INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER SCIENCE AND ENGINEERING TECHNOLOGIES

ISSN : 2454-9924

NOVEL CONTEXT-BASED DIVERSIFICATION FOR KEYWORD QUERIES OVER XML DATA

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ABSTRACT:

While keyword query empowers ordinary users to search vast amount of data, the ambiguity of keyword query makes it difficult to effectively answer keyword queries, especially for short and vague keyword queries. To address this challenging problem, in this paper we propose an approach that automatically diversifies XML keyword search based on its different contexts in the XML data. Given a short and vague keyword query and XML data to be searched, we first derive keyword search candidates of the query by a simple feature selection model. And then, we design an effective XML keyword search diversification model to measure the quality of each candidate. After that, two efficient algorithms are proposed to incrementally compute top-k qualified query candidates as the diversified search intentions. Two selection criteria are targeted: the k selected query candidates are most relevant to the given query while they have to cover maximal number

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ISSN : 2454-9924

of distinct results. At last, a comprehensive evaluation on real and synthetic data sets demonstrates the effectiveness of our proposed diversification model and the efficiency of our algorithms.

Index Terms—Privacy protection, personalized web search, utility, risk, profile

INTRODUCTION:

THE web search engine has long become the most important portal for ordinary people looking for useful information on the web. However, users might experience failure when search engines return irrelevant results that do not meet their real intentions. Such irrelevance is largely due to the enormous variety of users' contexts and backgrounds, as well as the ambiguity of texts. Personalized web search (PWS) is a general category of search techniques aiming at providing better search results, which are tailored for individual user needs. As the expense, user information has to be collected and analyzed to figure out the user intention behind the issued query. The solutions to PWS can generally be categorized into two types, namely click-log-based methods and profile-based ones. The click-log based methods are straightforward—they simply impose bias to clicked pages in the user's query history. Although this strategy has been demonstrated to perform consistently and considerably well [1], it can only work on repeated queries from the same user, which is a strong limitation confining its applicability. In contrast, profile-based methods improve the search experience with complicated user-interest models generated from user profiling techniques. Profile-based

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER SCIENCE AND ENGINEERING TECHNOLOGIES
ISSN : 2454-9924

methods can be potentially effective for almost all sorts of queries, but are reported to be unstable under some circumstances .

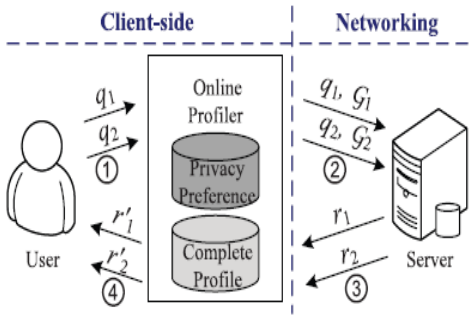

Fig. 1. System architecture of UPS.

Existing System:

In this section, we overview the related works. We focus on the literature of profile-based personalization and privacy protection in PWS system Previous works on profile-based PWS mainly focus on improving the search utility. The basic idea of these works is to tailor the search results by referring to, often implicitly, a user profile that reveals an individual information goal. In the remainder of this section, we review the previous solutions to PWS on two aspects, namely the representation of profiles, and the measure of the effectiveness of personalization The solutions in class two do not require third-party assistance or collaborations between social network entries. In these solutions, users only trust themselves and cannot tolerate the exposure of their complete profiles an anonymity server. In [12], Krause and Horvitz employ statistical techniques to learn a probabilistic model, and then use this model to generate the near-optimal partial profile. One main limitation in this work is that it builds the user profile as a finite set of attributes, and the probabilistic model is trained through predefined frequent queries. These assumptions are impractical in the context of PWS. Xu et al. [10] proposed a privacy protection solution for PWS based on

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER SCIENCE AND ENGINEERING TECHNOLOGIES
ISSN : 2454-9924

hierarchical profiles. Using a user-specified threshold, a generalized profile is obtained in effect as a rooted subtree of the complete profile. Unfortunately, this work does not address the query utility, which is crucial for the service quality of PWS. For comparison, our approach takes both the privacy requirement and the query utility into account.

