Information Retrieval

Exercise – Winter term 2025/2026

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Agenda

1. Ranked Retrieval Measures
2. GitHub Repository
3. TIRA

Precision–Recall Curve

Exercise

Given the following two rankings:

System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
D	t_2	👎	👎	👍	👍	👎	👎	👍	👍	👎	👍
E	t_1	👎	👍	👍	👎	👍	👍	👍	👎	👎	👎
E	t_2	👍	👎	👍	👍	👎	👎	👎	👍	👍	👎

Which system is better?

Precision–Recall Curve

Given the following two rankings:

System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
D	t_2	👎	👎	👍	👍	👎	👎	👍	👍	👎	👍
E	t_1	👎	👍	👍	👎	👍	👍	👍	👎	👎	👎
E	t_2	👍	👎	👍	👍	👎	👎	👎	👍	👍	👎

Which system is better?

They achieve equal precision and recall for topics t_1 and t_2.

System	Topic	Precision	Recall
D	t_1	0.5	1.0
D	t_2	0.5	1.0
E	t_1	0.5	1.0
E	t_2	0.5	1.0

Precision–Recall Curve

Given the following two rankings:

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D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
D	t_2	👎	👎	👍	👍	👎	👎	👍	👍	👎	👍
E	t_1	👎	👍	👍	👎	👍	👍	👍	👎	👎	👎
E	t_2	👍	👎	👍	👍	👎	👎	👎	👍	👍	👎

Which system is better?

Draw the precision–recall curves.

Precision–Recall Curve

Given the following two rankings:

System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
D	t_2	👎	👎	👍	👍	👎	👎	👍	👍	👎	👍
E	t_1	👎	👍	👍	👎	👍	👍	👍	👎	👎	👎
E	t_2	👍	👎	👍	👍	👎	👎	👎	👍	👍	👎

Which system is better?

Draw the precision–recall curves.

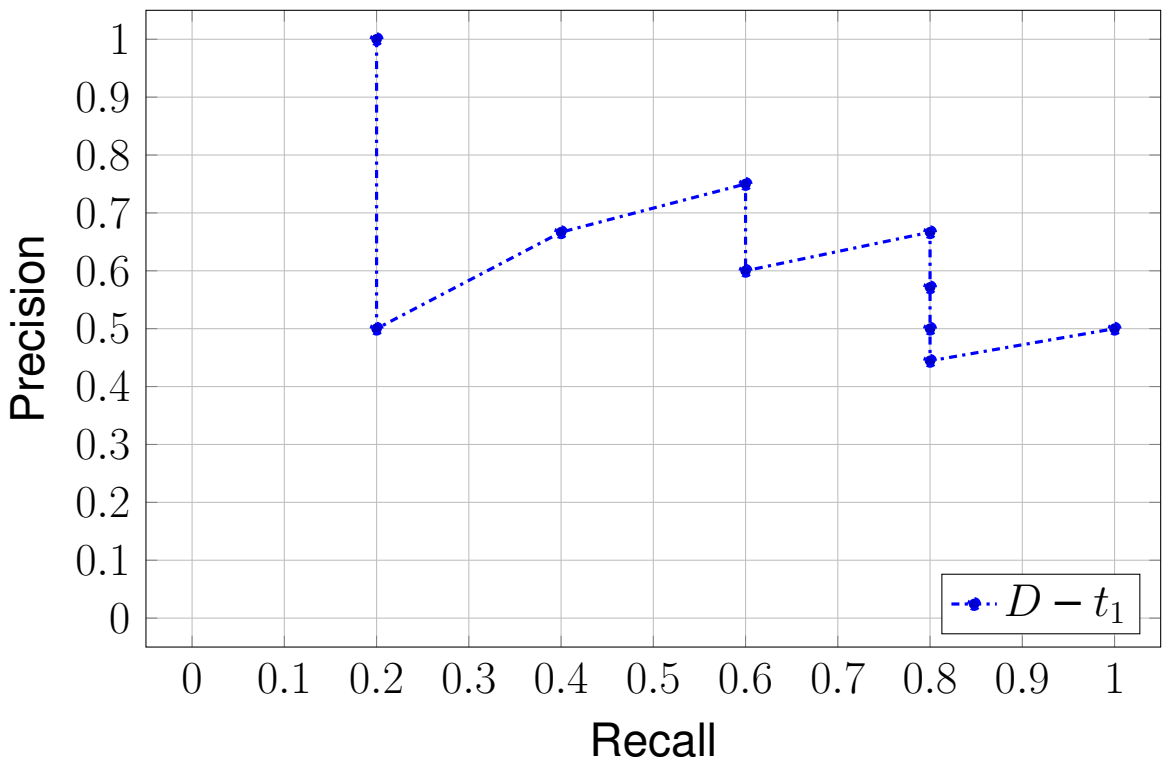
Compute precision and recall at rank k.

