Personalizing Mobile Commerce Website Using Google Analytics

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Abstract

Today number of ecommerce users who make day to day transactions are increasing. the largest m-commerce sites offer millions of products for sale. Choosing among so many options is challenging for consumers. This rapid expansion has resulted in new challenges to both companies as well as customers. Customers are overloaded with multiple choices for a specific product, which results in a confused and lost state.

Personalized recommendation is the key technology to solve some of the challenges that face and affect the performance of Ecommerce system. In this paper, a personalized recommender system based on Google Analytics data is proposed for personalizing the m-commerce website. to present the results, a comparison is used to show the recommended products status before and after applying the proposed work.

Keywords: ***Personalization, Recommender systems, M-commerce, Google Analytics.***

المستخلص

ان أعداد مستخدمي التجارة الإلكترونية آخذة في الازدياد يوما بعد يوم ،حيث ان أكبر مواقع التجارة الإلكترونية توفر الملايين من المنتجات للبيع. لذا فان عملية الاختيار من بين العديد

من هذه الخيارات يشكل تحديا للمستهلكين. وقد أدى هذا التوسع السريع إلى ظهور تحديات جديدة لكل من الشركات وكذلك العملاء .

ان التوصية الشخصية هي التكنولوجيا الرئيسية لحل بعض التحديات التي تواجه وتؤثر على أداء نظام التجارة الإلكترونية. ففي هذه الورقة تم اقتراح نظام مخصص شخصي يستند إلى تحليل البيانات من خلال اداة التحليل الخاصة بغوغل لتخصيص موقع التجارة الإلكترونية. لعرض النتائج، تم عمل مقارنة تبين المنتجات الموصاة التي سيتم اقتراحها للمستخدم قبل وبعد تطبيق النظام المقترح.

1. Introduction

The World Wide Web (www) is a popular and collaborative medium to spread information today. The capability to track user's web surfing behavior has made the e-commerce and customers closer than ever before. It is now feasible for e-commerce company to personalize the product message for customers at a big scale which is denoted as Personalization. *Personalization* is an effort of a service provider to offer extra information as recommendations for the customers and in the same time to limit unrelated recommendation results from appear to the customers. This effort can be done by expecting the needs and interests of customers for the sake of generating accurate results. Different personalization systems push somewhat different recommendations according to the web data type they gather and methods they use to analyze and generate recommendations [1]. Typically, most of the current personalization efforts depend on feedbacks of users. Information gathered by such way is known as explicit input. One example, is to ask visitors to rate contents and products based on the degree of interests and needs they have on a particular product. One big challenge with this approach is that, these websites

which do personalization with such approach frequently find themselves having out-of-date information about the visitors. This is reasonable since most users are unwilling to provide feedbacks as expected by website owners [2].

Then Researchers have realized the limitation of the explicit input approach, so they began to look at alternative methods, e.g. using implicit input. Implicit input denotes to the information collected in unnoticeable manner. For example, the time a visitor takes to go through an article, or the browsing behavior and paths of a given visitor. This approach can benefit any personalization system since all interactions done by the user can be used to analyze user's need. Moreover, using the implicit approach can reduce the burden of explicitly giving feedbacks. Personalized contents can be delivered to the users at almost no cost. Therefore, efforts of personalization process are considered valuable added feature which is an important factor for attracting returning visits from users. Such repeated visits are mainly valuable for businesses purpose since it enriches the growth in sales [2].

2. Related Works

A recommendation system is mainly a system that can learn about a user's personal interest based on the user's behaviors and can then deliver the most proper content to meet the user's needs. Recommendation systems have been applied in various industries, and their usefulness has been recognized in recent years [3]. This section reviews some of the research papers related to personalized recommender systems:

(1) In (2013), Aaron V. el al, proposed a method using the latent factor model to recommend and predict the latent factors of music audio where they possible to be gathered from usage data. They compare a traditional method using a bag-of-words representation of the audio signals with deep convolutional neural networks. Also, evaluated the predictions qualitatively. In addition, they showed that using predicted latent factors generates sensible recommendations, in spite of the fact that there is a big semantic gap between the characteristics of a song that affect user preference and the corresponding audio signal [4].

(2) In (2014), Chen et al, proposed a hybrid recommendation system of two-stages specialized in an e-learning application to suggest items in the users' learning journey. These two stages of this application are a- item-based collaborative filtering method for revealing similar item sets, and b- a sequential pattern mining system for filtering items according to a common learning patterns [5].

