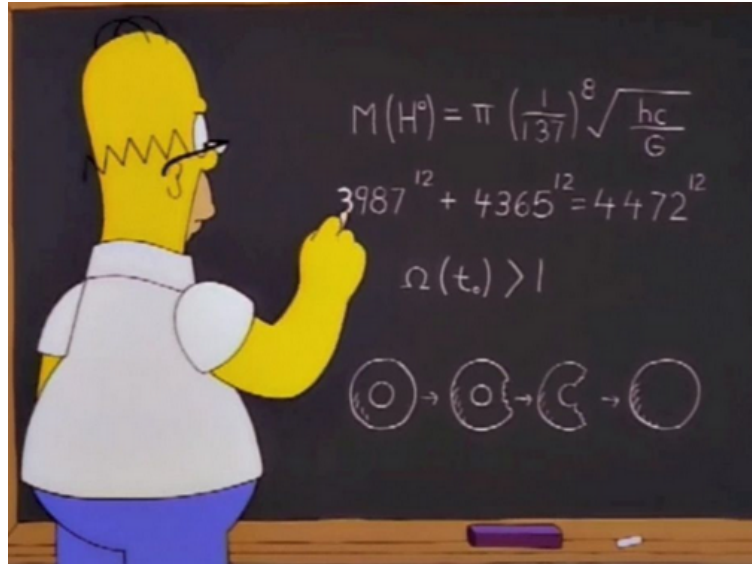# Prototyping Open Web Search Applications with TIRA: A Case Study in Research-oriented Teaching

Maik Fröbe, Theresa Elstner, Harrisen Scells, Benno Stein, Martin Potthast
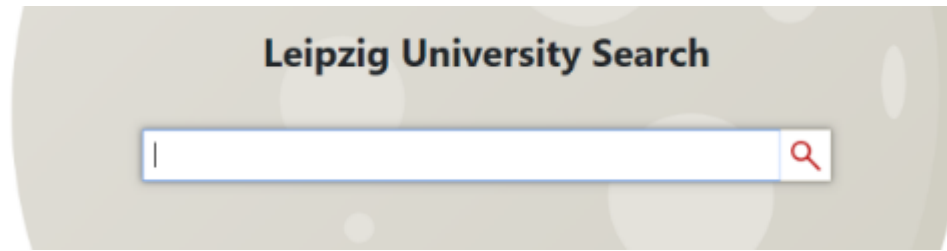OSSYM 11–13 October, CERN 2023

@webis_de   www.webis.de

Prototyping Open Web Search in Research-oriented Teaching

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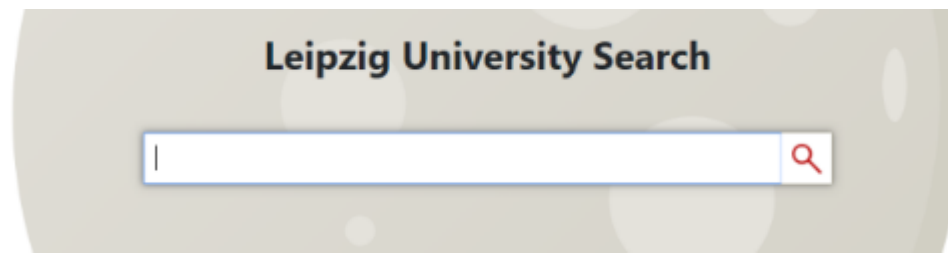

IR Exercise in 2017: Build a Search Engine for a Domain of your Choice

Prototyping Open Web Search in Research-oriented Teaching

an IR course

A long time ago in a ~~galaxy~~ far, far away....

IR Exercise in 2017: Build a Search Engine for a Domain of your Choice

Leipzig University Search

Pro

- ❑ Praxis project in a group
- ❑ Interesting technologies
  - – Nutch, Docker, Lucene, JS
- ❑ Cranfield style evaluation
  - – Evolved into research

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Prototyping Open Web Search in Research-oriented Teaching

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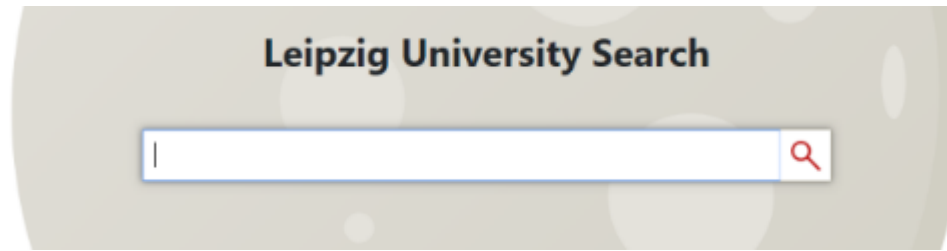IR Exercise in 2017: Build a Search Engine for a Domain of your Choice

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Con

- ❏ Each group works on a different problem
  - – No/Limited shared learning
- ❏ Created resources are barely reusable
  - – Much too small, unclear quality, etc.

