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Conference Paper · August 2015

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Using Contextual Information to Understand Searching and Browsing Behavior

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ABSTRACT

There is great imbalance in the richness of information on the web and the succinctness and poverty of search requests of web users, making their queries only a partial description of the underlying complex information needs. Finding ways to better leverage contextual information and make search context-aware holds the promise to dramatically improve the search experience of users. We conducted a series of studies to discover, model and utilize contextual information in order to understand and improve users' searching and browsing behavior on the web. Our results capture important aspects of context under the realistic conditions of different online search services, aiming to ensure that our scientific insights and solutions transfer to the operational settings of real world applications.

Categories and Subject Descriptors: H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval—*Search process*

General Terms: Algorithms, Performance, Experimentation

1. CONTEXTUALIZING SEARCH

Modern search still relies on the query-response paradigm, which is characterized by a sharp contrast between the richness of data in the index, and the relative poverty of information in the query, usually expressed in a few keywords to capture a complex need. This is particularly true in online search services, where the same query may be observed from many users, with considerable variations in their search intents. Contextual information is the obvious route to try to restore the balance, and behavioral data related to user's searching and browsing activities provides new opportunities to model contextual aspects of user needs.

The importance of contextual information in search applications has been recognised by researchers and practitioners in many disciplines, including recommendation systems, information retrieval, ubiquitous and mobile computing, and marketing. Context-aware systems [1] adapt to users' operations and thus aim at improving the usability and effectiveness by taking context into account. In this thesis we consider two types of behavior: (1) 'searching'—when users are issuing queries and we are trying to improve search results (SERP) taking context of sessions into account; and (2) 'brows-

ing'—when users are surfing a website and we are predicting their movements utilizing context.

The main research problem of this thesis is to investigate the value of context in searching and browsing user behaviour on web: *How to discover, model and utilize contextual information in order to understand and improve users' searching and browsing behaviour on web?* The general research problem is broken down to four specific research questions. We start by developing a general analytic framework that views context-aware search from the system's perspective: **RQ1:** *How to define a general analytical framework for context-aware systems?* This analytic part defines a general framework for modeling context, and introduces the notions of optimal contextual models and useful contextual models. Next, we look at the impact of specific contextual aspects: **RQ2:** *What is the impact of geographical location as a contextual information?* [2] **RQ3:** *How to discover users behavioral aspects as contextual information?* [3] We look at behavioral dynamics—changes in aggregated user behavioral features over time to detect changes in user satisfaction and drifts in query intent: **RQ4:** *How to define and to detect changes in user satisfaction with retrieved search results?* [4]. Our general research methodology is to conduct research on realistic data from various on-line search services, ensuring our results transfer to operational cases. This has a number of important consequences. Evaluation is key in operational environments, and we follow the current state of the art approach to evaluation, consisting of: (1) *offline stage*—where the progressive evaluation (time-wise), cross validation (object-wise) and human judgments procedures are employed; and (2) *online stage*—where the developed techniques are integrated into web systems. We employ traditional A/B and multivariate testing procedures providing reliable estimates of the performance of the alternative approaches.

Acknowledgments This research is supported by STW (CAPA project). Thanks to the ACM SIGIR for a Student Travel Grant.

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SIGIR'15, August 09–13, 2015, Santiago, Chile.

ACM 978-1-4503-3621-5/15/08.

DOI:<http://dx.doi.org/10.1145/2766462.2767852>.