

A Novel Approach for Web Personalization

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ABSTRACT

In the present world web is huge storage of information and it will keep increasing with growing of internet technologies. But the human being capability to read, access and understand content does not increase with that trend. Hence it becomes complex to website owners to present proper information to the users. This led to provide personalized web services to users. One of the well-known approaches in providing web personalization is Web Usage Mining. In this paper, our motive of web usage mining is to discover users' access patterns of web pages automatically and quickly from the huge server access log records, such as frequently visited hyperlinks, frequently accessed web pages and users grouping. Also, we proposed a new method for discovering users' access patterns and recommend it to the user.

Keywords

Web Usage mining; Web Intelligence; Web Personalization; F-P Growth Tree; Markov Model

1. INTRODUCTION

As the ease and speed with which business transactions are often carried out over the web has been a key actuation within the rapid growth of electronic commerce. Specifically, e-commerce activity that involves the end user is undergoing a major revolution. The ability to trace users' browsing behavior all the way down to individual mouse clicks has brought the vendor and end client closer than ever before. It's currently possible for a merchant to personalize his product message for individual customers at a vast scale, a phenomenon that's being stated as mass customization.

The scenario represented above is one among several possible applications of web Usage mining that is the method of applying data mining techniques to the detection of usage patterns from web information, targeted towards numerous applications.

Web personalization is a relatively new and difficult field for web content delivery. In order to fulfill expectations of visitors, customers and loyal users, internet world is troubled to offer excellent customized services throughout their interaction with the system. The impacts of personalization and recommendation system are often experienced by the rapid popularity that this area has gained within the previous few years. Customers preferably choose to visit those websites, that perceive their needs, offer them rapid value added customized services and simple access to needed data in simple graspable format. Web personalization and recommendation system plays a significant role in meeting this goal.

Corporate world looks towards the large volume of transactional and interaction information generated by the web for R&D that facilitates the creation of latest innovative competitive services and products [1]. In today's e-business world, most of the main e-commerce players have tailored the

web personalization and recommendation system including Yahoo!, Amazon, eBay, Netflix, NewsWeeder, IBM and plenty of more.

Web personalization characterized in two sub category first one is active personalization, users explicitly supplies content to system in order to obtain customized services/features. Once experiencing the benefits, users may be more willing to submit information without caring of its consequences. Moreover, second is passive personalization, user is often oblivious of what information is being occupied. Since personalization is achieved by means of intensive information about users, hence privacy standards like P3P [2] must be employed.

This article is organized as follow: section.2 provides a background overview of web personalization. Section.3 explains the existing system and its process. Section.4 outlines the problem arrived in existing system. Section.5 presents the solution approach and proposed system. Section.6 represents the architectural view of proposed system. Section 7 Describe the proposed algorithm. Section 8 outlines the applications, advantages and limitation of proposed approach. Section 9 concludes the paper. Finally, section 10 describes the future work.

2. BACKGROUND

In this paper authors discovered the user session files and developed groups on the idea of similar characteristics using fuzzy algorithms [3]. Consistent with their analysis a user or a page can have over one cluster. In their proposed approach, after preprocessing of usage information dissimilarity matrix of preprocessed information is formed. This is often utilizing by fuzzy algorithms in sequence to cluster typical user session.

Author proposed most advanced system, "WebPersonalizer" [4]. It's a robust framework for mining web log files to extract the helpful data for the aim of recommendations based on the browsing equivalence of current user to previous user. After collection and cleaning of usage information (creating numerous abstractions of collected data), data mining techniques like association rule mining, sequential pattern discovery, classification and clustering are applied in order to get interesting usage patterns.

The most necessary contribution within the area of web usage mining is STRATDYN (Strategic and Dynamic) add-on module presented during this paper [5]. It determines the variations between direction patterns of user and then it exploits the site linguistics within the visualization of the results. During this approach, web pages are grouped along on the basis of construct hierarchies. He targeted on "interval based coarsening" technique for usage information at completely different levels of abstraction. For this purpose he used basic and inferior stratograms for visualization of the results.

