# Informatics 225
# Computer Science 221

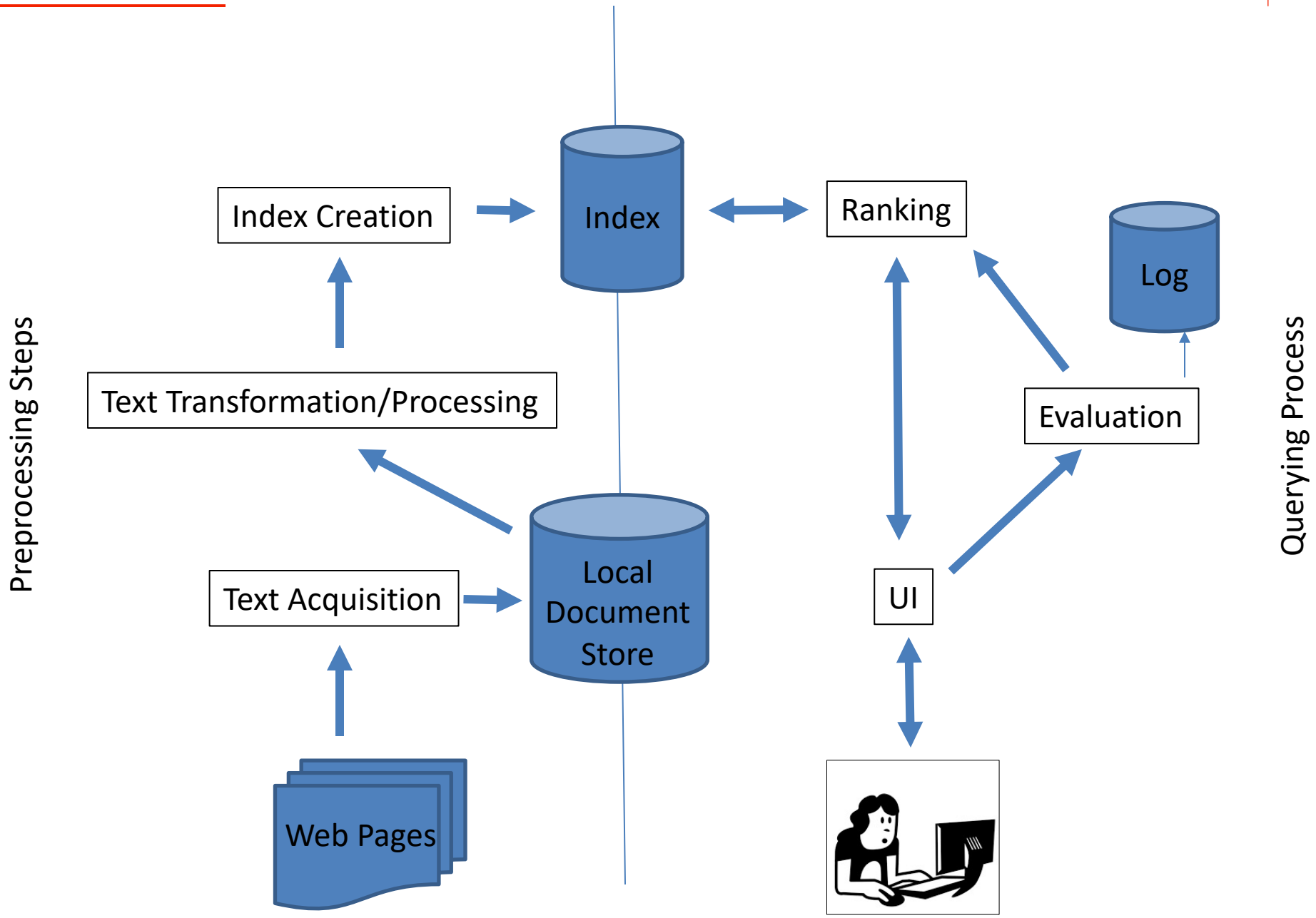
# Information Retrieval

Lecture 23



*These course materials borrow, with permission, from those of Prof. Cristina Videira Lopes, Addison Wesley 2008, Chris Manning, Pandu Nayak, Hinrich Schütze, Heike Adel, Sascha Rothe, Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie. Powerpoint theme by Prof. André van der Hoek.*

