

A Survey on Short Term Behaviour Modelling

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Abstract : The context of a user significantly influences user preferences and respectively his/her behavior. The nature and the way users are using the web today, is most exciting and explored topic now a days. Mining the user's behavior to provide pattern of the user's interest will lead to better prediction of the user's behavior and can increase user experience. Furthermore, today business emphasis on this type of information, as this can be useful in order to improve their services. In this paper we have tried to review work done in area of capturing user's short-term behavior (on the level of a session), which indirectly enables to, predict the session end intent or the length of the session and respectively adjust generated recommendations.

IndexTerms - User Context, Short-Term Behavior, Personalization, User Model, Session End Intent

I. INTRODUCTION

Web Personalization is one of the extents of the web tradition mining that can be defined as delivery of content tailored to a particular user or can be defined as implicitly or explicitly gathering visitor information and leveraging that knowledge in content delivery framework to manipulate what information present to users and how you present it [3]. Personalized approval became an essential part of modern Web applications. The activities for personalized recommendation includes acquisition, processing and maintenance of a data about the user, his behavior and preferences; these play a crucial role on the task applied: a personalization, recommendation or various predictions on the site. User preferences work for as the basis for tailoring services and its content for specific user. The Web Personalization process divides into four distinct phases: collection of web data, pre-processing of web data, analysis of web data and decision making/final recommendation. Web data includes past activities/click streams as recorded in Web server logs and/or via cookies or session tracking modules [4]. User preferences/activities are highly influenced by his/her context, e.g., time, location, mood. Context is generally defined as "a predefined set of contextual attributes, the structure of which does not change over time"[5]. This type of data can be used to identify an actual the user's objectives which helps to generate relevant recommendations. Generally user's behavior is not used in recommender approaches. But the behavior as a set of actions, a user performs on the web. In other words, while preferences express what the user likes, the behavior describes how the user acts [1]. Identification of behavioral changes between individual session actions is important to understand actual user behavior [2]. Seeing a user short-term behavior in modern approval approaches, will improve the user experience. In this paper we primarily focus on user short-term behavior (on the level of a session), pros and cons of the short-term user behavior modelling and its application to the personalized recommendation problem in order to improve his experience almost intermediately.

II. USER PREFERENCES AND USER BEHVAIOR

Table 1 gives a brief overview of user preferences and behavior which are considered to be basis of short term modelling. By modelling behavior and preferences various challenges in the web personalization domain could be overcome which are discussed in later section in this research paper.

Table 1 User Preferences vs. Behavior

User Preferences	User Behavior
<ul style="list-style-type: none"> It works as source for modifying services and its content for specific user. 	<ul style="list-style-type: none"> It describes how a user acts.
<ul style="list-style-type: none"> They are considered by recommender approaches. 	<ul style="list-style-type: none"> Also it describes how user interacts with website structure and website content.
<ul style="list-style-type: none"> User's actual state could be identified with the help of user context which is used for recommendation approaches.[1] 	<ul style="list-style-type: none"> For example how much time user spent in one session, which all items he/she has visited etc. This type of website usage information improves personalization performances [6].

Based on the session end intent estimate i.e. in a single session what are the user actions and interaction with website; not only number of actions, but also an estimated time, the user will browse may bring better user experience and business potential.[1]

Consider an example assume that any user wants to go for particular pages on the site as per his/her interest. Suppose we refer our web site name is *www.abccollege.com*. Now user checks every time events, syllabus, result and academic tabs. Based on this user's navigation, however, in combination with previous users' visits focusing on the same subject the system makes recommendations to the user. Assume, for example, that many users in the past have seen the page *www.abccollege.com/result.html*, *www.abccollege.com/syllabus.html* and other page link is *www.abccollege.com/academic.html* during the same visit. If the current user visits the first two, the system can recommend the third one, based on the assumption that people with similar interests present similar navigational behaviour. By observing how the user behaviour evolve within a single session we can improve his/her experience with website. Both user behaviour and preferences are influenced by his/her context.

III. LITERATURE REVIEW

User behavior typically subjects to various factors. It is always based on long term behavior which is stable while short term behavior is highly noisy and thus does not give sufficient information. According to [1] the author describes that there is a great chance that the user actual behavior will follow in some measure his/her historic patterns. For this reason, user actual behavior may be similar to behavior of other users. User behavior can often be determined by individual's long-term and short-term preferences. [7].

For personalization or recommendation task the various types of input attributes can be modelled as follows: [8]

- User preferences, interests, goals or attitudes,
- Proficiencies, knowledge,
- Interaction history (user's interaction with the system, tasks performed),
- Stereotypes (e.g., predefined categories).

In [2] author have proposed a user model to capture short term behavior changes within a single session which is influenced by various external factors. The author focuses on modelling behavioral attributes capturing data usage, then site characteristics capturing content and structure of pages visited within the session. The author observed how similar is the actual session to previous, or in the other words, if it reminds moments when previous sessions changed (e.g., user ended the session and leaved). Actual session is compared to average of the previous sessions.

Following the idea of the short-term and long-term behavior, the author [1] have proposed model which consists (Fig. 1) of several time layers (e.g., day, week), two parts (personal – reflecting a behavior of modelled user; global – reflecting a behavior of all users). Moreover, several additional attributes are stored to help describe the (temporal) actual session (e.g., time spent within the session).

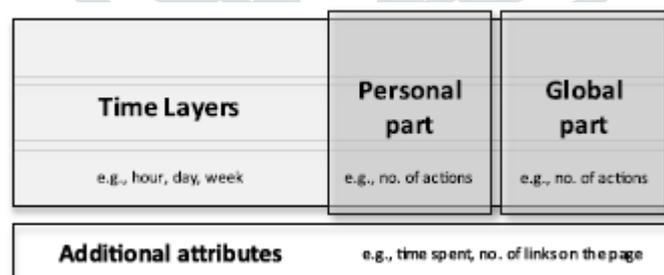


Figure 1: The idea of short term behavior model [1]

Along with this the model can also predict the user future behavior. The knowledge of user future actions allows us to differentiate recommendations, e.g., for a user who will perform two actions before leaving the session and a user who will perform 20 actions within a session. Following challenges have been identified by the author based on the experiences:[1]

- Short-term behavior modelling-
- Session end intent prediction
- Spend time prediction
- Short-term behavior boosted recommendation

IV. RESEARCH AREAS

Various future areas could be taken into consideration for research. Improving Short-term behaviour modelling as it depends on user context which mainly influences user behaviour. Session end intent prediction: This could investigate predicting session

categories using only the first few actions which would enable personalized experiences within a single visit. Furthermore, it would be interesting to monitor which user demographic subgroups use the product in a given way, and subsequently connect changes in usage patterns. Short-term behavior to boost recommendation and personalization systems.

V. CONCLUSION

By studying various works of different authors which focused on short term modelling we could conclude that short term behavior could be used for identification of session author (by looking for the most similar sessions in the past) or fraud detection (by identification of highly unusual user activity in comparison to user's history). Another area for future improvements lies in usage of additional data sources allowing to model new types of data describing different behavioral traits. These could be data from eye trackers, which become nowadays very popular, or another biometric data describing user movements, or gestures.

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