Author targeted on web usage mining during this paper [6]. This method depends on the application of statistical and data mining strategies to the web log data, resulting in a group of helpful patterns that indicate user's navigational behavior. During this approach numerous data mining algorithms are applied to search out navigational patterns.

Collaboration filtering techniques used for recommendation require accumulation of large quantity of historical user-preference data that is queried to supply a personalized expertise. Model-based collaborative filtering techniques are most well-liked over the somewhat additional accurate memory-based collaborative filtering techniques primarily as a result of their higher potency and scalability. Authors introduced a web usage profile maintenance scheme known as incremental relational Fuzzy subtractive clustering (RFSC) [7], which may efficiently add new usage data to an existing model overcoming the expense related to frequent transforming. They additionally introduced a quantitative measure, known as impact factor. When the worth of impact factor exceeds a predefined threshold, transforming is recommended.

In this paper [8] authors proposed a standard technique that allows tags to be incorporated to standard collaborative filtering algorithms. Firstly it reduces the three-dimensional correlations into three two-dimensional correlations and then applies a fusion method to re-associate them. The fusion method outperforms standard baseline models with the incorporation of tags. Fuzzy clustering techniques are found to be very efficient in clustering accuracy.

Author proposed a machine-learning-based method that use of two methods are web content analysis and web structure analysis [9]. Each Web page is represented by a set of content-based and link-based characteristics, which can be utilized as the input for various machine learning algorithms. This approach outperforms the traditional text classification methods. A challenging problem in recommendation systems deals with unvisited or newly added pages. Author [10] addresses this problem by introducing a novel Weighted Association Rule mining algorithm. This approach can enhance the overall quality of web recommendations.

In this paper [10], authors suggested a framework for web mining based personalization that together with web usage data with web content and site structure for predicting user's future requests more accurately. Authors [11] proposed an algorithm called modified IncSpan for effective mining of sequential patterns from the incremental database. This algorithm is capable to discover sequential patterns from database basis on the sequential patterns comes from the insert and append database, and the clogged sequential patterns are comes from the resultant sequential patterns.

Collaborative Filtering is that the preferred recommendation technique. However, Classical collaborative Filtering systems use only direct links and customary features to model relationships between users. Authors given a brand new densified behavioral network primarily based collaborative filtering model (D-BNCF), based on the BNCF approach that uses navigational patterns to model relationships between users [12]. This approach achieves a high exactness when new links are exploited to calculate the predictions.

So far, collaborative filtering has been the foremost successful technique within the design of recommender systems, wherever a user is usually recommended those items, which individuals with similar tastes and preferences liked within the

past. Though the studies of tag-aware recommender systems have achieved fruitful goals, however there are still few challenges that are nonetheless to fulfill, which are highlighted during this paper [13].

They argue that evaluating the user experience of a recommender needs a broader set of measures than have been ordinarily used and recommend further measures that have proved effective. They planned an intelligent recommendation system that utilizes the boosted item based mostly collaborative filtering (for the efficient rating of predicted items) and association rule mining technique (for creating a customized recommender system for the target user) [14]. This method improves the web recommendation preciseness.

In this paper [15], authors planned a way for developing web personalization system using changed Fuzzy Possibilistic C means (MFPCM). The author claims that this approach raises the chance that URLs given before a user are going to be of his interest.

Authors formulated a system that builds and maintains community web directories by using a web usage mining framework that gives a variety of personalization functionalities during this paper [16]. It absolutely was named as OurDMOZ, which incorporates adaptive interfaces and web content recommendations.

In this paper [17], author extends the standard clustering collaborative filtering models. They formulate the Multiclass Co-Clustering (MCoC) drawback and propose an efficient solution to it in order to search out significant subgroups. They additionally propose a unified framework that extends the standard collaborative filtering algorithms by utilizing the subgroups data, for raising their top-N recommendation performance.

Authors planned a multi-agent primarily based system application model for categorization, retrieving and recommendation learning objects that are stored in several and heterogeneous repositories [18]. In order to boost the accuracy, they need come up with a data retrieval model, that relies upon the multi-agent system approach and an ontological model.