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IR Exercise WiSe 2023

Shared Task by Students for Students

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IR Exercise WiSe 2023

Shared Task by Students for Students

Scenario: Searching the IR Anthology

IR Anthology   Full-text search...   🔍

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IR Exercise WiSe 2023

Shared Task by Students for Students

Scenario: Searching the IR Anthology

IR Anthology | Full-text search... | 🔍

Realization with TIREx (= an integration of existing tools)
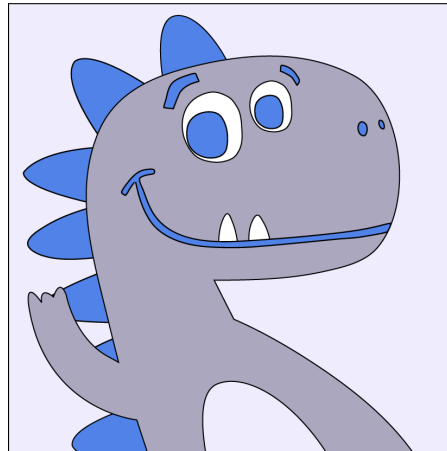
TIREx = TIRA + ir_datasets + PyTerrier

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IR Exercise WiSe 2023

Shared Task by Students for Students

Lets look at the results:

$$\texttt{https://www.tira.io/}$$

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IR Exercise WiSe 2023: Backup

- ❏ 189 submissions of Docker images
- ❏ Shared leaderboard

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IR Exercise WiSe 2023: Backup

❏ Looking into SERPs rendered with DiffIR allows to formulate hypothesis

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IR Exercise WiSe 2023: Backup

Submissions

Dataset

iranthology

	Team	Approach	Run	P@10 ↓	RR	nDCG@10		
☐	🐾 👁 ir-lab-sose-2023-dogument-retriever	PL2-KL	2023-06-24-16-12-04	0.39	0.66	0.438	📄 🔍 📝	⌄
☐	🐾 👁 ir-lab-sose-2023-memory	Multi-Field	2023-06-21-03-15-35	0.387	0.722	0.459	📄 🔍 📝	⌄
☐	🐾 👁 ir-lab-sose-2023-order-google-scholar	IN-EXPC2	2023-06-25-23-09-51	0.387	0.691	0.447	📄 🔍 📝	⌄
☐	🐾 👁 ir-lab-sose-2023-order-google-scholar	lemurtf_idf	2023-06-25-23-05-08	0.36	0.674	0.42	📄 🔍 📝	⌄
☐	🐾 👁 ir-lab-sose-2023-order-google-scholar	lemurtf_idf-2	2023-06-26-21-20-32	0.36	0.674	0.42	📄 🔍 📝	⌄
☐	📄 👁 ir-lab-sose-2023-tutors	IR-Anthology 2022	2023-06-19-18-48-35	0.31	0.664	0.371	📄 🔍 📝	⌄
☐	🐾 👁 ir-lab-sose-2023-tutors	ANCE	2023-06-18-15-47-12	0.271	0.496	0.294	📄 🔍 📝	⌄
☐	🐾 👁̸ ir-lab-sose-2023-memory	bm25-sdm	2023-06-20-13-28-17	0.265	0.68	0.366	📄 🔍 📝	⌄

Items per page: 10 ▾ 171-180 of 189 |< < > >|

❑ Almost all student teams outperformed our production system

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IR Exercise WiSe 2023

Shared Task by Students for Students

Lets look at the results: `https://www.tira.io/`

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Prototyping Open Web Search in Research-oriented Teaching

Shared Task by Students for Students

Lets look at the results: `https://www.tira.io/`

Realization + Short Hands-On

- ❏ Milestone 1: Data creation + Pooling + Judgment
- ❏ Milestone 2: Create software submissions
- ❏ Milestone 3: Write up + fill judgment holes

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Pro

- ❑ Standardization + reusability
- ❑ Did scale very well
- ❑ We enrich "something" with complete experiment setups
  - – Data + dockerized software

Con

- ❑ Quality of resulting data is not clear
  - – Not yet clear if observations from previous work transfer
    [Sakai'22,Schaer'12]
- ❑ I hoped that student teams build more on top of each other