# Architecture



# Generic approach

- Find a set *A* of *contenders*, with $K < |A| << N$
  - *A* does not necessarily contain the top *K,*
  - but has many docs from among the top *K*
  - Return the top *K* docs in *A*

- Think of *A* as pruning non-contenders

- The same approach is also used for other (non-cosine) scoring functions

- Will look at a few schemes following this approach

# Index elimination

- Basic algorithm for cosine computation only considers docs containing at least one query term

- Take this heuristic further:
  - Only consider high-idf query terms
  - Only consider docs containing many query terms

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- At query time, only compute the complete scores for docs in the champion list of some query term
  - Pick the *K* top-scoring docs from amongst these

# Static quality scores

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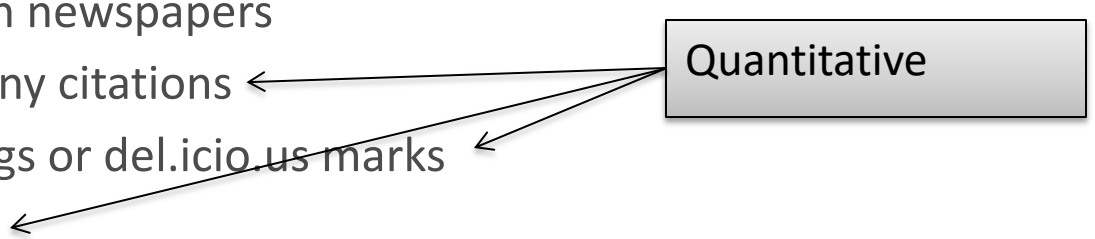
- *Relevance* is being modeled by cosine scores
- *Authority* is typically a query-independent property of a document
- Examples of authority signals
  - Wikipedia among websites
  - Articles in certain newspapers
  - A paper with many citations
  - Many bitly's, diggs or del.icio.us marks
  - (Pagerank, HITS)



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- Thus, a quantity like the number of citations is scaled into [0,1]
  - Informal exercise: suggest a formula for this.

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- Now we seek the top *K* docs by net score

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- Thus, can concurrently traverse query terms' postings for
  - Postings intersection
  - Cosine score computation

# Why order postings by *g(d)*?

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- In time-bound applications (say, we have to return whatever search results we can in ~50 ms), this allows us to stop postings traversal early
  - Short of computing complete scores for all docs in postings

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- Seek top-*K* results from only the docs in these champion lists

# Another heuristic: High and low lists

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- A means for segmenting index into two tiers

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- Now: not all postings in a common order!
- How do we compute scores in order to pick off top *K?*
  - Two ideas follow

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- Compute only the scores for docs in this union

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- Can apply to cosine or some other net scores

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- These constitute the metadata about a document

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  - Sometimes build range trees (e.g., for dates)
- Field query typically treated as conjunction
  - (doc *must* be authored by shakespeare)

