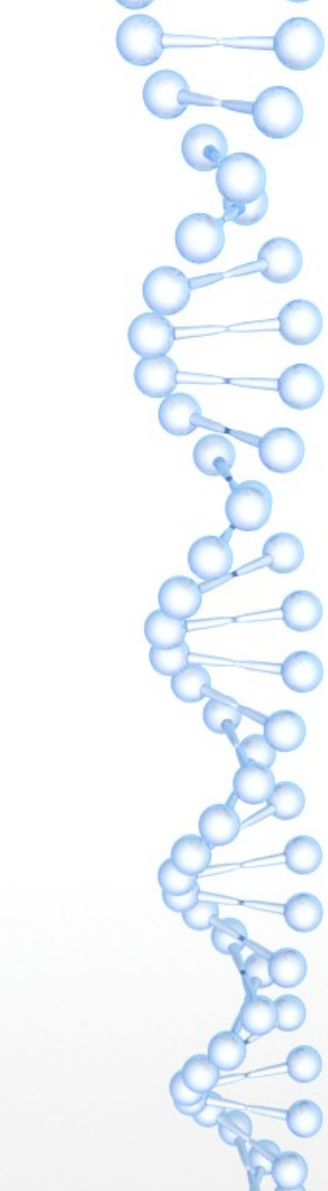

Information Retrieval
ITIS401
Chapter-8
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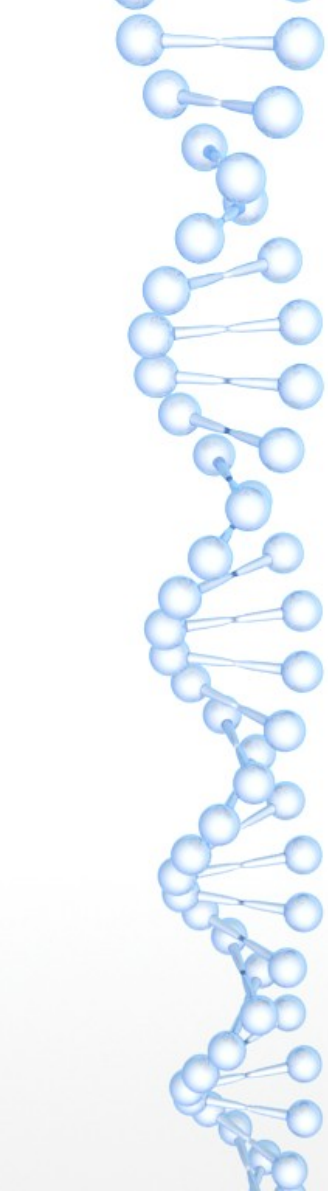
Dr Mohamed Abdeldaiem



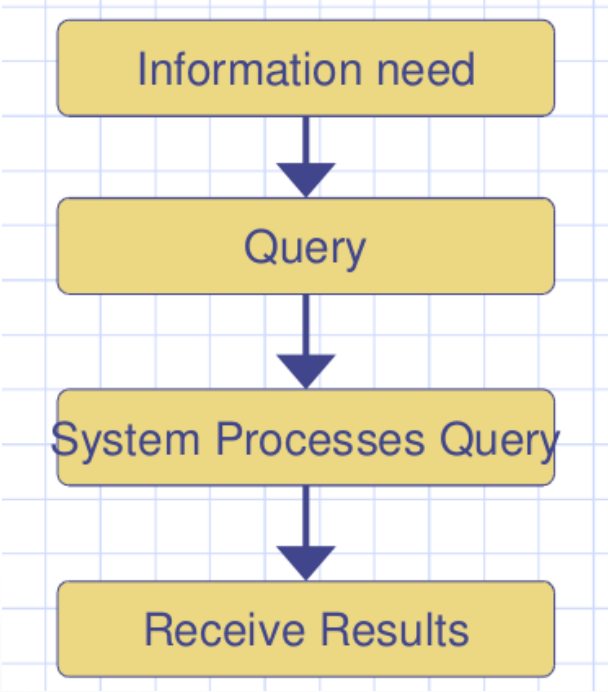
Lecture Overview

- Interpretation and Execution of Query Statements
- Search: Part of a user task
- Handling User Queries
- Information Retrieval Models
- Classical IR Models
-

Interpretation and Execution of Query Statements

In Chapter 7, we described the languages and logic of information retrieval systems from the point of view of a user. Here, we begin our look inside the IRS to understand how commands are interpreted and executed.

