

# Information Retrieval

Exercise – Winter term 2025/2026

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# Agenda

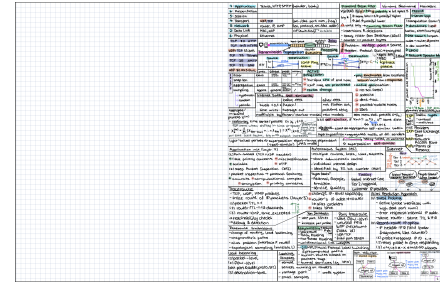
1. Exam Formalities
2. IR Ranking Paradigms
3. Metrics in high-dimensional spaces

# Formalities

## Exam

Friday, **20 Feb. 2026 11:00 - 12:30**, Hörsaal 1114

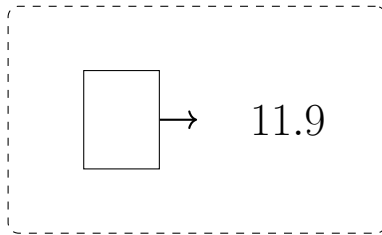
- ❑ Exam tasks will be in German
- ❑ Your answers must be in either English or German
- ❑ Bring your student ID card, a valid ID, and writing utensils
- ❑ You may use the following materials during the exam:
  - a non-programmable calculator
  - a one-sided, handwritten (pen and paper; not digitally handwritten) DIN A4 sheet of paper with notes (with name and matriculation number, has to be handed in)
- ❑ If you have any questions beforehand, please ask them via Discord



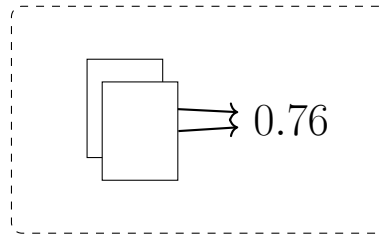
Refer to [\[temir.org\]](https://temir.org) for more details.

# IR Ranking Paradigms

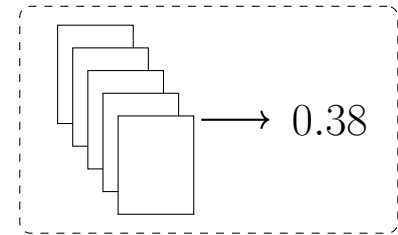
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise

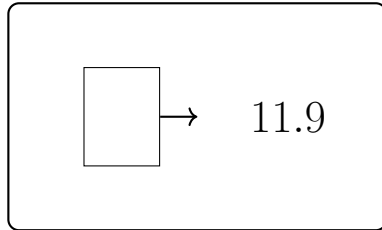


How do they differ?

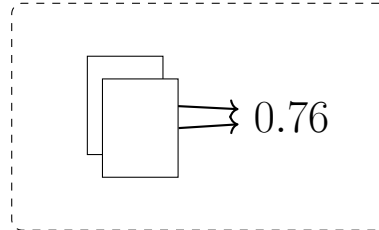
Refer to [IR:I-173] & [IR:III-[251-258]] for more details.

# IR Ranking Paradigms

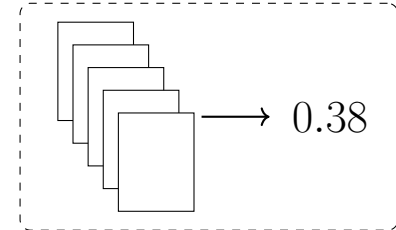
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



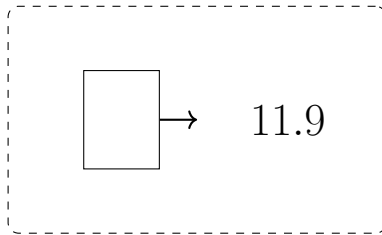
How do they differ?

- *Pointwise* approaches predict the relevance of each document *independently*, without considering the relationships between documents.

