

Information Retrieval

Exercise – Winter term 2025/2026

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Agenda

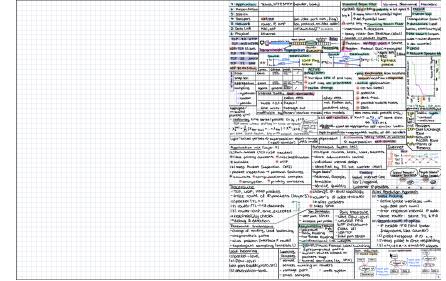
1. Exam Formalities
2. IR Ranking Paradigms
3. Metrics in high-dimensional spaces

Formalities

Exam

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

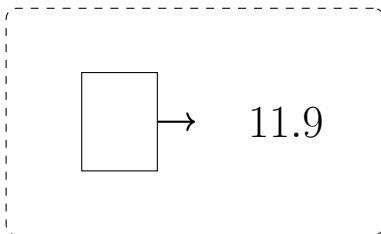
- Exam tasks will be in German
- Your answers must be in either English or German
- Bring your student ID card, a valid ID, and writing utensils
- You may use the following materials during the exam:
 - a non-programmable calculator
 - a one-sided, handwritten (pen and paper; not digitally handwritten) 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



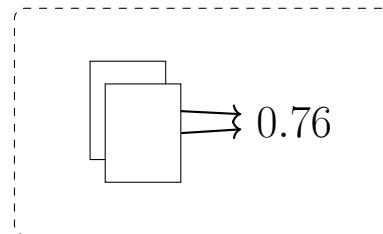
Refer to [temir.org] for more details.

IR Ranking Paradigms

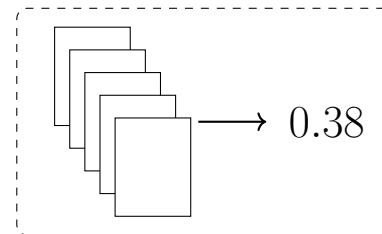
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise

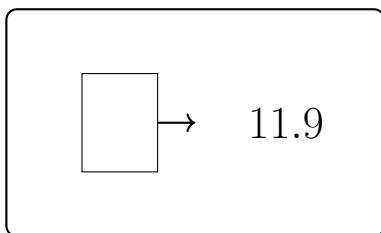


How do they differ?

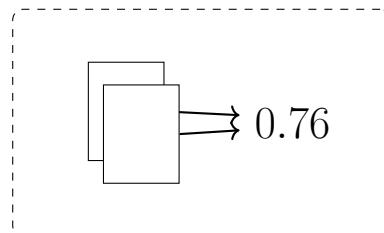
Refer to [IR:I-173] & [IR:III-[251-258]] for more details.

IR Ranking Paradigms

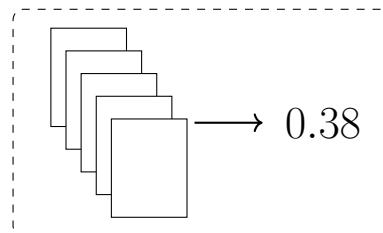
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



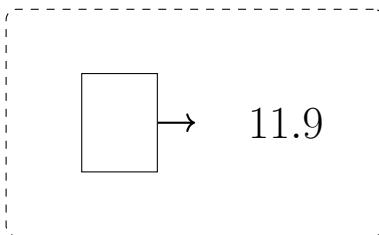
How do they differ?

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

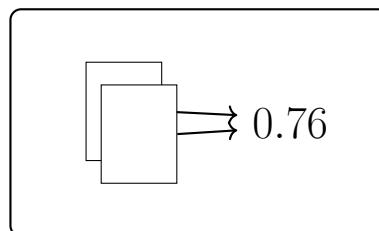
Refer to [IR:I-173] & [IR:III-[251-258]] for more details.

IR Ranking Paradigms

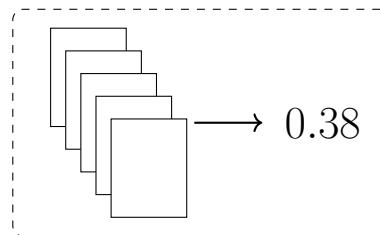
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



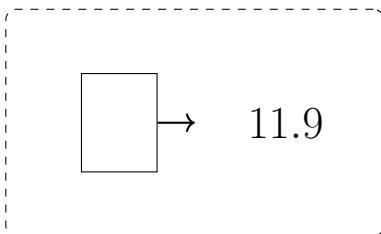
How do they differ?