Prototyping Open Web Search in Research-oriented Teaching

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Adjustments for SoSe 2023/24 to Milestone 3 resolves the cons

Mini components + submission to LongEval

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Prototyping Open Web Search in Research-oriented Teaching
Vision: Make many "mini stones" available to students
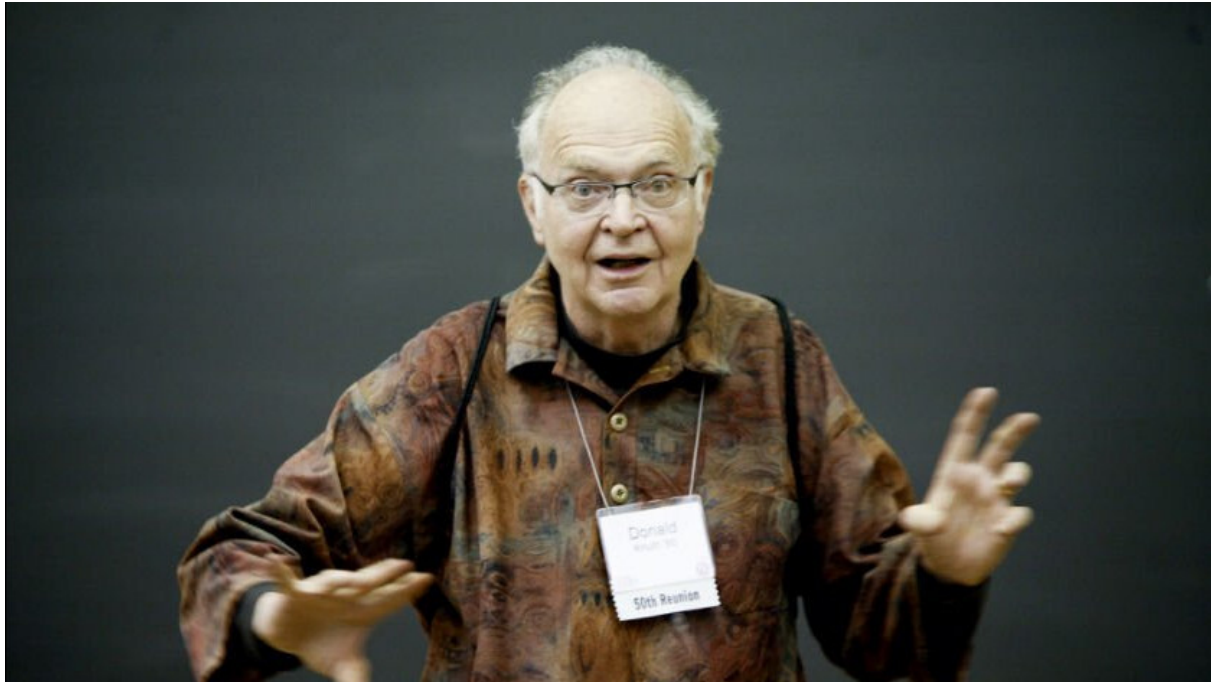
"People think that computer science is the art of geniuses
but the actual reality is the opposite, just many people doing
things that build on each other, like a wall of mini stones."

Donald Knuth

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We want to follow this idea with TIREx
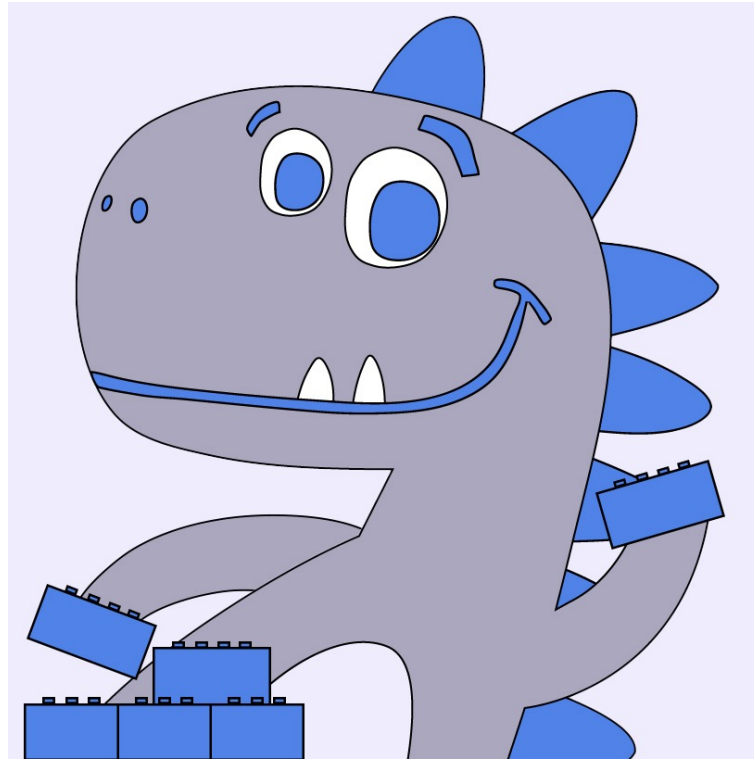
Prototyping Open Web Search in Research-oriented Teaching