Precision–Recall Curve

System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
	precision	1	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{4}{7}$	$\frac{4}{8}$	$\frac{4}{9}$	$\frac{5}{10}$
	recall	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{5}{5}$

Precision–Recall Curve

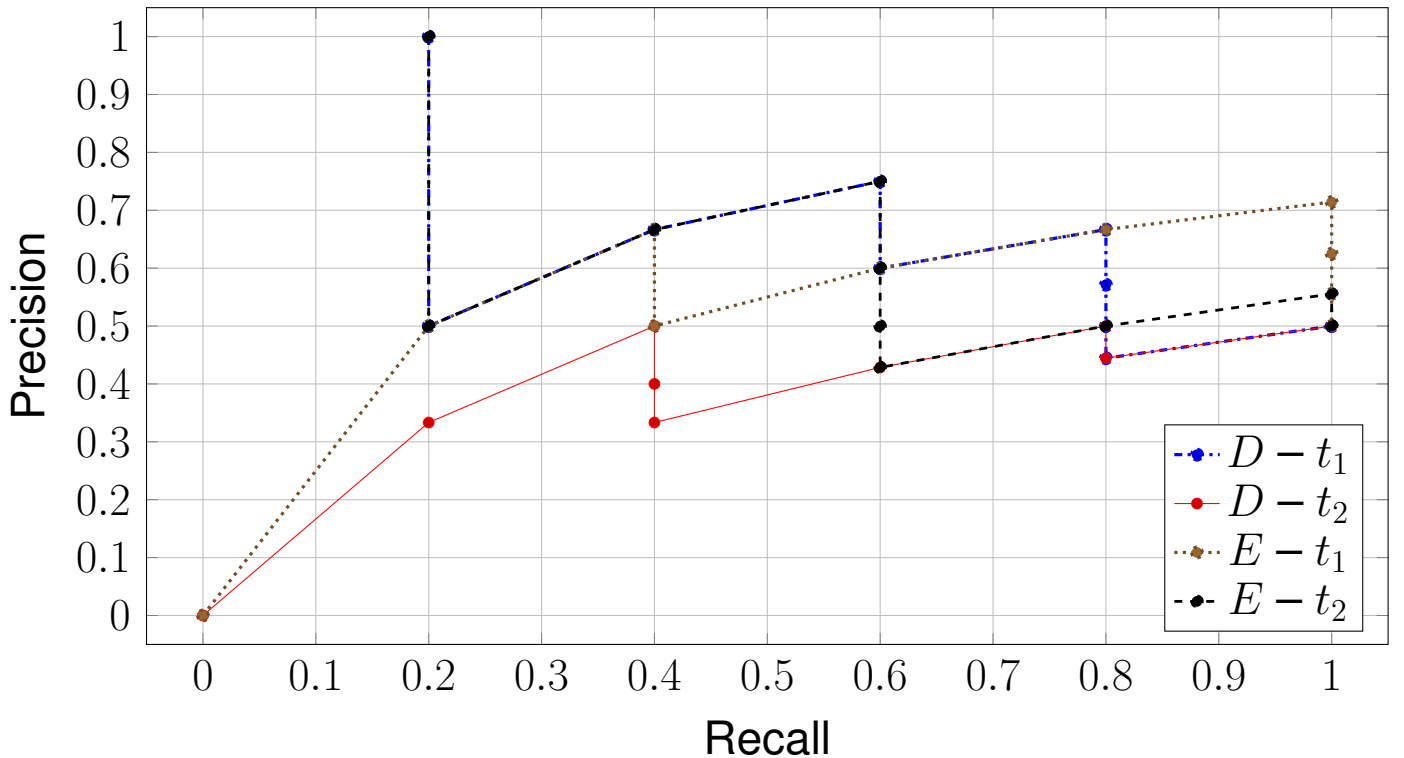
System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
	precision	1	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{4}{7}$	$\frac{4}{8}$	$\frac{4}{9}$	$\frac{5}{10}$
	recall	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{5}{5}$