# Zone

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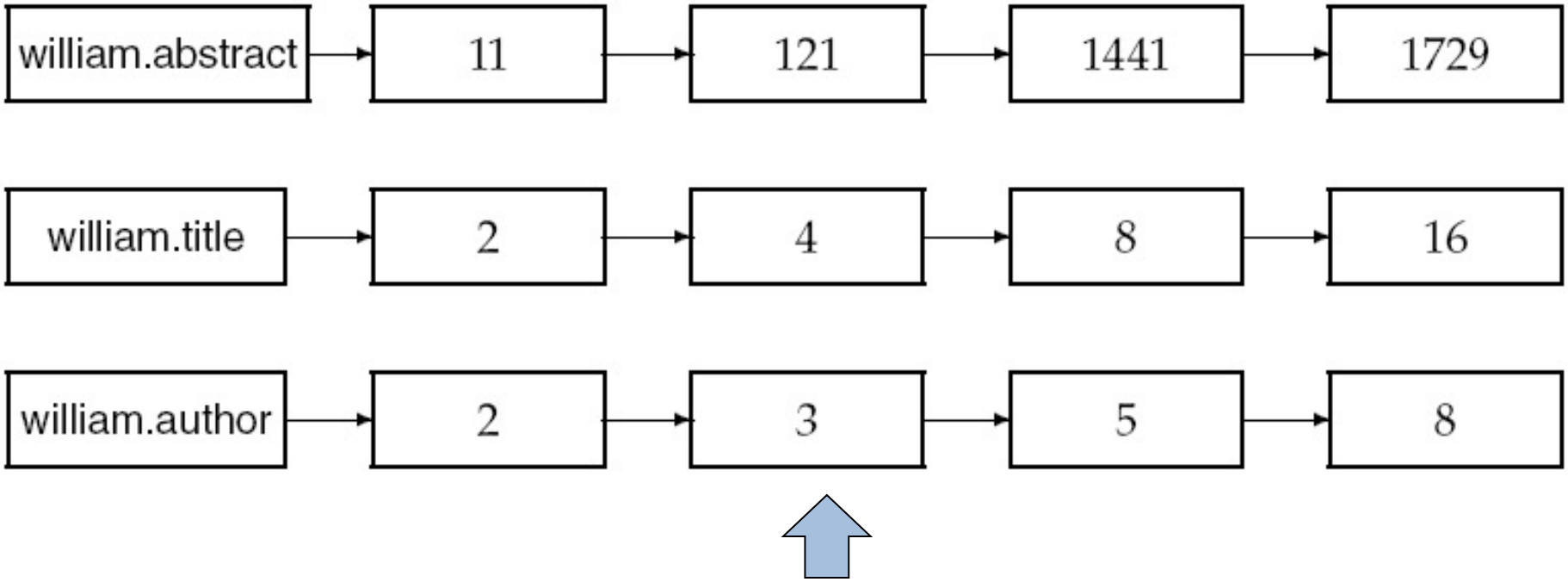
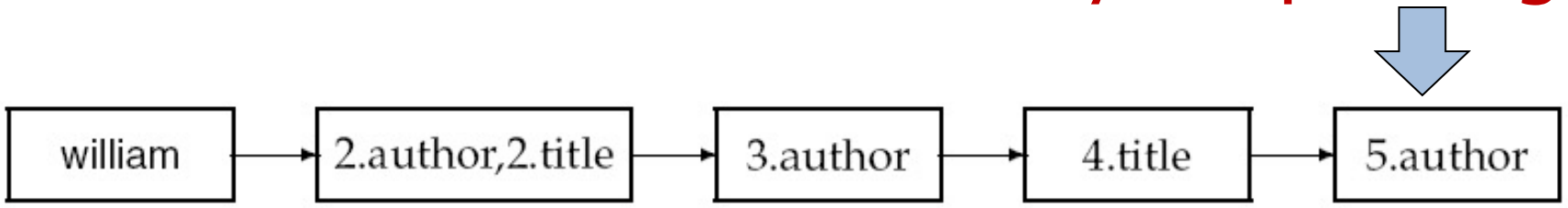
- Build inverted indexes on zones as well to permit querying
- E.g., "find docs with *merchant* in the title zone and matching the query *gentle rain*"

# Example zone indexes




Encode zones in dictionary vs. postings.



