Web Personalization and Recommendation: A Review

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***Abstract*: During the past few years the World Wide Web has emerged as prevalent and mostly accepted way of communication and information broadcasting. It provides a platform for exchanging a variety of information, ranging from research papers, and instructive substance, to multimedia content, software and personal logs (blogs). Personalization in information retrieval aims to advance the user's experience by incorporating the user's context into the retrieval methods. The user interests and predilections play a significant role to boost effectiveness of information retrieval systems. The ambition of this research paper is to study the recent efforts done in the area of Web information reclamation and web personalization.**

Keywords— Web information reclamation, Personalization, Web Recommendation Introduction

I. INTRODUCTION

A. Information Reclamation

It concerns itself with the indexing and retrieval of information from assorted and mostly-textual information resources. Information Retrieval can also defined as "The study of systems for indexing, searching, and recalling data, particularly text or additional unstructured forms."

For the Information Retrieval to be proficient, the documents are usually transformed into an appropriate representation. There are numerous representation models. These representation models are characterized in accordance with two scopes: the mathematical basis as well as the properties of the model.

B. Web Personalization

Web personalization can be delineated as any action that customizes the information or services offered by a web site to client, or a set of users, based on knowledge attained by their navigational behaviour, recorded in the web site's logs, in other words, its usage. The piece of information is often coalesced with the substance and the formation of the web site, and the inclination of the client, if they are obtainable. The web personalization process and universal architecture of it, is illustrated in figure 1 and 2. Using the four aforesaid sources of information as input to pattern discovery techniques, the system tailors the provided content to the requirements of each visitor of the web site. The personalization process can outcome in the dynamic generation of recommendations, the formation of index pages, the highlighting of existing hyperlinks, the publishing of targeted commercials or emails, etc.

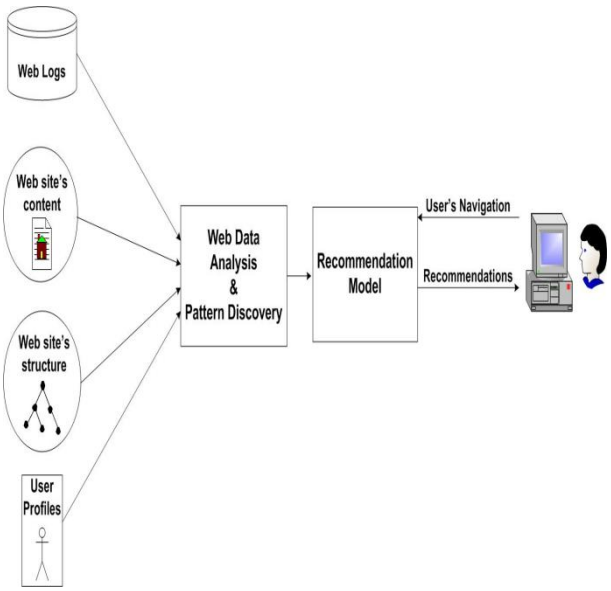

Fig. 1. The web recommendation process

A personalization method typically consists of three basic components: a personalization objective, a user preference elicitation process and a personalization engine (Figure 2).

A personalization aspiration is commonly considered as positive, and its aim is to boost the system utility and user satisfaction. There typically exists one specific aim, or numerous goals that together constitute a goal space. Conceptually, a goal space can be considered as an independent or interdependent n-dimensional space. Resolving qualitatively and numerically such a goal space implies to apply analytical strategies such as multi-criteria analysis in order to assist decision-making processes. For example, tourism services aims to provide attraction and traveling information, e.g., "at the right place, at the right time, to the right user".

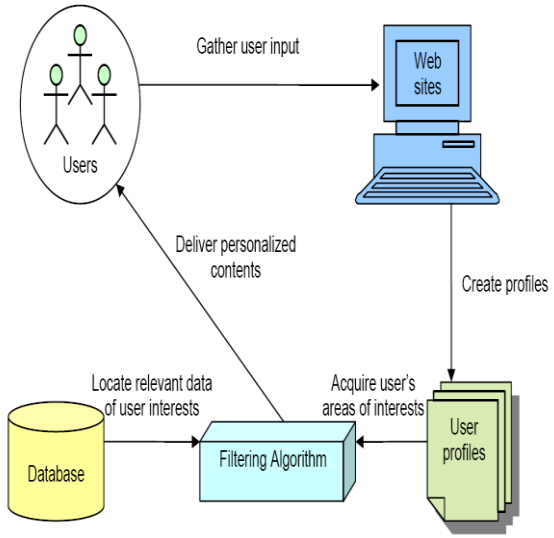

Fig. 2. General architecture of web personalization

User or client preference elicitation over a specified domain knowledge needs either observing user's picking behaviors, or honestly interacting with the client with pre-defined questions. The range of techniques used varies from the inherent tracking of client deeds to unconcealed client feedbacks on the information provided. Evaluating user preferences is either derived by precise information such as direct client feedbacks, keyword-based evaluation of user's interests, or inherent user feedbacks such as analysis of reading times, occurrence of document downloads and page browsing.