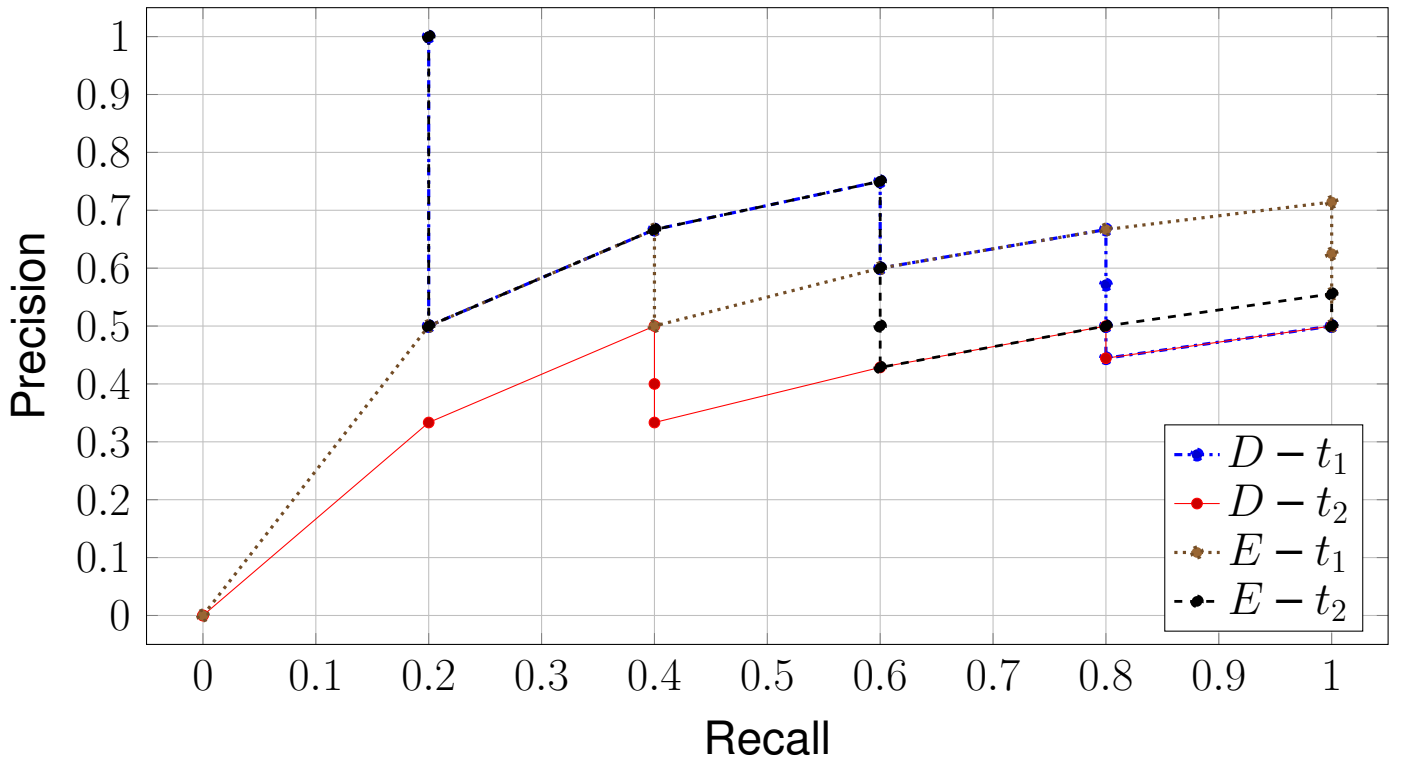
Precision–Recall Curve

System	Topic	Relevance at rank									
		1	2	3	4	5	6	7	8	9	10
D	t_1	👍	👎	👍	👍	👎	👍	👎	👎	👎	👍
	precision	1	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{4}{7}$	$\frac{4}{8}$	$\frac{4}{9}$	$\frac{5}{10}$
	recall	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{5}{5}$
D	t_2	👎	👎	👍	👍	👎	👎	👍	👍	👎	👍
	precision	0	0	$\frac{1}{3}$	$\frac{2}{4}$	$\frac{2}{5}$	$\frac{2}{6}$	$\frac{3}{7}$	$\frac{4}{8}$	$\frac{4}{9}$	$\frac{5}{10}$
	recall	0	0	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{5}{5}$
E	t_1	👎	👍	👍	👎	👍	👍	👍	👎	👎	👎
	precision	0	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{2}{4}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{5}{7}$	$\frac{5}{8}$	$\frac{5}{9}$	$\frac{5}{10}$
	recall	0	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{5}{5}$	$\frac{5}{5}$	$\frac{5}{5}$	$\frac{5}{5}$
E	t_2	👍	👎	👍	👍	👎	👎	👎	👍	👍	👎
	precision	1	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{3}{6}$	$\frac{3}{7}$	$\frac{4}{8}$	$\frac{5}{9}$	$\frac{5}{10}$
	recall	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{5}{5}$	$\frac{5}{5}$