Search: Part of a user task



Classical IR

1-This is central task

2-Add feedback loop where user refines query.

Modern IR

- Part of the Big Picture
- An essential tool
- Used in search,filtering, and browsing

Handling User Queries

Goal of the search component

- predict which documents are relevant to the user's need
- rank the documents in order of predicted likelihood of relevance to the user.

Need a model which encompasses

- documents
- queries
- ranking functions

Information Retrieval Models

A retrieval model consists of:

- D: representation for documents
- R: representation for queries
- F: a modeling framework for D, Q, and the relationships among them R(q, d i): a ranking or similarity function which orders the documents with respect to a query.

Classical IR Models

- Boolean model
- Vector Space model
- Probabilistic model

The Boolean Model

Based on set theory and Boolean algebra

- Documents are sets of terms
- Queries are Boolean expressions on terms

Historically the most common model

- Library OPACs
- Dialog system
- Many web search engines, too

The Boolean Model, Formally

- **D: set of words (indexing terms)** present in a document each term is either present (1) or absent (0)
- **Q: A Boolean expression** terms are index terms

  operators are AND, OR, and NOT
- **F: Boolean algebra** over sets of terms and sets of documents

Boolean Relevance Prediction

- **R**: a document is predicted as relevant to a query expression iff it satisfies the query expression
- ((text ∨ information) ∧ retrieval ∧ ¬theory)
- Each query term specifies a set of documents containing the term
- AND (∧): the intersection of two sets
- OR (∨): the union of two sets
- NOT (¬): set inverse, or really set difference

Boolean Relevance example

((text ∨ information) ∧ retrieval ∧ ¬theory)

- “Information Retrieval”
- “Information Theory”
- “Modern Information Retrieval: Theory and Practice”
- “Text Compression”

Implementing the Boolean Model

- First, consider purely conjunctive queries

  $(t\ a \wedge t\ b \wedge t\ c)$
- Only satisfied by a document containing all three terms
- If $D(t\ a) = \{ d \mid t\ a \in d \}$, then the maximum possible size of the retrieved set is the size of the smallest $D(t\ a)$
- $|D(t\ a)|$ is the length of the inverted list for t a

Algorithm for AND queries

1. For each query term t
   1. retrieve lexicon entry for t
   2. note f_t and address of I_t (inverted list)
2. Sort query terms by increasing f_t
3. Initialize *candidate set* C with I_t of the term with the smallest f_t
4. For each remaining t
   1. Read I_t
   2. For each $d \in C$, if $d \notin I_t$, $C \leftarrow C - \{d\}$
   3. If $C = \{\}$, return… there are no relevant docs
5. Look up each $d \in C$ and return to the user

Beyond AND

- Consider a query that is a conjunction of dis-junctions (AND of OR's)
- (text OR data OR image) AND (compression OR compaction) AND (retrieval OR indexing OR archiving)
- Treat each dis-junction as a single term merge the inverted lists for each OR'd term or, just add the f t values for a worst-case approximation of the candidate set size

Thoughts on the Boolean Model

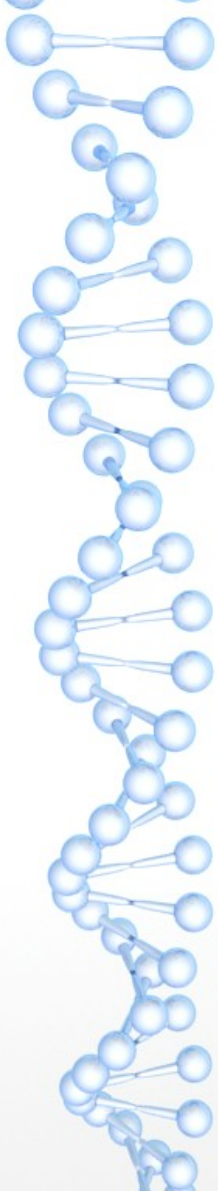
- **Very simple model based on sets**

  easy to understand and implement
- **Only retrieves exact matches**
- **No ranking of documents**:

  r() is Boolean
- **Retrieves too much, or too little**

  Sets are easy, but complex Boolean expressions aren't

  'cats and dogs' vs. (cats AND dogs)
- **All terms are equally important**



End of Chapter-8

Any Question…?