- *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.

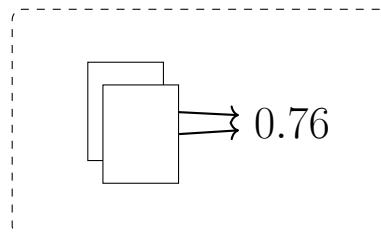
Refer to [IR:I-173] & [IR:III-[251-258]] for more details.

IR Ranking Paradigms

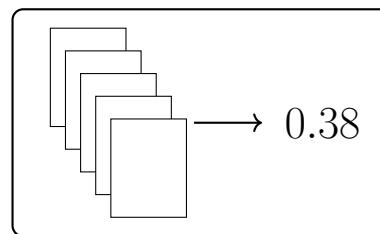
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



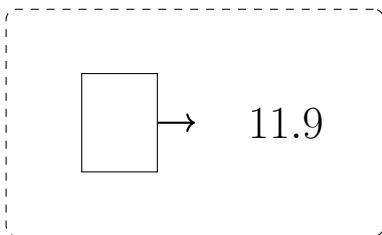
How do they differ?

- 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.

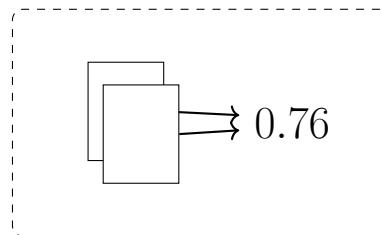
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IR Ranking Paradigms

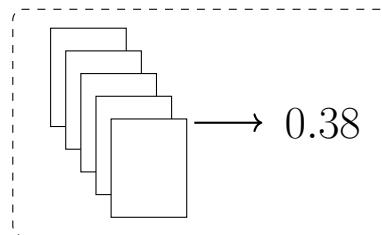
Pointwise [Fuhr, 1992]



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

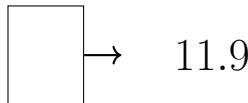
In all cases, comparisons are made with respect to a fixed query.

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

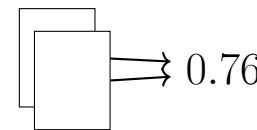
IR Ranking Paradigms

Pointwise Approaches

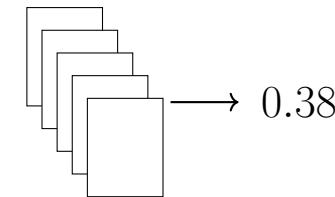
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



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

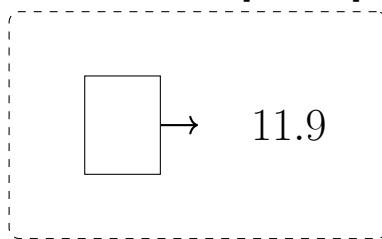
- Logical* models
- Algebraic* models
- Probabilistic* models
- Bayesian* models
- Information theoretic* models

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

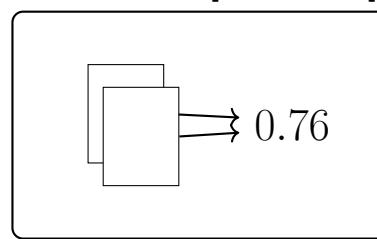
IR Ranking Paradigms

Pairwise Approaches

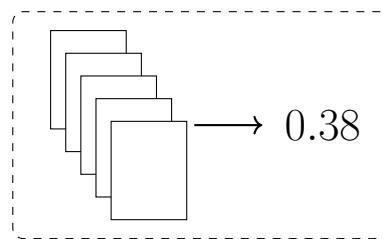
Pointwise [Fuhr, 1992]



Pairwise [Joachims, 2002]



Listwise



Assuming relevance $\rho : Q \times D \times D \rightarrow \mathbb{R}$ 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]]:

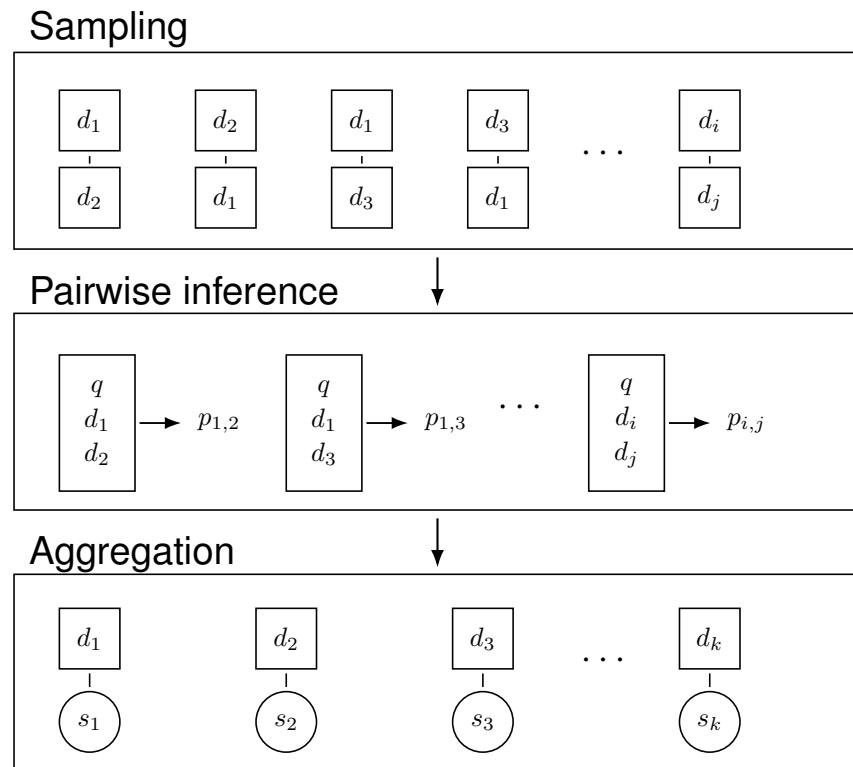
duoT5 [Pradeep et al., 2021]

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

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

IR Ranking Paradigms

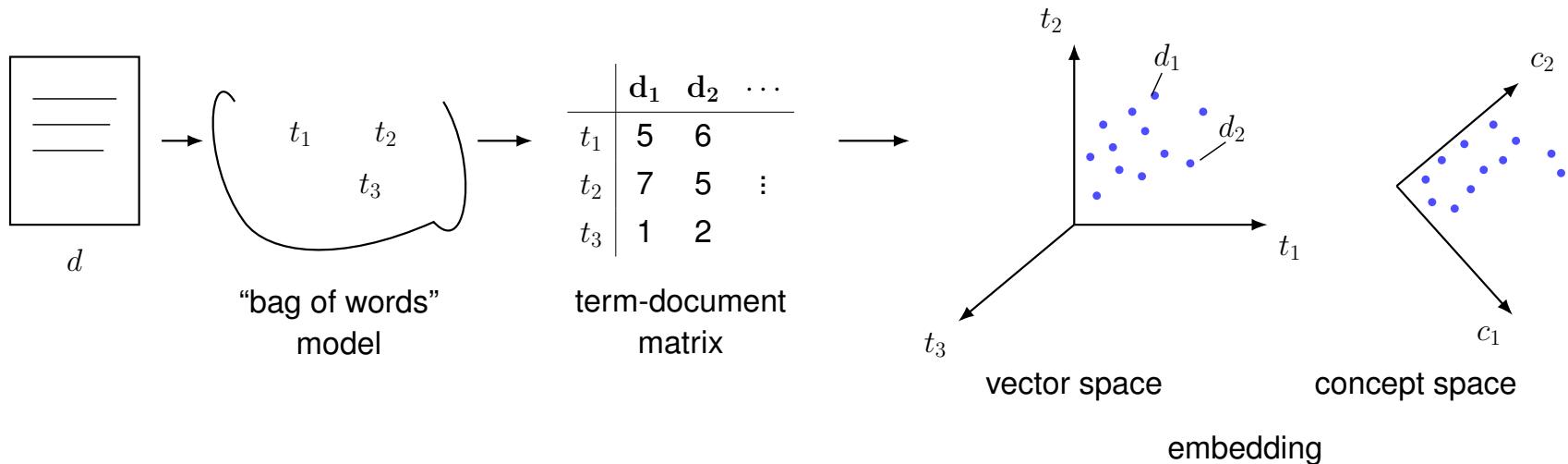
Pairwise Approaches: duoT5 [Pradeep et al., 2021]



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.