Information retrieval: Evaluation of NUI for dynamic query systems
Annotated Bibliography

Most search engines generate dynamic query suggestions (DQS) – or query auto-completions – which are ranked sets of queries based on query prefixes typed, tapped, or spoken in a user interface. Query candidates are iteratively ranked to display a 'top-n' recommendation below the search box, and the query suggestions are dynamically updated as the user's query grows or shrinks. Keystrokes, the selected dynamic query suggestion, and the user's final query are, by default, sent to the search engine provider. Additionally, user session cookies can assist search providers to study query reformulation, click-through rates, and the abandonment of the search interaction.

Generating DQS from one or two characters or terms is a computationally difficult task – in particular, to make qualitatively helpful suggestions in milliseconds, chosen from tens of thousands of possible completions. Also, since single-query sessions account for at least 50% of search traffic (Shokouhi 2013), using past user query sessions can influence how the DQS are relevant to the specific user, not the entire user population.

Papers

Shokouhi, M. (2013). "Learning to Personalize Query Auto-completion". SIGIR: Annual ACM Conference on Research & Development in Information Retrieval, 103-112.

The author presents a novel learn-to-rank method for personalising query auto-completion rankings, using offline training labels. The paper compares existing popularity-based query auto-completion rankings to the new method using America Online (AOL) and Bing query logs. The paper claims improvements of up to 9% in mean reciprocal rank for the personalised completed queries.

Supervised training is used with a new method to assign training labels to previous queries based on demographics of users according to Yahoo! Clues (service not available in 2016). Bar-Yossef and Haus' (2011) method of ranking query term suggestions by past popularity is set as a baseline.

The paper is significant because it uses information about the user, leveraging the differing demography and other data specific to users, to build better models for ranking candidate dynamic query suggestions. The user's long term search history and location are the most effective for personalizing auto-completion rankers.

Di Santo, G., McCreadie, R., Macdonald, C., & Ounis, I. (2015). "Comparing Approaches for Query Autocompletion". Proceedings of the 38th International ACM SIGIR Conference on Research and Development in Information Retrieval, 775-778.

Di Santo et al. (2015) study different query completions ranking approaches on a commercial medical search system (query log, document corpus and search engine.) The results of their study indicate the most effective query completion method is dependent on the number of characters a user has typed so far (as a prefix), "with the most effective approach differing for short and long prefixes."

Niu, X., & Kelly, D. (2014). "The use of query suggestions during information search". Information Processing & Management, 50(1), 218-234.

To be completed 10/05/2016.

Kelly, D., Gyllstrom, K., and Bailey, E. "A comparison of query and term suggestion features for interactive searching". In Proc. of SIGIR, pages 371–378, 2009.

To be completed 10/05/2016.

Topics for Discussion

Q: Should dynamic query suggestions vary across search vertical? Do they, in practice?

Currently web search engines do not generally vary dynamic query suggestions depending which vertical they are in.

Web search engine verticals for search include:

- **Google.com**: All, News, Videos, Images, Shopping, Maps, Books, and Apps (number: 8).
- **Bing.com**: Web, Images, Videos, Maps, News (number: 5). Bing has an Autosuggest API.
- **Yahoo.com**: Web, Images, News, Answers, Recipes, Sport, Finance, Lifestyle, TV, Movies (number: 10)
- Verticals unique to **Yandex.com**: Mail, Maps, AppMetrica, Translate, Disk
- Verticals unique to **Dogpile.com**: Shopping, White Pages
- **Amazon.com**'s search combo box uses faceting for dynamic query suggestions e.g. *apple watch* is faceted to *apple watch* in All Departments/in Electronics/in Cell Phones and Accessories/in Men's Watches, as well as additional query term suggestions prefixed by *apple watch*.

Q: Should dynamic query suggestions be automatic query expansions?

- PubMed searching: "If you enter an entry term for a MeSH term the translation will also include an all fields search for the MeSH term associated with the entry term. For example, a search for odontalgia will translate to: *"toothache"[MeSH Terms] OR "toothache"[All Fields] OR "odontalgia"[All Fields]* because Odontalgia is an entry term for the MeSH term *toothache*."
Source: HTTP URI:
http://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.How_PubMed_works_automatic_te

Q: Are paid keywords included in dynamic query suggestions on major search engines?

Currently search engines do not generally insert ads in auto suggestions.

Q: Does the inclusion of advanced query operator syntax stop dynamic query suggestions from being effective?