This paper [19] provides an insight into the chance of merging data mining techniques with web access logs analysis for achieving a cooperative effect of web usage mining and its utilization in web personalization. The paper describes the information preprocessing, pattern discovery, and pattern analysis steps, as three basic steps within the process of WUM, that web designers ought to follow in information extraction. the choice of association rules discovery algorithm as a WUM technique by no way to understood as a suggestion that it's the most effective WUM algorithm, however as a appropriate framework for a research. It is hard, if not impossible; to declare that one data mining algorithm is that the best generally, as a result of the possible outcomes of WUM method always depend upon the problem in hand. Despite the distinction in frameworks, information hidden in click stream data discovered in WUM method, could and may be used for web personalization and additionally for undertaking remedial actions and creating consequent enhancements of the previous application design.

In this paper [20], initial they need mainly focused on the web mining types- web content mining, web structure mining and web usage mining. After that, they need introduced the web mining techniques within the area of the web personalization. Personalization needs the various goals and conjointly it's

helpful to develop different business application. Ecommerce is one among the instance of this personalization technique that depend on the how well the website owners understand the user's behavior and their desires. Web usage mining is helpful for the pattern matching, web site reorganization, product/site recommendation etc.

There is a wealth of recommendation models for personalizing a web site based on earlier users' navigational behavior. Most of the models, however, are solely based on usage information. During this section we study various techniques for web personalization. Most of the technique based on uses history and personal information of user, but still it's not appropriate. So we proposed a new technique for web personalization.

In this paper [31], Author have proposed an efficient and novel architecture for web search personalization using web usage mining, without user's explicit feedback. Author uses the sequential access pattern mining algorithm and Apriori algorithm for web search personalization. Apriori algorithm provides frequent patterns and explosive candidate sequences, but requires large space for processing. We will use FP-growth tree and markov model to reduce limitation of this algorithm. Also we use the page rank algorithm proposed in this paper [32]. They use prNG Graph for finding user access patterns. We use FP-growth tree in place of prNG graph and enhance the performance. Our proposed algorithm for web personalization provides better performance in compare to this algorithm [31].

3. PROPOSED TECHNIQUES

As Recommendation algorithms aim at proposing "next" pages to a user based on her current visit and also the past users' navigational patterns. Within the overwhelming majority of related algorithms, only the usage information are used to generate recommendations, whereas the structural effects of the web graph are neglected. we tend to claim that taking also into account the website structure and used link analysis algorithms ameliorates the quality of recommendations. During this paper we tend to present, a completely unique personalization algorithm which combines usage data and link analysis techniques for ranking and recommending web pages to the user. Victimization the web site's structure, web log file and its usage information we turn out weight matrix to be used for producing personalized recommendations.

Proposed web personalization scheme use FP growth [21], weighted rule mining concept [22] and markov model [23]. Proposed scheme use FP growth tree concept for locating frequent uses page's efficiently without candidate set generation, whereas weighted mining method are used to apply relative weight over each transaction after identification of session and user. Markov Model use to assign that relative weight over their relative location in transaction probability chain matrix suggested by markov model.

Proposed scheme for web page recommendation will be easily perceive by the architectural diagram as show in figure 1. Wherever proposed diagram having two completely different layers, front and back. Front layer is use to grape web data i.e. web transaction data in web log. Whereas backed layer used to analyses this data and generate resultant markov model for future web page recommendation.

3.1 Front Layer

Front layer liable for capturing consumer web access behavior over web log file whereas back layer use this historical data as

a input to analyses consumer web behavior for web personalization. Once analysis over log file is done, back layer make resultant markov model.

After completion of markov model if any consumer X requests a web page P1, web server performing two completely different jobs over that request before replying. First redirect that user request to transaction probability matrix of backend layer, transaction probability matrix recommended number of most frequent page to user having higher relative weight.

3.2 Backend Layer

Back layer is use to pre- process and refine raw log file and generate transactional matrix using markov model. Back layer having following step

3.2.1 Pre-Processing

Log file used to capture consumer server behavior over the network at any time that is what page has been requested by which consumer and once all this data has been capture in web server log file. Along with that necessary data there's also some inconsistent data like noise, null value and other error data which isn't so necessary for web personalization therefore so as improve web mining result it's ought to refine web log file before mining. Data cleaning, user and session identification, knowledge integration and so on are main necessary part of preprocessing.