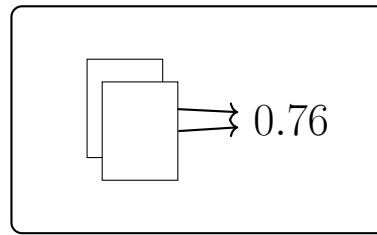
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# IR Ranking Paradigms

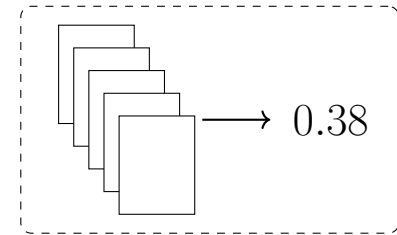
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



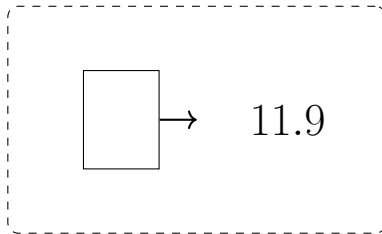
How do they differ?

- ❑ *Pointwise* approaches predict the relevance of each document *independently*, without considering the relationships between documents.
- ❑ *Pairwise* approaches predict the *relative* relevance of pairs of documents.

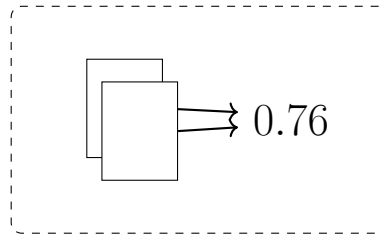
Refer to [IR:I-173] & [IR:III-[251-258]] for more details.

# IR Ranking Paradigms

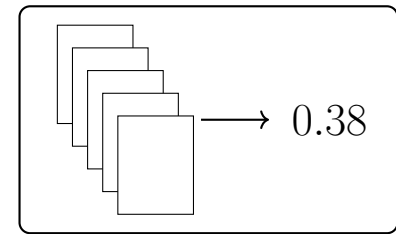
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



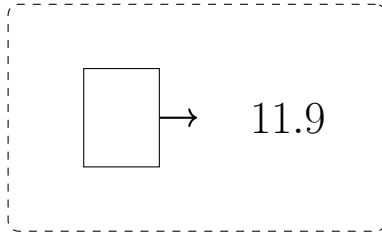
How do they differ?

- ❑ *Pointwise* approaches predict the relevance of each document *independently*, without considering the relationships between documents.
- ❑ *Pairwise* approaches predict the *relative* relevance of pairs of documents.
- ❑ *Listwise* approaches predict the relevance of a list of documents as a whole.

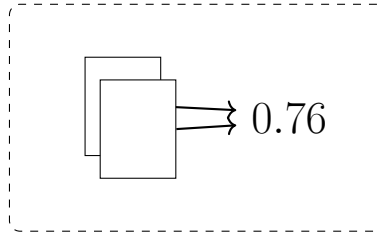
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# IR Ranking Paradigms

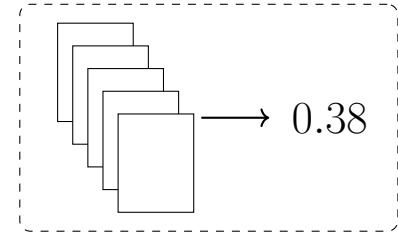
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



How do they differ?

The IR ranking paradigms differ in the object they compare.

Paradigm	What is compared
Pointwise	A single document
Pairwise	Two documents
Listwise	An entire ranking

In all cases, comparisons are made with respect to a fixed query.