C. User Profile and Collaborative Filtering

The collaborative filtering is one of the techniques of recommender system. In the literature, the recommender system is used by large community of researchers to improve the web search. Another technique of recommender system is content based approach. As our research is focused on user behavior rather than product/ item information, the collaborative filtering is preferred over the content based approach.

Collaborative Filtering is an approach which considers not only the profile of the active user but also considers the neighborhood of the active user with similar preferences while recommending the items. The meaning of Collaborative filtering means that people collaborate(work together) to assist one another in filtering the documents they access by using their feedback.

It is observed that collaborative filtering system algorithms are required to consider the following points to provide useful recommendations:

1) Similarity between users for cluster formation
2) Choosing a sub-set of the neighborhood
3) Prediction for rating of items

Collaborative filtering (CF) is the method of filtering for information or patterns using techniques involving collaboration among multiple agents, viewpoints, data sources etc[1].

In this approach, query is submitted by the user. Query topic is pre-processed by eliminating Stop Words (semantically non-relevant terms) followed by stemming. The processed query goes through a search engine and documents are retrieved. This approach intends to efficiently personalize search results according to each user's information need by accurately updating client profile timely, suggesting documents according to analogous clients and by restructuring the information fulfilling the needs.

II. RECENT WORK IN THE WEB RECOMMENDATION

Shuk Ying Ho.[9] developed hypotheses about consumer reactions to dissimilarity in presentation timing and recommendation type and the relations between the two. The result establishes that quality gets better over the course of an online session but the prospect of considering and agreeing to a particular recommendation weakens over the course of the session.

Cheng Chih Chang et. al. [2] proposed a hybrid approach that educates the artificial neural networks to group users into diverse clusters, and applies the well-established Kano's method to taking out the implicit needs from users in diverse clusters.

Cui Wei et. al. [5] presented a crossbreed web personalization system derived from clustering and contiguous sequential patterns. Their system clusters log files to verify the basic architecture of websites, and for each cluster, they utilized contiguous sequential pattern mining to more optimize the topologies of websites.

To attend to the need of e-learning resource recommendation, Mojtaba Salehi [7] uses characteristics of resources and learners and the sequential patterns of the learner's accessed resource in recommendation process. Learner Tree is created to take into account explicit multi-attribute of resources, time-variant multi-inclination of learner and learners' rating matrix at the same time. inherent attributes are established and revealed using matrix factorization. BIDE algorithm also is utilized to realize sequential patterns of resource accessing for convalescing the recommendation superiority. Eventually, the recommendations results of BIDE and inherent and explicit attribute based collaborative filtering are mingled. The experimentations demonstrated that their proposed method do better than the prior algorithms on precision and recall measures and the learner's real learning preference can be gratified precisely according to the real-time up dated appropriate information.

C.S. Ok, H.Y. Kang, and B.H. Kim [4] proposed a recommender system for a manufacturing appstore which

is planned and constructed to invigorate online application trade among application developers and petite size manufacturing companies. The aspire of the recommender system is to prepare and give each website client an effectual application recommendation list. The list for a client might encompass items which are not purchased by the client but are valuable. To build the recommendation listing the proposed system makes a list of users having analogous purchasing pattern to the specified user. To construct the user list each user is represented by a k-dimensional vector of categories which are pre-determined corresponding to industry and business area. Based on the vectors, user similarities are calculated for each pair of clients. With the user listing the system attempt to find the recommendation contender items which are purchased by users in the list but not by the target user. To rank items in the contender list an item similarity metric is utilized. The metric for a specified item involves how close the item is to the applications which the target user purchased. Finally, contender items are ranked by this metric and first r items are recommended to the target user.

Chin-Chih Chang, Chu-Yen Kuo [3] proposed a Web service assortment mechanism based on user ratings and collaborative filtering. In this technique the quality of service of Web services, the feedback from the users and resemblance among the users are taken into deliberation for selecting Web services. This proposed method was verified by a case study of a journey information system and then the Mean Average Precision (MAP) is calculated by the experimentations.

Antonio Hernando et. al. [1] presented a fresh method for illumination of recommendations made by recommender systems based on collaborative filtering. Their technique is based on the visualization of trees of items, and it offers the users with a rapid and gorgeous technique of understanding the recommendations. This kind of visualization presents users with priceless information about the consistency of the recommendations and the significance of the ratings the user has given, which may help assist users to make a decision which recommendation to choose.

Pu Wang [8] presented a collaborative filtering personalized recommendation approach based on ontology in the particular domain. The scheme mingles ontology technology and item-based collaborative filtering. This recommendation approach can undertake the conventional recommenders trouble, such as matrix sparsity and cold start trouble.

