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Toward a Model of Interaction for Complex Search Tasks

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ABSTRACT

Information on the Web and in digital libraries has rich annotation but the current Search engines excel at short queries that fail to exploit this power. The potential of semantic annotation is not realized in shallow navigational search but holds the promise to significantly enhance complex tasks or information needs, by supporting the task as a whole over multiple interactions with the system. We analyse the different phases of interaction for a complex search task, and give insight in different goals of the interaction in each the phase. The resulting model of interaction suggests ways in which the semantic annotation can be exploited to iteratively articulate the information need and to explore the search results.

Categories and Subject Descriptors: H.3.3 [**Information Storage and Retrieval**]: Information Search and Retrieval—*Search process, Selection process*
General Terms: Experimentation, Measurement, Performance
Keywords: Model of Interaction, Interactive IR, Task based retrieval

1. INTRODUCTION

This is a position paper on interactive search exploiting semantic annotations for complex search tasks, as emerged in the breakout group discussion of the third ESAIR Workshop [5]. This breakout group discussed the searcher's role in exploiting semantic annotation. So assuming we have rich data with various types of annotation—and we are nicely progressing in that way—then what can we do with it! What potential added value is in the Semantic Annotation? What do users have to know or do in order to formulate an information need to a semantically rich system? The breakout group came to the conclusion that, in fact, the searcher is the main bottle-neck in exploiting semantic annotation: we need more than 2.5 keywords in order to use the annotation. This has a number of fundamental consequences on the model of interaction (§2), how this model relates to the underlying information need (§3), and in terms of the type of system that supports such a model (§4).

2. MODEL OF INTERACTION

In this section we discuss the traditional IR model of batch search, the potential role of semantic in this model, and an extended model of interaction.

The standard model of IR is the one step batch search model depicted in Figure 1. This model is prevalent as an abstraction of the search process in Cranfield/TREC style evaluations, and directly reflects the anatomy of a standard search engine. As a result it is also the dominant mental model of search and explicitly or implicitly impacts the way we think about IR.

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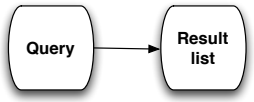

Figure 1: Model of Interaction: One step batch retrieval

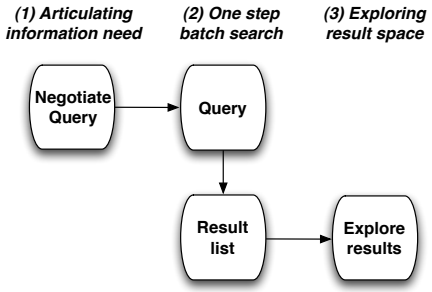

Figure 2: Model of Interaction: Complex search

The standard one-step model has many strengths. It also suits particular forms of information access well, in particular the short navigational Web queries that are common in Web search. In the context of richly annotation resources, the model is less attractive: Why would searchers provide more than a few keywords for such types of search requests? How can the semantic annotation of the collection augment the result list for such types of search requests?

It is clear that we should look at more complex tasks rather than shallow navigational needs or even ad hoc informational requests—tasks that cannot be comprehensible articulated in a few keywords. Here, semantic annotations may provide valuable cues for expressing complex information needs, even complete search strategies [3]. For this purpose we need to extend the traditional batch search model, with a phase leading up to the final query and with a phase that explores more of the results, as depicted in Figure 2.

Prequel: Negotiated Query Formulating a fully explicit complex query may be impractical since it requires substantial effort, or even impossible since it requires intimate knowledge of the exact data and annotations [4]. Hence, interaction is key. Searchers may interactively construct a complex query by incrementally refining their search request with constraints on both content and semantic structure as suggested by the results of a previous query.

Sequel: Exploring Results For a more complex task, the semantic structure of result space allows for exploring various different aspects of the results, guided by the interface in ways similar to faceted search. That is, a searcher explores the results by making various selections based on content and annotation structure, and inspecting particular slices of the results.

3. USER INTERACTION

In this section we explore the consequences of the model in terms of the relation with the underlying information need.

Scope of Information Need In the first phase of the interaction the searcher is articulating her information need. Here the scope of the query is changing to fit that of the underlying information need. A typical interaction may start with a simple keyword query, which is iterative refined by adding structural hints based on the semantic annotations. The goal of this stage is to arrive at a verbose query that exactly articulates the underlying information need. In the third phase of the interaction the search is exploring different part of the result space, highlighting different aspects of the information retrieved for the same information need. A typical interaction may select different clusters or facets/facet-values, by drilling down and backtracking by reversing the selections. The goal of this stage is to satisfy the searcher by exploring the whole result set rather than consulting one or a few privileged results.