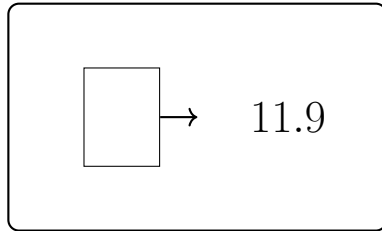
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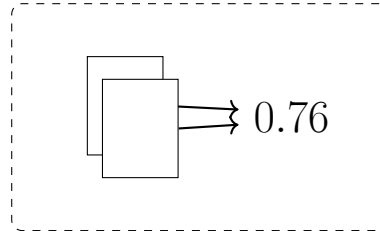
# IR Ranking Paradigms

## Pointwise Approaches

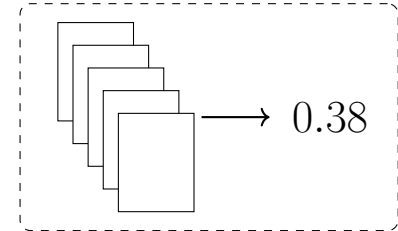
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



Assuming relevance  $\rho : \mathbf{Q} \times \mathbf{D} \rightarrow \mathbb{R}$  is a function of a query  $q$  and *one* document  $d$ , we distinguished different types of retrieval models [IR:III-[8,14]]:

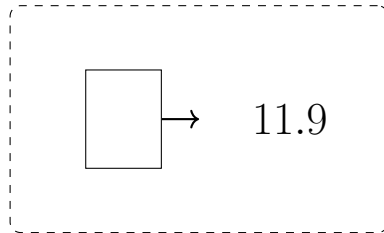
- ❑ *Logical* models
- ❑ *Algebraic* models
- ❑ *Probabilistic* models
- ❑ *Bayesian* models
- ❑ *Information theoretic* models

Refer to [IR:I-173], [IR:III-[8,14]] & [IR:III-[251-258]] for more details.

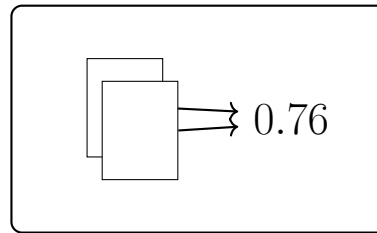
# IR Ranking Paradigms

## Pairwise Approaches

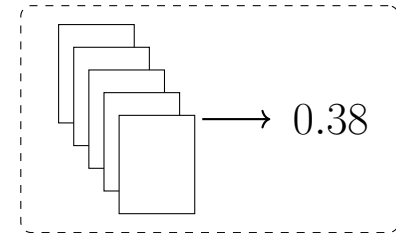
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



Assuming relevance  $\rho : \mathbf{Q} \times \mathbf{D} \times \mathbf{D} \rightarrow \mathbb{R}$  is a function of a query  $q$  and *two* documents  $d_i, d_j$ , we saw a specific neural retrieval models [IR:I-[174-181]]:

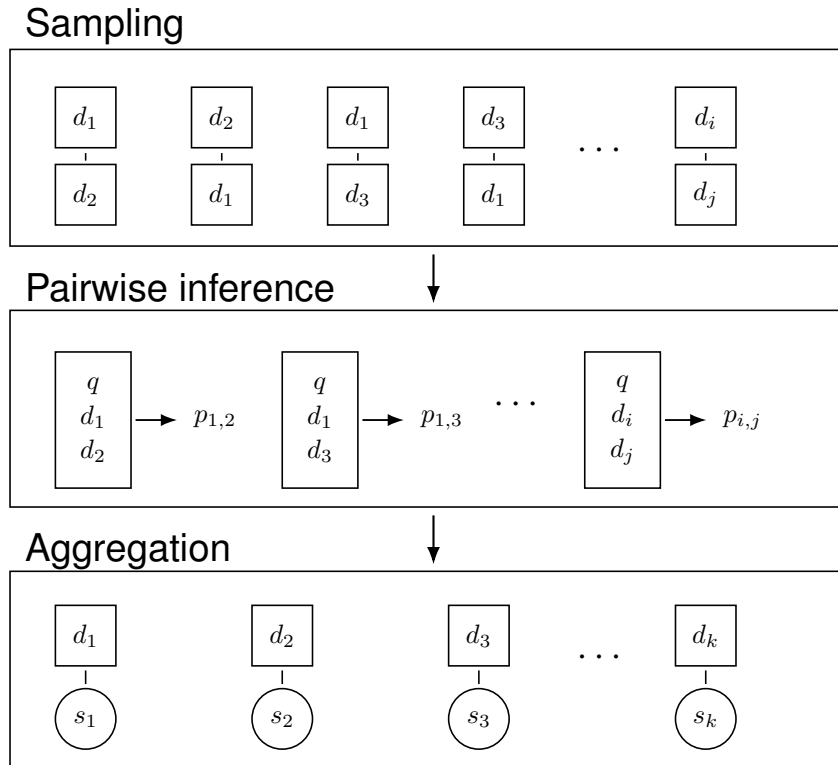
duoT5 [Pradeep et al., 2021]