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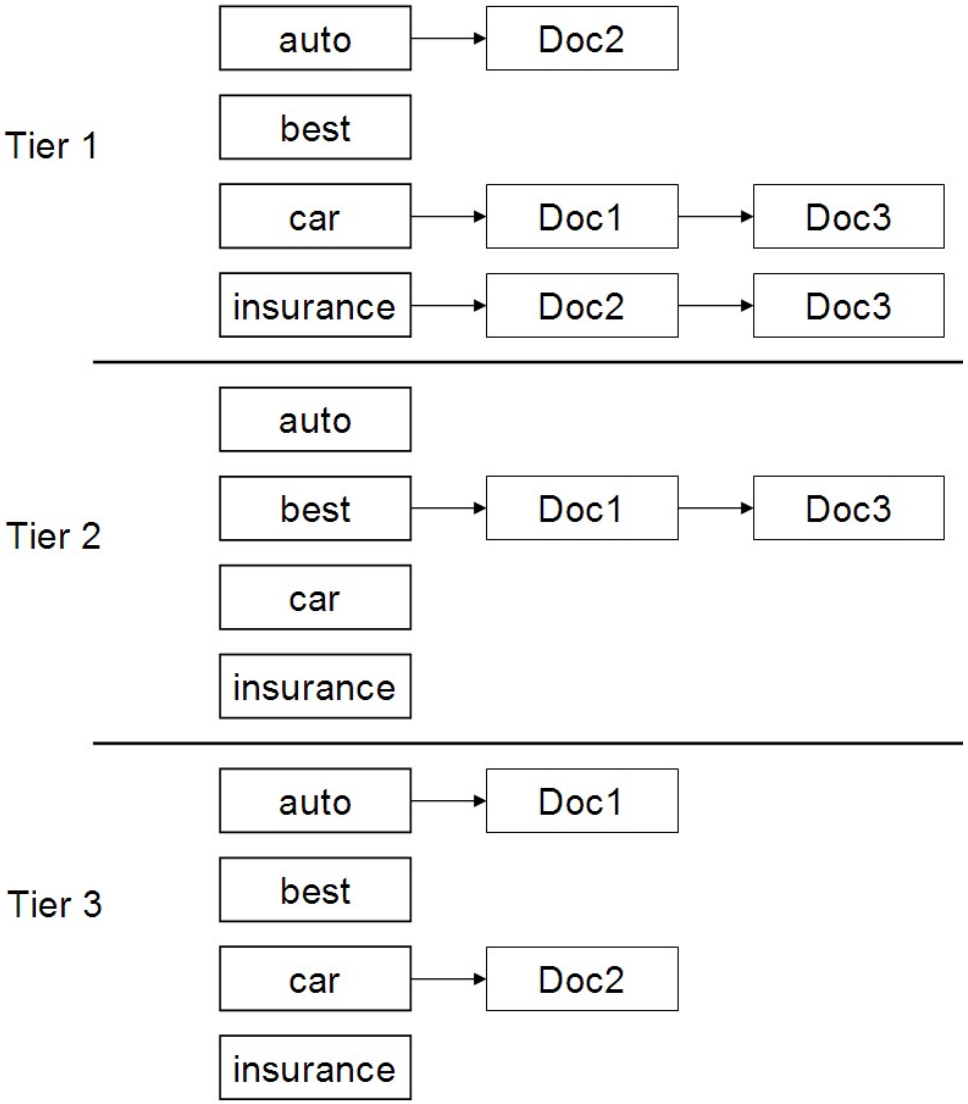
- At query time use top tier unless it fails to yield *K* docs
  - If so drop to lower tiers