Precision–Recall Curves



Precision–Recall Curves



- Points between the original data points have no direct interpretation
- Best system can be quantified by the larger area under its curve
- Average precision $AP(q, R)$ estimates the area under the uninterpolated precision–recall curve for topic t and query $q \in Q$
- $MAP(Q)$: Average precision-recall curves for different topics

[“An Introduction to Informaiton Retrieval” (Manning et al.), Section 8.4]

Next Steps

Assignment

- Exercise sheet on temir.org
- Download Docker
- Create a GitHub account for the next stage (i.e., building an IR system)
- Create TIRA account
- Inspiration

GitHub Repository

Version Control System VCS

We maintain all project work in a monorepo so that everything stays in one place.

1. Sign up for GitHub [*].
2. Fork the wows-code repository [†].
3. Clone the forked repository [*].
4. Create a directory to store your team's work and push your changes [†]. Use the format `ks-<TEAM-NAME>`.
5. Start developing with dev containers [*].
6. Once your approach is "finished enough", create a pull request to the original repository [*].

For detailed instructions, see the repository's ECIR26 README file.

To contribute multiple approaches, keep each in its own directory, e.g., `ks-<TEAM-NAME>-01`, `ks-<TEAM-NAME>-02`, ...

[*] Required for **every** team member
[†] Required for only **one** team member

Get Started

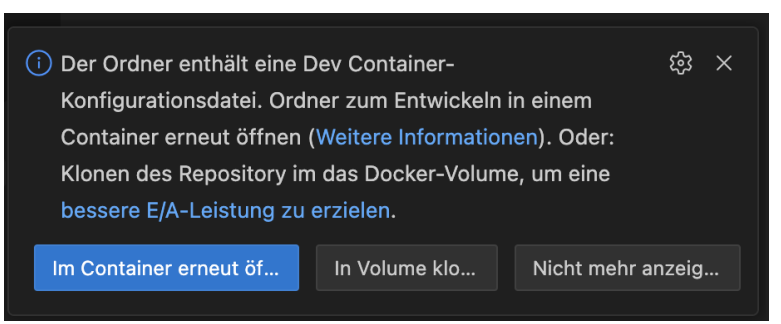
Development Container

- Dev containers allow using container as a full-features development environment
- Container environments should be easy to use, create, and recreate
- `Dockerfile` builds environment (e.g., base image, package installation)
- `devcontainer.json` configures how VS Code uses environment (e.g., VS Code extensions)
- For further details on Docker and dev containers, refer to these slides

Get Started

Development Container

1. Ensure that **Docker** is running.
2. Open a directory that contains **exactly one** dev container configuration in its root.
   - Open your cloned fork of the wows-code repository.
   - Use the CLI to navigate to the directory containing the dev container configuration (e.g., `cd ecir26/template-new-approach`).
   - Run `code .` to open the directory in a dedicated VS Code instance.
3. When prompted, select `Reopen in Container` in VS Code, or invoke it manually from the Command Palette (`cmd/ctrl + shift + p` or `F1`).
4. Continue following the instructions in the `README` file.



(3): `Reopen in Container` in VS Code.

If you run into issues with (3), try `docker pull <DOCKER-BASE-IMAGE>` to get a clearer error message. You can find <DOCKER-BASE-IMAGE> in the corresponding Dockerfile.

Get Started

Artifact-Free Approach

- Create index
- Implement retrieval strategy
- Running `./retrieve.py <OPTIONS>` will create multiple files.
  - Possible options are specified in README file.

`zcat run.txt.gz`:

query ID	-	document ID	rank	score	-
74	Q0	950c12d12803 . . . b6	0	9.558411251356873	pyterrier
74	Q0	6075d2b6a65d . . . 36	1	8.716015411249087	pyterrier
⋮					⋱

`cat retrieval-metadata.yml`:

- Resources
- . . .

Get Started

Pyterrier Artifact Approach

PyTerrier is a Python framework that enables the construction of declarative retrieval pipelines.

What is artifact sharing?