- ❑ Used as *reranker* given candidate documents retrieved by a first-stage retrieval model (e.g., BM25)
- ❑ *Compares* documents  $\rightarrow$  document relevance scores are derived from pairwise comparisons

Refer to [IR:I-179] & [Pradeep et al., 2021] for more details.

# IR Ranking Paradigms

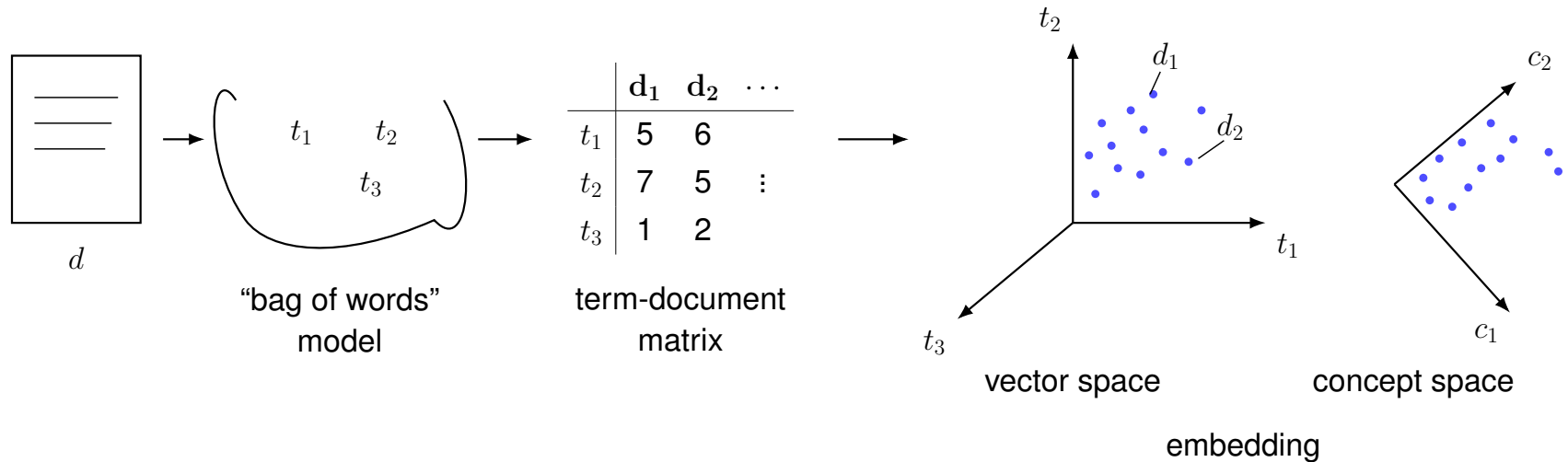
Pairwise Approaches: duoT5 [Pradeep et al., 2021]



Refer to [IR:I-179] & [Pradeep et al., 2021] for more details.

# Metrics

## Analytic Document Modeling



- ❑ High-dimensional spaces: Vector directions are more important than distances → cosine similarity is more meaningful than Euclidean distance

Refer to [IR:III-16] for more details.