# Example tiered index



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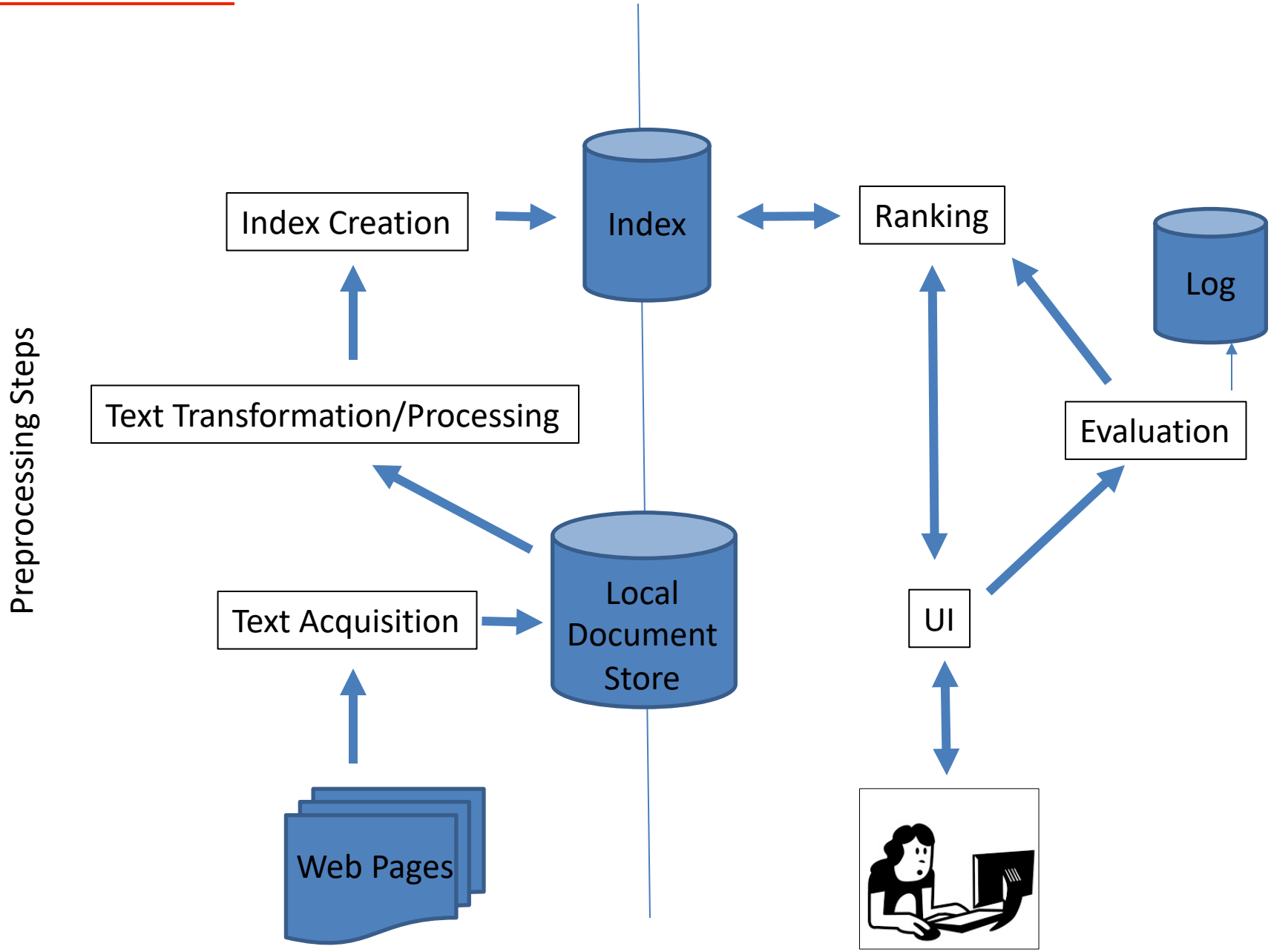
  - **Would like scoring function to take this into account : add weights!**

# Architecture



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- This sequence is issued by a **query parser**
  - Some method that will transform a user query into a stream of multiple queries.