To alleviate the setback of sparsity and cold-start, trust is incorporated in the collaborative filtering approaches with encouraging experimental results. Song, William et. al. [10] proposed a computational model for trust-based collaborative filtering with a method to generate and proliferate trust in a social network. He applied this technique to measure trusts on users' ratings of hotels and illustrate its feasibility by comparing the testing results with the customary collaborative filtering methods, e.g. Mean Absolute Error.

Jun Zhang et. al. [6] presented a fresh approach to compute user likeness based on weighted bipartite network and resource allocation standard for collaborative filtering recommendation. The focal point is to compute the asymmetric user weighted matrix and transform it into a symmetric user similarity matrix. They carry out extensive experiments over Movielens data set and demonstrated that their proposed approach can construct enhanced recommendation accuracy and can partly to alleviate the trouble of sparseness. Compare with conventional collaborative filtering recommendation algorithms based on adjusted cosine similarity, the proposed method can perk up the average predication accurateness by 0.6%.

III. Comparisons

In all of the above studied systems, one of the following approaches has been used:

- Memory-based Collaborative filtering
- Model-based Collaborative filtering
- Hybrid recommenders

Each of above approach has following advantages and disadvantages:

TABLE 1:

Approach	Advantages	Disadvantages
Memory-based Collaborative filtering	Simple implementation new data can be added effortlessly and incrementally need not consider the content of the items being recommended scale well with co-rated items	are dependent on human ratings have restricted scalability for big datasets
Model-based Collaborative filtering	better address the sparsity, scalability and other setbacks	lose valuable information for dimensionality reduction techniques
Hybrid recommenders	improve prediction performance conquer CF problems such as sparsity and gray sheep	have increased complexity and expenditure for implementation

IV. Proposed Approach

Phase 1: Ontology for Query Expansion

In this approach, User profile is built and algorithm finds the context of a user query using relevance feedback and Ontology. In addition, this approach uses a time-based automatic user profile updating with user's changing behavior.

Phase 2: Dynamic User Profile

Here the existence of a set of n users is assumed, $U = \{u_1, u_2 \ldots u_n\}$ and item $i = \{i_1, i_2 \ldots i_n\}$. User Profile for user u consists of tuples

$u(n) = \{<i_1, W(u,i_1)>, <i_2, W(u,i_2)> \ldots <i_n, W(u,i_n)>\}$

where for any item i_m, the computed weight is $W(u, i_m)$. User Profile P is a vector of weight of all terms of user.

Phase 3: Using CF and User profiles for Personalization/Recommendation

The presented approach aims to efficiently personalize search outcomes in accordance with each user's information requirement by precisely updating user profile in timely manner, recommending pages according to analogous users and by reorganizing the information fulfilling the needs.

Algorithm

Step 1. Foremost discover the reviewers that reviewed both products.

Step 2. Calculate the sums and the squared sums of the ratings for the both products,

Step 3. Compute the sum of the reviews of the products.

Step 4. The capability to recommend products is achieved by being able to locate similarities between them. To do that, we use the Pearson Correlation Score. The Correlation Score is a great measure of how fine two sets of data fit on a straight line. One attractive feature of the Pearson Score is that it corrects for grade inflation. That is, if one product has constantly higher scores than another, there can still be a perfect correlation — if the difference between the ratings is consistent.

Quantify resemblance $R(L,u_i)$ between lively user L and user u_i as the Pearson correlation coefficient between their term weight vectors

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$$sim(a,b) = \frac{\sum_{p \in P} \left(r_{a,p} - \overline{r_a}\right)\left(r_{b,p} - \overline{r_b}\right)}{\sqrt{\sum_{p \in P} \left(r_{a,p} - \overline{r_a}\right)^2} \sqrt{\sum_{p \in P} \left(r_{b,p} - \overline{r_b}\right)^2}}$$

Where

a, b : users

$r_{a,p}$: rating of user a for item p

P : set of items, rated both by a and b

$\overline{r_a}$ and $\overline{r_b}$ = user's average ratings

Step 5. Making Predictions as follows

$$pred(a,p) = \overline{r_a} + \frac{\sum_{b \in N} sim(a,b) * \left(r_{b,p} - \overline{r_b}\right)}{\sum_{b \in N} sim(a,b)}$$

V. Conclusion

Personalized Information Retrieval has been quite popular among researchers of IR in recent years. The proposed ideas of combining the dynamic user profile, ontology and collaborative filtering have generated a great deal of interest for IR.

It is analyzed from experiments that this approach does not mislead the users as it gets implicit representations from them, transforming the appropriate recommendation results into effective results.

This research makes a significant review on Personalized Information Retrieval and information overload and mismatch issues in the information retrieval field. We also

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