- *Data Cleaning:* Data cleaning could be a method of removal of unwanted data i.e. not necessary for web personalization like http sound, image and graphics data because page having sound. Graphics and picture extension isn't relevant for decision taking in web personalization [24]. Data cleaning method additionally involves removal of unwanted unsuccessful http status code. Status codes are mainly three digit code returns by server. Server serve status code in four completely different categories particularly 200 Series, 300 series, 400 series and SOD series wherever 200 series status code for successful transaction, 300 series code used for redirect and 400 series code for unsuccessful authentication (401), forbidden request for constrained subdirectory (403) and file not found (404,whereas SOD series code for server error.

In proposed methodology data cleaning method use to recognized helpful token and remove unwanted and redundant token then store in data base once normalization.

- *User & Session identification:* User and session identification is incredibly necessary step towards web personalization usually IP address is employed to differentiate however once there's an proxy server then variety of user having same IP address then some additional attribute like browses data, software package and Refer URI field is employed as per concern[25].
- *Path Completion:* Due to the presence of proxy server and local cache, there are a lot of significant accessed information which are not stored in the web access log data therefore path completion is a method which append lost page references in server access log file. Similar methods can be used for path completion those used for user identification.

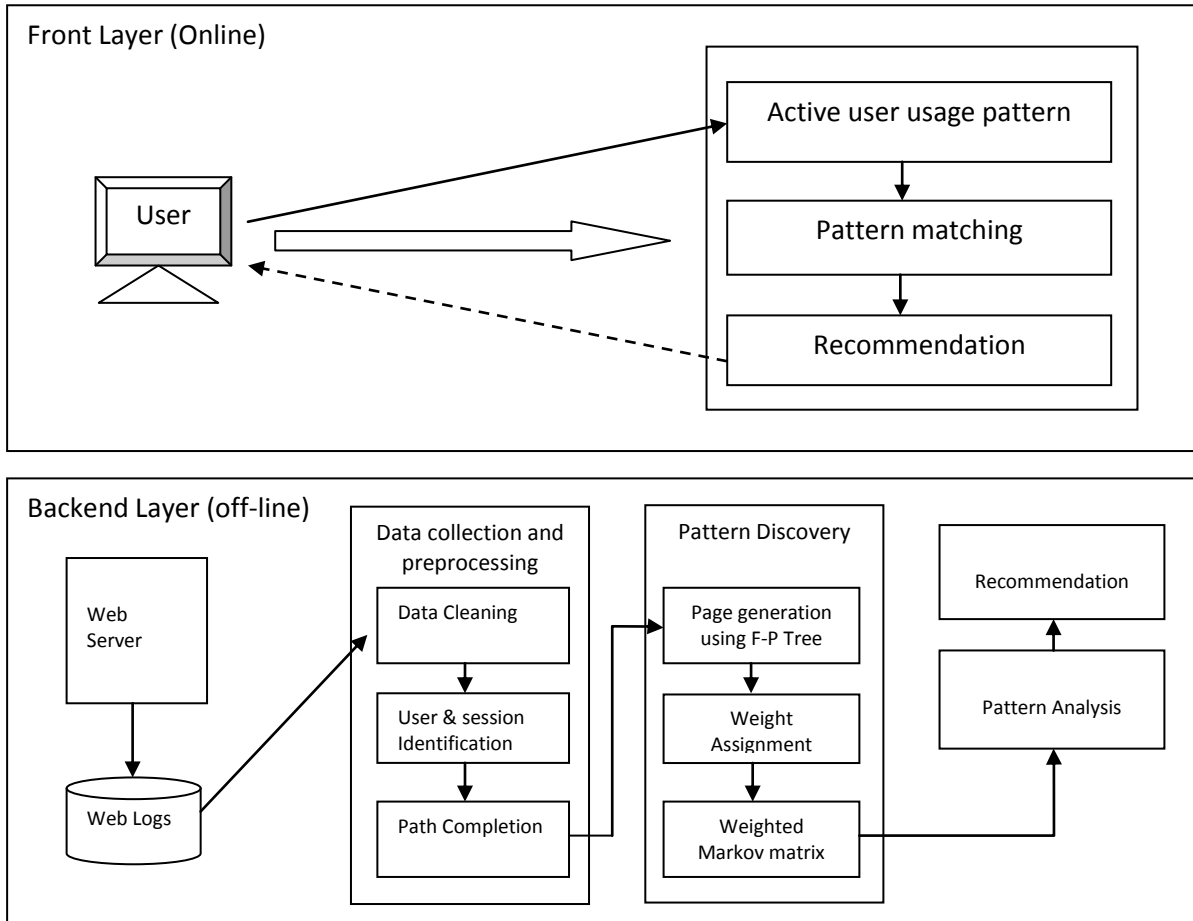


Figure 1. Architecture diagram of proposed work

3.2.2 Pattern discovery

After identifying user transactions there are different types of mining techniques are present to perform pattern discovery in web log data. We use F-P growth algorithms [26], weight assignment rule and Markov modal for pattern discovery.

F-P tree for frequent page generation: Proposed algorithms used F-P growth concept to generate numerous web page. F-P growth algorithms use to produce frequent item set without need to generating candidate item set so it is very time efficient to use F-P growth.

