

Using UPS Framework in Personalized Web Search

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Abstract— Personalized web search is a very convenient way to improve search results quality by modifying search results for users with individual information needs. However, users are not easily get ready to expose their private preference information to search engines. On the other hand, privacy for individual is different, and it can be compromised if there is a gain or profit to the user in output. Therefore balance must be maintained between search quality and privacy protection in PWS. The UPS framework adaptively creates user profile by queries while respecting user specified privacy requirements. Our runtime generalization goal is striking a balance between two predictive metrics that evaluate the utility of personalization and the privacy risk of exposing the generalized profile. UPS framework consists of two greedy algorithms GreedyDP and GreedyIL, for runtime profile generalization. Here we also have an online prediction mechanism for deciding personalizing a query is beneficial or not.

Key words: Privacy protection, personalized web search, Utility of personalisation, Privacy risk, Runtime profile generalisation

I. INTRODUCTION

Web search engines help user to find useful information on the World Wide Web (WWW). But when same query is submitted by different users, typical search engines return the same result regardless of who submitted the query. In general, each user has different information needs for his search query. Personalisation is the process of representing the right information to right user at the right moment. An important part of personalization is creating a user profile. The user profile could be created on the client PC or on an Internet server. Both these methods have different advantages. Client side profile gives better privacy protection, a more complete view of the user data. The solutions to PWS can generally be divided into two types, namely click-log-based methods and profile-based ones [4]. The click-log based methods are very simple they just see the pages clicked in user's query history. Profile-based methods improve the search results with the help of complicated user-interest models created from user profiling techniques. Profile-based methods are effective for all kinds of queries but are reported to be unstable under some various circumstances. We study privacy protection in PWS applications that model user preferences as hierarchical user profiles. We propose a PWS framework called UPS that can adaptively generalize profiles by queries while respecting user specified privacy requirement.

II. UPS FRAMEWORK

The main objective of this paper is to give a client-side privacy protection framework called UPS (User Customizable privacy preserving System) for personalized

web search. UPS could easily adopted by any PWS that captures user profiles in a hierarchical taxonomy.

Following are the main objectives of the UPS in personalized web search:

- 1) To provide privacy protection to the personalized web search.
- 2) To improve the search quality with the personalization utility of the user profile.

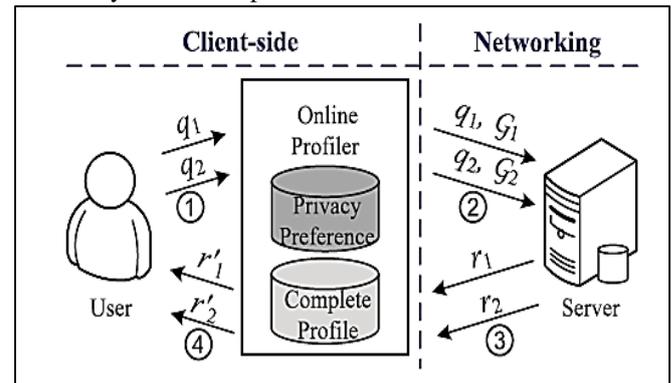


Fig. 1: System architecture of UPS.

The framework works in two phases, namely the offline and online phase, for each user. In the offline phase, a hierarchical user profile is created and modified with the user-specified privacy requirements. The online phase handles queries as follows:

- When a user enters a query on the client system, the proxy server creates a user profile in runtime according to the query terms. The output of this step is a generalized user profile satisfying all the privacy requirements.
- After that, the query and the generalized user profile are sent together to the PWS server for personalized web search. The search results are personalized with the profile and delivered back to the proxy server.
- Finally, the proxy server represents results to the user.

III. LITERATURE SURVEY

In this section, we are going to see the existing personalised web search techniques. We focus on the literature of profile-based personalization and privacy protection in PWS system.

A. Privacy protection in PWS System

1) A Utility-Theoretic Approach to Privacy in Online Services

Up to this day the recent efforts have shown the potential use to improve performance by introducing methods to personalize services based on special knowledge about users and their interest [1]. In this approach it finds a provably near-optimal optimization of the utility-privacy tradeoff in a productive way. The author evaluates their methods on data

collected from a log of the search history of volunteer participants. They separately monitor all individual users' preferences about their privacy and its utility via a large-scale survey. They show that a significant level of personalization can be gained using a relatively small amount of information about users.

B. Profile based personalization

1) Using ODP Metadata to Personalize Search

The Open Directory Project is one of the largest collective efforts to create manually explanatory web pages. In that paper the author discussed how these metadata can be used to achieve high quality personalized web search [2]. First, he mention this by introducing an additional criterion for web page ranking, namely the distance between a user profile defined using ODP topics and the sets of ODP topics covered by each URL returned in regular web search. Author empirically shows that this enhancement produce better results than current web search using Google. Then, in the second part of the paper, he investigates the boundaries of biasing Page- Rank on subtopics of the ODP in order to automatically extend these metadata to the whole web search.

2) Ontology-Based Personalized Search and Browsing

As the number of Internet users are increasing and also the number of accessed Web pages increasing, it is become more difficult for users to find results which are related to their particular interests. The centre of the problem is that whether the user is browsing or searching, is user is an eighth grade student or a Nobel Prize winner, the identical information is selected and it is represented the same way. In this paper, the author shows research that use information navigation system based on a user profile structured as a weighted concept hierarchy. A user can create his or her own concept hierarchy and use it for browsing Web sites. Or, the user profile can be created from a reference ontology by 'watching over the user's shoulder' while they browse [3]. Current work is based on investigating the interaction between the user profiles and conceptual search where documents are indexed by their concepts in addition to their keywords.

IV. CONCLUSIONS

This paper presents a client-side privacy protection framework called UPS for personalized web search. This UPS framework allowed users to specify customized privacy requirements through the hierarchical profiles. In addition to that, UPS also performed online generalization on user profiles to protect the personal privacy without any compromization to the search quality. We proposed two greedy algorithms, namely GreedyDP and GreedyIL, for online profile generalization. Our experimental results shows that UPS could give quality search results while preserving user's customized privacy requirements. The results also confirmed the effectiveness and efficiency of this solution. For future work, we will try to resist adversaries with broader background knowledge, such as richer relationship among topics (e.g. exclusiveness, sequentiality, and so on. We will also going to introduce more sophisticated and easy method to build the user profile, and better metrics to predict the performance (especially the utility) of UPS.

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