

Utility Analysis for Topically Biased PageRank

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ABSTRACT

PageRank is known to be an efficient metric for computing general document importance in the Web. While commonly used as a one-size-fits-all measure, the ability to produce topically biased ranks has not yet been fully explored in detail. In particular, it was still unclear to what granularity of “topic” the computation of biased page ranks makes sense. In this paper we present the results of a thorough quantitative and qualitative analysis of biasing PageRank on Open Directory categories. We show that the MAP quality of Biased PageRank generally increases with the ODP level up to a certain point, thus sustaining the usage of more specialized categories to bias PageRank on, in order to improve topic specific search.

Categories and Subject Descriptors

H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval

General Terms

Experimentation, Design

Keywords

Biased PageRank, Open Directory, Personalized Search

1. INTRODUCTION

Full-text search is probably one of the most important facilities to access documents in the Web. Unlike controlled collections such as digital libraries, the web does not have a rich set of annotations. Consequently, when the user wants to focus her query to a specific subject, she has to reformulate it with additional terms describing her topic of interest. Yet this also implies that the set of possible results is restricted to those documents which *contain* the given query terms. If the user wants for example to find “sales contact” persons in the topic of “Business concerning natural textile fabrics”, she has to express all this information as terms. This query augmentation will clearly deprive her from finding most pages containing only the phrase “sales contact” and the name of some textile company.

Since most queries submitted to web search engines consist only of very few keywords, search results are susceptible to be implicitly biased towards generally popular web sites. This is due to enriching text retrieval methods like TFxIDF with link analysis algorithms as PageRank [4]. A promising approach to solve this dilemma of under- and

over-specification was to bias PageRank to favor a specific set of pages, called *biasing set* [2]. In most cases these biasing sets have been selected as subcategories of given large scale taxonomies, such as the Open Directory (ODP)¹.

Although there exist a few prior studies analyzing the properties of such topically biased PageRank [1], many aspects remained unstudied. In this paper we complete the investigation. We perform a utility analysis for topically biased PageRank and clarify the relation between the parameters of an ODP category (e.g., depth, number of children and siblings, number of pages therein, etc.) and the quality of the resulted biased rankings. We also investigate the correlation between the biased ranking and the generic, non-biased one. Finally, we sketch some applications of biased PageRank which could benefit from our study.

2. DEEPER INSIDE ODP

Setup. We empirically analyzed the quality of the ODP-biased PageRank vectors² using both quantitative measures, i.e., Kendall Tau similarity [3], and qualitative ones, i.e., Mean Average Precision (MAP). Our testbed was a 9.3M document web graph focused on the ODP catalog, which we have recently gathered using the Heritrix³ crawler. About 100 biasing (sub-)categories were randomly chosen from four top level categories, namely Business, Computers, Recreation and Sports. This selection process was executed as follows: For each of the four top categories, three subcategories were randomly picked; then, for one of them, we again randomly took three subcategories and so on, until no deeper levels were available. Almost all paths ended at level 6 (with level 1 being one of the ODP root categories). Finally, we computed Biased PageRank vectors using the pages residing in each of these categories as biasing sets.

We also selected five queries per category randomly using Google AdWords⁴, which suggests commonly used query terms to some specific keywords of interest. Whenever such a query resulted in less than one hundred results within our index, we replaced it by another one, randomly selected as well. Nevertheless, in most cases we obtained several thousands of results per query. Note that these queries are implicitly focused on each given ODP topic, and thus they should have resulted in rather similar outputs for Nonbiased and Biased PageRank.

¹<http://dmoz.org>

²We biased PageRank simply by using uniformly distributed non-zero values within its personalization vector [4].

³<http://crawler.archive.org/>

⁴<http://adwords.google.com/>