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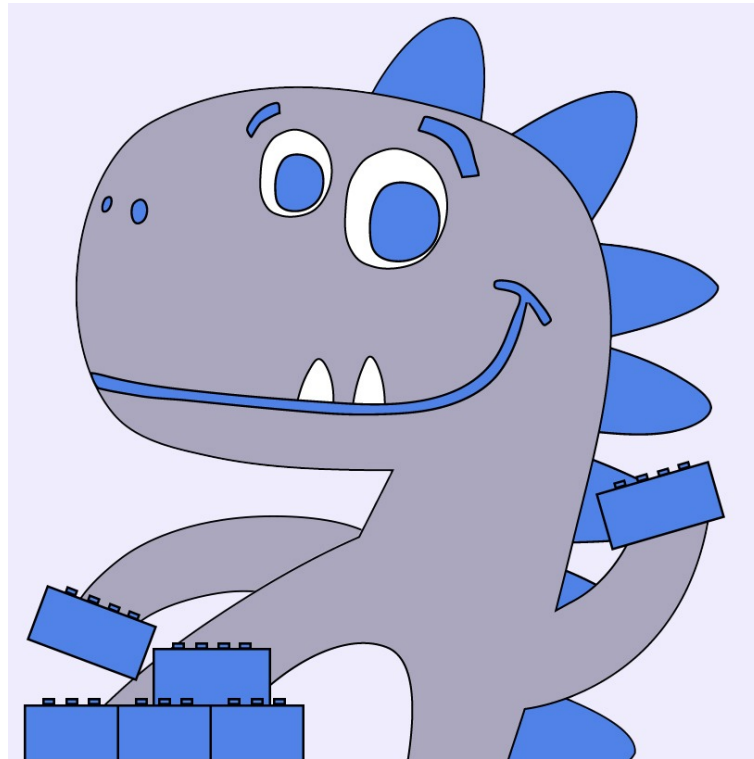
Goal: Simplify to compose reproducible and declarative pipelines

- ❑ Workshop proposal under review at ECIR'24: Call for reusable components
- ❑ Many components must only be executed "once in a lifetime"
- ❑ Students can use expert components while focusing on the modeling part

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Example: Query Segmentation

Query Segmentation Revisited

Matthias Hagen   Martin Potthast   Benno Stein   Christof Bräutigam

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Example: Query Segmentation

Query Segmentation Revisited

Matthias Hagen   Martin Potthast   Benno Stein   Christof Bräutigam

- ❑ **Query:** `hubble telescope achievements`

- ❑ **Segments:** `hubble telescope | achievements`

- ❑ `hubble telescope achievements` $\Rightarrow$ `"hubble telescope" achievements`

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Execute the 2011 query segmentation... Before submission to TIREx/TIRA

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Execute the 2011 query segmentation... Before submission to TIREx/TIRA

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Query segmentation using PyTerrier of component submitted to TIREx/TIRA

Setup Retrieval Pipeline

```python
query_segmentation = tira.pt.transform_queries('webis-query-segmentation/hyb-a', dataset)

pipeline = query_segmentation >> rewrite_segments_to_phrases >> bm25
```
[5]   Python

Prototyping Open Web Search in Research-oriented Teaching

Query segmentation using PyTerrier of component submitted to TIREx/TIRA

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[5]                                                                        Python
```

❑ Improves nDCG@10 from 0.00 to 0.31 for `hubble telescope achievements`

❑ Use cached outputs from TIREx if available, otherwise use Docker image

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Conclusions

Summary

- Students develop IR systems in a shared task style scenario
- Last term: IR Anthology as corpus
- Next term: LongEval as corpus + optional submission to this shared task
- Some future term: Selective search against the OWS index?
  - We can prototype open web search applications that way

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Future Work

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- ir_pad for teaching: Small standardized notebooks
- Pipeline search

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thank you!

Maik Fröbe