C.f. meta-searching (e.g. Dogpile.com); digital libraries (e.g. UniMelb); DuckDuckGo ! bangs (e.g. query is "queen !allmusic", which searches allmusic.com for the term 'queen', and presents allmusic.com's SERP.)

Q: Does the presentation on SERP (e.g. faceting) change the ways dynamic query suggestions should be computed?

Notes

Note: Possible sources of dynamic query suggestions

- Text collection
- Search history log
- Attributes of the query terms themselves
- A search query's (relative) popularity
- Temporal factors (past, immediate past and future)
- Personal interests (personalisation)
- Consider factors other than *relevance* of suggested queries, such as: diversity
- "Queries that have previously been successful, and/or characteristics of potentially relevant documents (Wacholder, 2011)" – Shiri, A. and Zvyagintseva, L. (2014). "CAIS Paper: Dynamic Query Suggestion in Web Search Engines: A Comparative Examination." Annual Conference of the Canadian Association for Information Science.
- "terminological sources such as thesauri and other types of controlled vocabularies (Shiri & Revie, 2006)" - ibid

Note: Synonyms for dynamic query suggestions

- Query autocompletion/auto-completion
- Real Time Query Expansion (RTQE)
- interactive query expansion
- interactive query formulation
- Search-as-you-Type (SayT)
- query completion
- dynamic query term suggestions
- type-ahead search
- autosuggest/auto-suggest
- suggestive searching/search suggestions

Note: Anchoring bias based on prefixes and dynamic term suggestions

"At times, when a searcher chooses a way to express an information need that does not successfully match relevant documents, the searcher becomes reluctant to radically modify their original query and stays stuck on the original formulation. Hertzum and Frokjaer, 1996 note that at this point "the user is subject to what psychologists call anchoring, i.e., the tendency to make insufficient adjustments to initial values when judging under uncertainty". This can lead to "thrashing" on small variations of the same query. Russell, 2006 remarks on this kind of behavior in Google query logs." (*Hearst, M. (2009), Search User Interfaces, Cambridge University Press.*)

- "cognitive and physical moves"

Note: Length of list of dynamic query suggestions

"It is hypothesized that the number of query suggestions offered by the three web search engines may have an effect on users' query formulation and expansion behaviour in searching for simple and complex search topics. The number of suggested queries and the way they are presented to the searcher have interface design implications. Research should examine the impact of the presentation of short and long lists of query suggestions on the interaction behaviour of web searchers." (ShiriZvyagintseva-2014-CAIS-DQS)

Note: Scope for research and personalisation limits

- Stated scope: "mobility hardware scenarios (phones, tablets, shared large screens, augmented reality systems etc.)". Hardware and form-factors for search at museums, public information terminals, libraries (OPACs) etc., would presumably have no personalisation, but may customised for the given purpose.
- Time period, location, type of information, literacy, information literacy (context-sensitive)
- Presentation (font, font size, font colour)
- "Individuals may differ in myriad ways—genetically, culturally, by social network, by preferences—all of which may change or adapt endogenously over time." Source: *Epstein, J. (2006) Generative Social Science. 5-47.*

Note: Query reformulation and tolerance for errors

- "Tolerance for misplaced keywords" (e.g. in the wrong field), and "spelling and word order errors" (Chaudhuri, S. and Kaushik, R., (2009) "Extending Autocompletion to Tolerate Errors." Proceedings of the 35th SIGMOD International Conference on Management of Data, 707–18.)
- Is the system trying to guess the whole query solely from the prefix, or provide an affordance to the user to make his queries more precise through query reformulation or some semantic query & corpus analysis?

Note: Information needs

- A user may not know how to articulate her search intent in the appropriate terms – dynamic query suggestions can expand (or contract) a mental search space.
- Do dynamic query suggestions minimise cognitive effort?
- How do 'bad' lists of DQS affect a user's cognitive load, or their thoughts about possible search spaces or the contents of a collection? Are searches abandoned due to 'bad' lists of DQS?
- Consider an oracle who has perfect knowledge of the user's mind and query intent. What list should the system present for a given prefix? Is this Maxwell demon impossible, due to human language variability and the nature of the web itself?

Issue: Mobility and resource consumption – network bandwidth

Paper 'paste-bin'

Name

- Epstein-2006-BookChapter-GSS.pdf
- ShahLiuGozalez-IbanezBelkin-2012-ASIST...
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