Information Flow There is a fundamentally different form of interaction between the searcher and the system. In phase 1, there is an information flow from the searcher toward the system, effectively a dialogue in which the searcher is communicating her information request as completely as possible. In phase 3, there is an information flow from the system to the searcher, effectively a dialogue in which the available information in the whole result set is communicated to the searcher.

Cost or Contribution The contribution of the exploration phase is clear, here our searcher is reaping the benefits from the information available in the collection. But what about the first phase where our searcher is putting substantial effort in articulating her information need? The effort is spend on making more and more of the information need explicit, even have it evolve in parallel with the query. A system that actively supports searchers to express their needs more accurately, makes a great contribution to the resulting search experience. In fact, this is helping to bridge the vocabulary gap due to linguistic and semantic variation—the core problem underlying IR!

4. ANATOMY OF A SYSTEM

In this section we explore the consequence of the model in terms of the type of system that supports the model.

Losing the Main Search Step There is a natural transition from phase 1, articulating the information need, to phase 3, exploring the result space. These phases make the original search step redundant, and our three phase model effective reduced to a two stage model. This suggests that thinking in terms of "something extra" before and after the standard model is fundamentally flawed.

Queries and Result Exploration Merge A candidate system for last phase is an exploratory search interface, but a similar interface could also be exploited to refine the query in first phase. That is, despite radically different goals and modes of information transfer in these two phases of the information episode, a very similar interface may be used. Complex query construction is supported by selecting building blocks consisting of content and semantic structure and combining them. Result exploration is supported by selecting facets and facet values that implicitly generate a refined query with an updated result set. In this way, query construction and browsing are merging naturally.

Iterative Search and Explore This results in an iterative series of search and explore steps, as depicted in Figure 3. Both the query construction phase as the result exploration phase are building a complex query explicitly or implicitly, and the main interaction is using the semantic annotation based on the retrieved results, either to refine the query or to explore part of the result space.

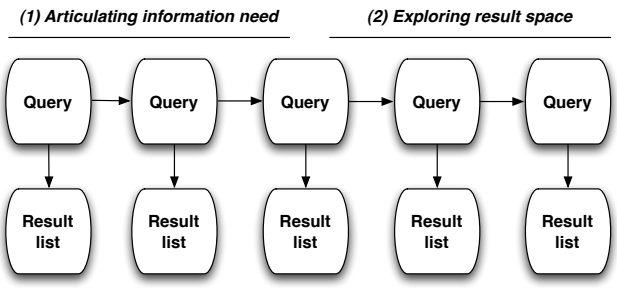

Figure 3: Model of Interaction: Iterative Search and Explore

5. CONCLUSIONS

This paper discussed a model of interactive search exploiting semantic annotations for complex search tasks. Similar points have been made for many years, mainly in the information science part of the field of IR, by researchers in interactive IR [6], task based search [7], information behavior [1], or search interface design [2, 8]. So in a sense, the paper is rehashing the well-known positions in favor of interaction and against the Cranfield/TREC abstraction of non-interactive search. The novel aspects of the paper are an integrated view on the phases of a complex model of interaction, the fundamental differences between these phases in terms of the information flow, goal and success criterion of the interaction, and the fundamental similarities in the type of systems that can support both phases.

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REFERENCES

[1] M. J. Bates. Information behavior. In *Encyclopedia of Library and Information Sciences*, volume 3, pages 2381–2391. CRC Press, New York, 3rd edition, 2010.

[2] J. L. Bennett. The user interface in interactive systems. *Annual review of information science and technology*, 7:159–196, 1972.

[3] A. P. de Vries, W. Alink, and R. Cornacchio. Search by strategy. In *Proceedings of the Third Workshop on Exploiting Semantic Annotations in Information Retrieval (ESAIR 2010)*, pages 27–28. ACM Press, New York USA, 2010.

[4] J. Kamps, M. Marx, M. de Rijke, and B. Sigurbjörnsson. Articulating information needs in XML query languages. *Transactions on Information Systems*, 24:407–436, 2006.

[5] J. Kamps, J. Karlgren, and R. Schenkel. Report on third workshop on exploiting semantic annotations in information retrieval (ESAIR). *SIGIR Forum*, 45(1), June 2011.

[6] I. Ruthven. Interactive information retrieval. *Annual review of information science and technology*, 42:43–91, 2008.

[7] P. Vakkari. Task-based information searching. *Annual review of information science and technology*, 37:413–464, 2003.

[8] M. L. Wilson, B. Kules, m. c. schraefel, and B. Shneiderman. From keyword search to exploration: Designing future search interfaces for the web. *Foundations and Trends in Web Science*, 2(1):1–97, 2010.