Proposed System:

In this section, we first introduce the structure of user profile in UPS. Then, we define the customized privacy requirements on a user profile. Finally, we present the attack model and formulate the problem of privacy preserving profile generalization. For ease of presentation, Table 1 summarizes all the symbols used in this paper Consistent with many previous works in personalized web services, each user profile in UPS adopts a hierarchical structure. Moreover, our profile is constructed based on the availability of a public accessible taxonomy, denoted as R, which satisfies the following assumption.

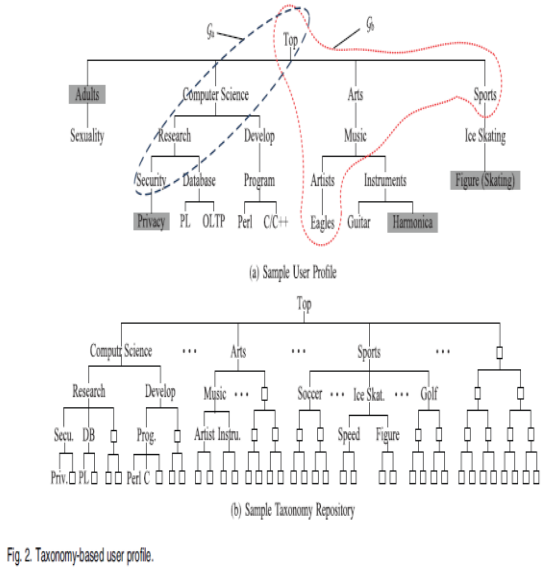

Fig. 2. Taxonomy-based user profile.

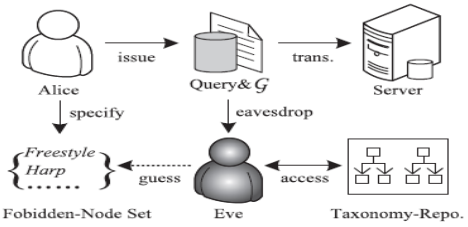

Fig. 3. Attack model of personalized web search.

UPS PROCEDURES

In this section, we present the procedures carried out for each user during two different execution

ISSN : 2454-9924

phases, namely the offline and online phases. Generally, the offline phase constructs the original user profile and then performs privacy requirement customization according to user-specified topic sensitivity. The subsequent online phase finds the Optimal _-Risk Generalization solution in the search space determined by the customized user profile.

1. offline profile construction,
2.offline privacy requirement customization,
3. online query-topic mapping, and
4. online generalization.

GENERALIZATION TECHNIQUES

In this section, we first introduce the two critical metrics for our generalization problem. Then, we present our method of online decision on personalization. Finally, we propose the generalization algorithms.

Metric of Utility

The purpose of the utility metric is to predict the search quality (in revealing the user's intention) of the query q on a generalized profile G. The reason for not measuring the search quality directly is because search quality depends largely on the implementation of PWS search engine, which is hard to predict. In addition, it is too expensive to solicit user feedback on search results. Alternatively, we transform the utility prediction problem to the estimation of the discriminating power of a given query q on a profile G under the following assumption.

EXPERIMENTAL RESULTS

In this section, we present the experimental results of UPS. We

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ISSN : 2454-9924

conduct four experiments on UPS. In the first experiment, we study the detailed results of the metrics in each iteration of the proposed algorithms. Second, we look at the effectiveness of the proposed query-topic mapping. Third, we study the scalability of the proposed algorithms in terms of response time. In the fourth experiment, we study the effectiveness of clarity prediction and the search quality of UPS.