Weight Assignment: Weight assignment concept is being used mapping every web page with their whole relevant page having higher relative weight.

$$R_w = \frac{\text{Number of occurrence of page } q \text{ and page } p \text{ together}}{\text{Number of occurrence of page } q} \dots\dots\dots 1$$

Relative weight of any page q with respect to p means probability of page q request after page p is being calculated by dividing number of occurrence of page p with page q together with number of occurrence of page q.

Weighted Markov matrix: Proposed algorithms use M*M two dimensional table to store relative weight. M is entire number of distinctive transaction /page that had been identifying in above step. For example relative weight of p wrt q is store at

qth row and pth column then at time pre fetching if q page is called then at qth row the page having maximum relative weight is to be recommended with page q.

3.2.3 Pattern Analysis

Now pattern analysis is the final method for web usage mining technique. The frequent patterns are extracted with the weight values. The weighted support is predictable and used for the pages. If user stands in a page we trace the matrix (calculated in pattern discovery section) and find out the next highest relative weighted pages. After that analysis of previous and current user usage recommend user to web pages are more likely to be accessed by the user in the future.

4. PROPOSED ALGORITHM

Algorithm

Step 1- Pre Processing – Token reorganization and removal of unwanted attribute and store in data base.

Step 2- preparing web log table using F-P growth - After web log preprocessing the recognized useful tokens are stored in the database. Normalization is also performed in order to remove the redundancy.

Step 3- Weight Assignment - For each page P_i this step evaluate weight for each of its relative page P_j

$$W_{p_i p_j} = \frac{\text{Total number of occurrence of } p_i \text{ \& } p_j \text{ together}}{\text{Total number of occurrence of } p_i} \dots\dots\dots 2$$

Step 4- Markov Model- Assign relative weight to two dimensional matrix as Markov model suggest

$$P_{i,j}^M = \begin{bmatrix} \dots & & \\ \vdots & \ddots & \vdots \\ \dots & & \end{bmatrix} = W_{p_i,p_j} \dots \dots \dots 3$$

Step 5- Pattern Analysis- Search in matrix for frequent pattern as user usage analysis.