# Aggregate scores

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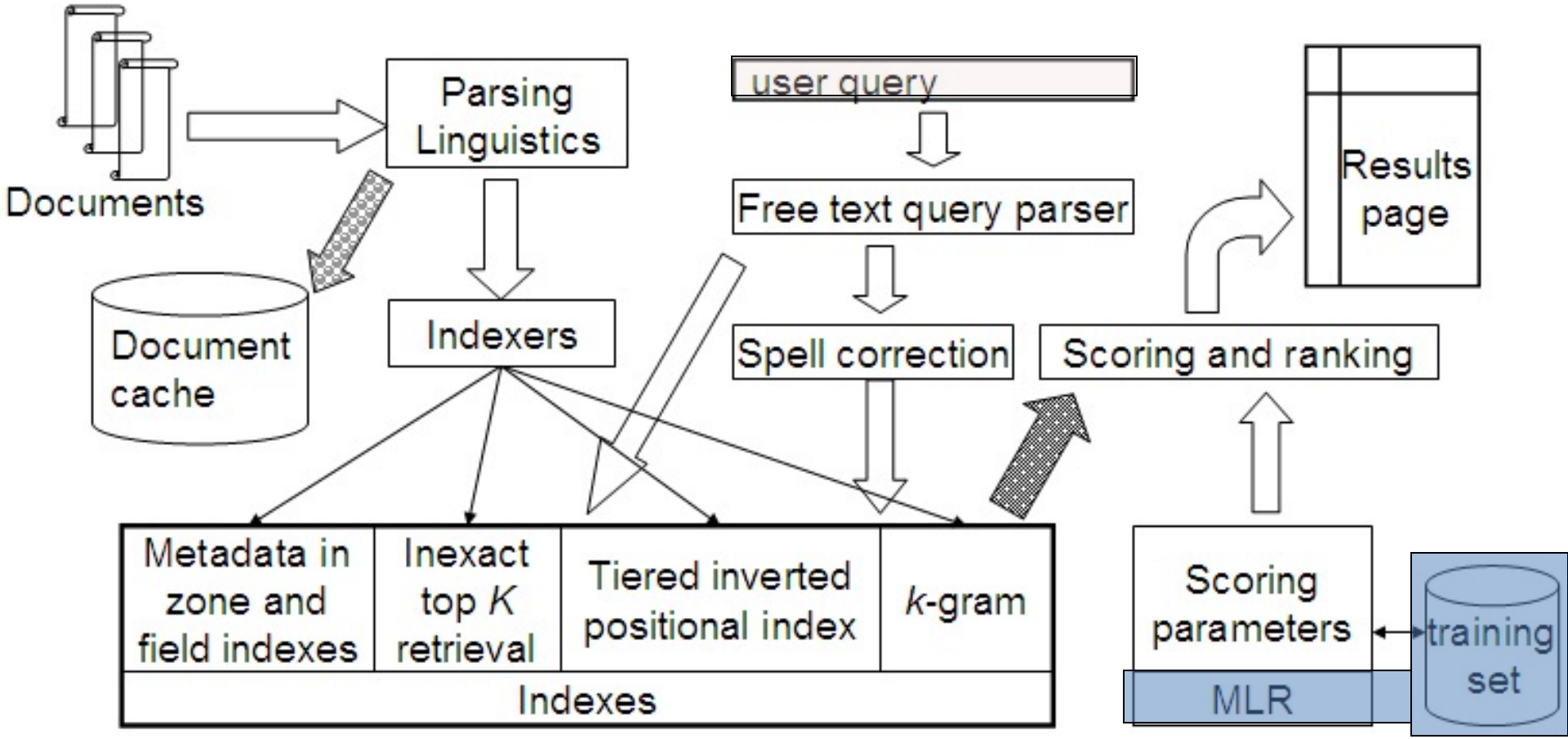
- How do we know the best combination?
  - *User surveys : ask real people to use your search engine (think MS3!)*
  - Some applications – expert-tuned
  - Hand-tune real-life systems is hard (e.g. tens or hundreds of possible threshold choices, what to consider or not, etc.)
    - Increasingly common technique: adaptive-learning based optimization

# Putting it all together



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