- Artifacts are trained models, pre-built indexes
- Proposed at SIGIR'25
- Functionality in PyTerrier Python package
  - Trained model: `pyterrier_bm25 = pt.Artifact.from_url(f"tira:dataset_id/ows/pyterrier-BM25-on-default")`
  - Pre-built index: `index = pt.Artifact.from_url(f"tira:dataset_id/ows/pyterrier-index-default")`
- Improves reproducibility & saves time
- Some PyTerrier Artifacts are available in TIRA (cf. overview)

Before running the PyTerrier Artifacts Approach to see how artifacts are used in development, first complete the PyTerrier Artifacts tutorial.

Get Started

Ideas:

- Build a custom index(es) and merge them
  - Use LLMs for query independent stopping/ context-aware term weights [Paper]
  - Index title/ metadata/ whole text
- Change document/ query representations
- Implement reranker(s)
- Perform query rewriting
  - (In-) Dependent of query intent/ type
- Combine n retrieval models
  - Assign weights based on LLM-generated relevance judgments (i.e., models whose retrieved documents score highest receive greater weight) [Paper]
- Query expansion [Paper] via . . .
  - . . . RM3 [Paper]
  - . . . LLMs [Paper]

Start coding and compare your ideas to baselines.

Assignment

- Implement one or more retrieval systems
- Due Date: Monday, 15.12.2025*, 23:59
- Deliverable: TIRA submission(s)

* Date pending confirmation from Jena.

TIRA Account

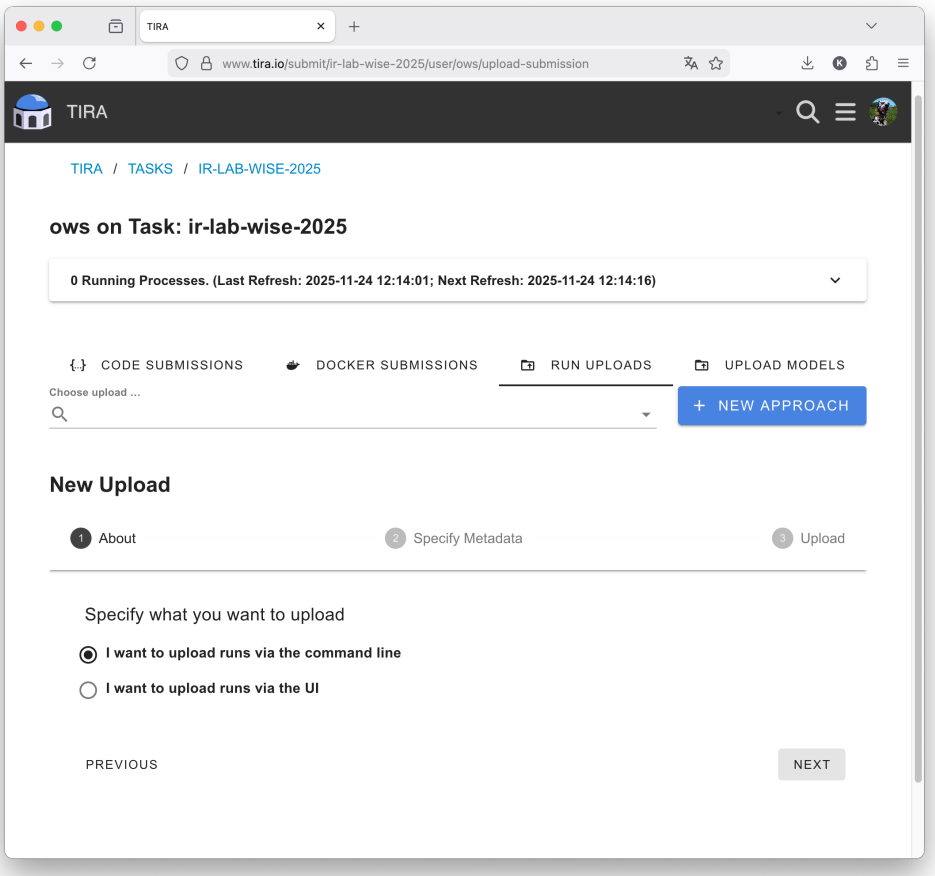
TIRA Integrated Research Architecture

1. Sign up to TIRA.
   - You may use `Login in with GitHub`.
2. Go to `GET STARTED`.
3. Go to `IR Lab Jena/Kassel/Radboud WiSe 2025`.
4. Register your team.

TIRA Token

Upload Runs

(1) Go to `IR Lab Jena/Kassel/Radboud WiSe 2025`, (2) click on `SUBMIT`.



Display personal token for uploading runs to TIRA by clicking on `NEXT`.