Step 6- Recommended Pages- Output of step 5 recommend to user for future uses

5. APPLICATIONS OF WEB PERSONALIZATION

Web personalization has been recently gaining great momentum in research and in numerous commercial web applications. One of the fascinating applications of personalization on Web is the recommender systems [27,28]. Recommender systems are used to provide users with a richer experience and help them to make the assortment process easier. In the web personalization, recommendation engines recommends object in the form of pages, products, advertisements etc depending upon the type and taste of the user. Now a day's countless of new products are being advertised over the media every day. Hence, various business strategies have been developed to retain the existing customers as well creating new customers. Web personalization recommendation is being used by various e business applications. Examples of some of such recommendation systems are Amazon.com, barnesnoble.com Ebay.com, FAIRWIS, LIBRA, CDNOW etc. The recommendations systems also recommend web pages for various web sites MEMOIR, Phoaks, GAB, Fab, Alexa.com, Quickstep, R2P, SOAP. It has also been used for recommending music, movies, videos or other services. CDNOW, Moviefinder.com, Movie lens, Moviefinder.com, Firefly, Morse are among some systems which suggest interesting movies and songs to the users. Recommender systems are also used in news reading domain as well. Tapestry, GroupLens, PHOAKS, WebMate, Alipes and Personal View Agent, Lotus Notes, PVA are among some systems which suggest interesting news to readers. Another interesting application of personalization is in adaptive hypermedia systems. For example WebWatcher helps its users by modifying the page that the users browse. The web personalization system has also been used for e-learning [27, 28].

6. ADVANTAGES OF WEB PERSONALIZATION

- Web personalization has given opportunity to e-commerce to make websites more personalized in marketing, which finally gives higher trade volumes [29].
- Government agencies are using this tool to identify threats and fight against terrorism.
- This predicting ability of mining applications can profit society by identifying illegal activities.
- The Organizations can establish a good and healthy relationship with customer by giving them the exact information that they want.
- Companies can understand the needs of the customer better and they can act in response to customer needs faster.

- The companies can retain customers by presenting information relevant to them [30].

7. LIMITATIONS

- Privacy is considered lost, when this technology is used on data of personal nature that might be a cause of concerns [7].
- The information collected by the companies can be used some other purpose which leads to the violation of privacy of users.
- The growing trend of selling personal data as a commodity encourages website owners to trade individual data obtained from own site. This trend has increased the amount of data being acquired and traded enhancing the likeliness of one's privacy being invaded.

8. CONCLUSION

Web is increasing rapidly, but on the other side the user's capability to access Web content remains stable. At present, Web personalization is the most appropriate approach to alleviate this problem and to provide users with tailored experiences. Web-based applications (e.g., e-commerce sites, e-learning systems, etc.) improve their performance by providing the individual user needs and preferences of each user, increasing satisfaction of user.

In this paper, we proposed Web personalization algorithm as one of the solutions to this problem, which makes use of Web usage mining. Summarizing, in this paper we explored the different methods of web personalization. We provided architecture and algorithm of the personalization process. Also we find out the advantages and limitation of web personalization.

9. FUTURE SCOPE

In this paper we provide architecture and algorithm for web personalization. In future we implement this algorithm with using web log file of server and also analyzing the result. Web personalization is the very significant approach in the today e-commerce world, so we will try our best for provides the superlative tool for web personalization.

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12. AUTHOR PROFILE

1. MONIKA DHANDI

I am a PG student of Computer Engineering, in Shri Vaishnav Institute of Technology and Science, Indore. I did B.E.(Computer Science and Engineering) from MIT Ujjain.

At my graduation level, I prepared application software for “Real Estate” and “Holiday Package” under project work. I am putting my sincere effort in research in the field of Web Usage which can help to predict next desired web page the user is interested in.

2. RAJESH KUMAR CHAKRAWARTI

[1] Objectives

Want to make the research as a career for my life, want to do new research in the Computer Science and Engineering and work for technical and social education for India. I wanted to devote my whole life for the development in growth of India that’s why I connected with IITs, NBA, ISO, IBM and other important organizations throughout India.

[2] Area of Interest

- (a) Word Sense Disambiguation (WSD) Systems.
- (b) Machine Translation (MT) Systems.
- (c) Computer Graphics and Multimedia.
- (d) Artificial Technologies (AI) and Fuzzy Systems.
- (e) Compiler Design. [33] [34]

[3] Educational Qualifications

(a) Ph.D. (Computer Engineering) (Pursuing) under the Guidance of Dr. Pratosh Bansal, Professor IET DAVV Indore(MP), at IET, DAVV Indore (MP) and Dr. Suresh Jain, Director & Professor PIEMR Indore (MP).