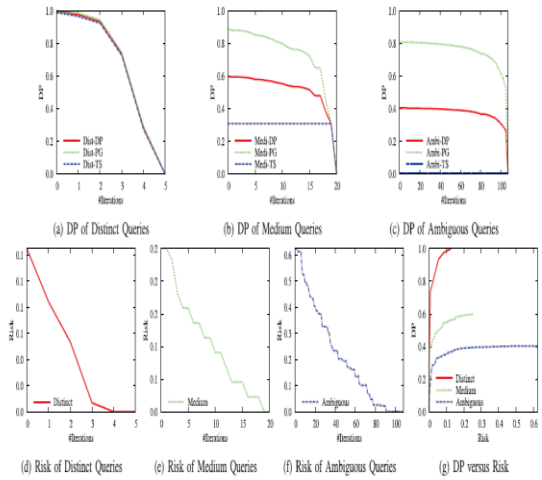

Fig. 5. Results of Distinct/Medium/Ambiguous queries during each iteration in GreedyDP/GreedyIL. All results are obtained from the same profile.

Scalability of Generalization Algorithms

We study the scalability of the proposed algorithms by varying 1) the seed profile size (i.e., number of nodes), and 2) the data set size (i.e., number of queries). For each possible seed profile size (ranging from 1 to 108), we randomly choose 100 queries from the AOL query log, and take their respective RðqÞ as their seed profiles. All leaf nodes in a same seed profile are given equal user preference. These queries are then processed using the GreedyDP and GreedyIL algorithms. For fair comparison, we set the privacy threshold _ ¼ 0 for GreedyIL to make it always run the same number of iterations as GreedyDP does. Fig. 7 shows the average response time of the two algorithms while varying the seed profile size. It can be seen that the cost of GreedyDP grows exponentially, and exceeds 8 seconds when the profile contains more than

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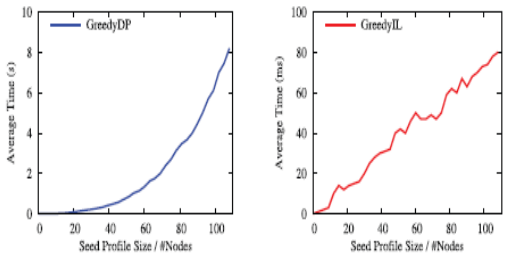
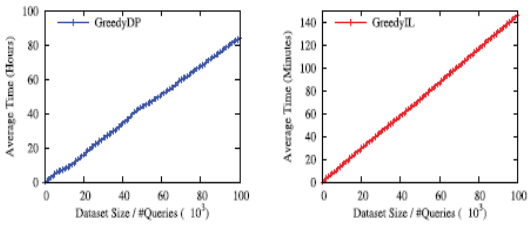
100 nodes. However, GreedyIL displays near-linear scalability, and significantly outperforms GreedyDP.



(a) Results of GreedyDP (b) Results of GreedyIL

Fig. 7. Scalability by varying profile size.



(a) Results of GreedyDP (b) Results of GreedyIL

Fig. 8. Scalability by varying data set size.

CONCLUSION

In this paper, we first presented an approach to search diversified results of keyword query from XML data based on the contexts of the query keywords in the data. The diversification of the contexts was measured by exploring their relevance to the original query and the novelty of their results. Furthermore, we designed three efficient algorithms based on the observed properties of XML keyword search results. Finally, we verified the effectiveness of our diversifi- cation model by analyzing the returned search intentions for the given keyword queries over DBLP data set based on the nDCG measure and the possibility of diversified query suggestions. Meanwhile, we also demonstrated the effi- ciency of our proposed algorithms by running substantial number of queries over both DBLP and XMark data sets.

ACKNOWLEDGMENTS

This work was supported by the National Science Foundation of China (No. 61170034), and China Key Technology R&D Program (No. 2011BAG05B04.

ISSN : 2454-9924

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ISSN : 2454-9924

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