Search Engine Architecture

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Crack into Google!

- Object Detection (Joseph)
- Result Ranker (Jay)
- Personal Preferences (Henry)
- Page Crawler (Sammy)
- Search Decoder (Amar)
- Information Domain Classification (Zac)
- Recommendation (Tina)
- Sponsor rank boost
- Metadata (Ben)
- Image Encoder (Simon)
- Repository
- Remove stopwords, stemwords
- Sell user data (Ryan)
Classical search engine architecture


Citation count: 20,662 (as of February 11, 2021)
User input
Query parser
Ranking model
Crawler & Indexer
Document analyzer & auxiliary database
Result display
Result post-processing
Domain specific databases
Abstraction of search engine architecture

Indexed corpus

Crawler

Doc Analyzer

Doc Representation

Indexer

Index

Ranker

Feedback

Query Rep

(Query)

Evaluation

User

results

Crawler

Indexed corpus

Doc Analyzer

Doc Representation

Indexer

Index

Ranker

Feedback

Query Rep

(Query)

Evaluation

User

results

CS4780: Information Retrieval
Core IR concepts

• Information need
  – “an individual or group's desire to locate and obtain information to satisfy a conscious or unconscious need” – wiki
  – An IR system is to satisfy users’ information need

• Query
  – A designed representation of users’ information need
  – In natural language, or some managed form
Core IR concepts

• Document
  – A representation of information that potentially satisfies users’ information need
  – Text, One sentence about IR - “rank
• Releva documents by their relevance to the user’s information need”
  – Relat information need
  – Multiple perspectives: topical, semantic, temporal, spatial, and etc.
Key components in a search engine

• Web crawler
  – An automated program that systematically browses the web for the purpose of Web content indexing and updating

• Document analyzer & indexer
  – Manage the crawled web content and provide efficient access of web documents
Key components in a search engine

• Query parser
  – Compile user-input keyword queries into managed system representation

• Ranking model
  – Sort candidate documents according to its relevance to the given query

• Result display
  – Present the retrieved results to users for satisfying their information need
Key components in a search engine

• Retrieval evaluation
  – Assess the quality of the returned results

• Relevance feedback
  – Propagate the quality judgment back to the system for search result refinement
Key components in a search engine

• Search query logs
  – Record users’ interaction history with search engine

• User modeling
  – Understand users’ longitudinal information need
  – Assess users’ satisfaction towards search engine output
Discussion: Browsing v.s. Querying

• Browsing – what Yahoo did before
  – The system organizes information with structures, and a user navigates into relevant information by following a path enabled by the structures
  – Works well when the user wants to explore information or doesn’t know what keywords to use, or can’t conveniently enter a query (e.g., with a smartphone)

• Querying – what Google does now
  – A user enters a (keyword) query, and the system returns relevant documents
  – Works well when the user knows exactly what query to use for expressing her information need
Pull vs. Push in Information Retrieval

- **Pull mode** – with query
  - Users take initiative and "pull" relevant information out from a retrieval system.
  - Works well when a user has an ad hoc information need.

- **Push mode** – without query
  - Systems take initiative and "push" relevant information to users.
  - Works well when a user has a stable information need or the system has good knowledge about a user's need.
Question: is Yelp a search engine?
What you should know

• Basic workflow and components in an IR system
• Core concepts in IR
• Browsing v.s. querying
• Pull v.s. push of information
Today’s reading

• Introduction to Information Retrieval
  – Chapter 19: Web search basics