(3) In (2015), Prajyoti L. et al, this paper focuses on offering a real time dynamic recommendation to all the customers of the website regardless of being registered or unregistered. An action-based rational technique proposed which utilized lexical patterns to produce item recommendation. Results prove that the proposed system return good quality accuracy and reduced limitations of traditional recommendation system [6].

(4) In (2016), ZhengXian L. et al, a hybrid recommendation system proposed for personalized recipe mobile application,

which combines content-based filtering, and collaborative filtering to improve the recipe recommended accuracy. the experiments discloses that the recommendation system has a scalable computational capability [7].

3. Personalized Recommending System

The large e-commerce websites offer millions of products for the visitors, which make it a challenge for the consumers to choose a suitable product. Here recommender systems have come in response to this problem. Personalization recommender system used in e-commerce website gather information from a customer which include products he/she is interested in and then recommends personalized products that are more likely will fit his/her taste or interest. The main function of the recommender system is to help the customer in the search process by pushing personalized recommendations or meta data such as ratings and user reviews in order to make Internet based shopping much easier [8].

Hence, a given recommender system performs several tasks which include:

1. Learning user interests.
2. Storing the information learned from users.
3. Filtering relevant contents based on stored information.
4. Suggesting the filtered information for the user.

Recommender systems are generally used by e-commerce sites for suggesting various products to their customers and also to provide them with information to help them decide which

products to purchase. The products suggested can be chosen based on best sellers on a site, on the locality of the consumer, or on basis of the previous buying pattern of the consumer as a prediction for future buying behavior [2].

4. Knowledge Discover in Databases (KDD)

It refers to data mining. It means the process of extraction the useful and the most relevant information from a specific dataset. This extracted information either implicit or explicit. It is useful improving the effectiveness of e-commerce website by discovering new methods and paths to sell products to customers [9]. Well known associate rules algorithms include: Apriori, Direct Hashing and Pruning (based on Apriori), Tree Projection algorithms, and FP-tree algorithms [10].

4.1 Association Rules

Association rules mining algorithms try to extract rules that can be used to predict the occurrence of an item depending on the existence of other items in a transaction. For example, given the following set, where each transaction is a set of items, the association rule will apply the form {A=>B}, where A and B are two sets of items [11]. Association rules have a good compact representation of preferences data that could improve the performance as well as the efficiency of storage. Similarly, the efficiency of association rule for discovering patterns and managing personalized marketing decisions has also been known [12].

4.2 Apriori algorithm

Apriori algorithm has been used for generating frequent item sets from database as shown in figure (2). The purpose of the algorithm (and all data mining, in general) is to obtain useful information from big amount of data. The algorithm goal is to discover the rules, which will satisfy a threshold of both a minimum support and a minimum confidence (Strong Rules).

5. Web Analytics

Web analytics is the process of measuring, collecting, analyzing and reporting of web data for the aim of understanding and optimization of web usage purpose. Web analytics is not just a process of measuring web traffic only, but it is also can be used as a tool for business and market research, and to assess and improve the efficiency of websites. Web analytics also can help to measure traffic and trends which so important in market researches [13]. Google Analytics is a web analytics tool, which offers Data Collection & Management, Data Analytics & Reporting, Data Consolidation, and Data Activation. The aim of this tool is to analyze, track and measure the traffic of website. Google Analytics is a multipurpose tool, which offers distinctive metrics to monitor how much the user is interacting with a website. General data examples that can be collected from Google Analytics are: user data, traffic sources, session data, device used to access a website, platform, page tracking, site speed, app tracking, social interactions, event tracking, and many more [14].

6. Proposed System

In this paper, we have implemented a personalized recommender system to be used to personalize the proposed ecommerce website by implementing Apriori Algorithm for discovering similar frequent sets. This proposed system will suggest a list of products for the customers when they visiting the website. The suggested products list is different for each individual customer depending on the purchase history of a customer. Apriori is applied on the data analytics which provided by Google analytics service (GA).These data are collected from the e-commerce website via GA code embedded in the website when the customers navigating it as explained in figure(4).

These data include transactions data and are collected from the e-commerce website via GA code embedded in the website when the customers do some actions such as purchasing a product or browsing a product's details. GA collects data including purchased products, time of purchased, country, device type, operating system and many others. Therefore, when a customer visits the website, an Ajax HTTP requests the GA data specifically the transaction table (which contains all purchased history of other customers) and the specific customer's purchases history as well. Then Apriori will applied on the returned GA data to generate frequent item sets as shown in figure (1).

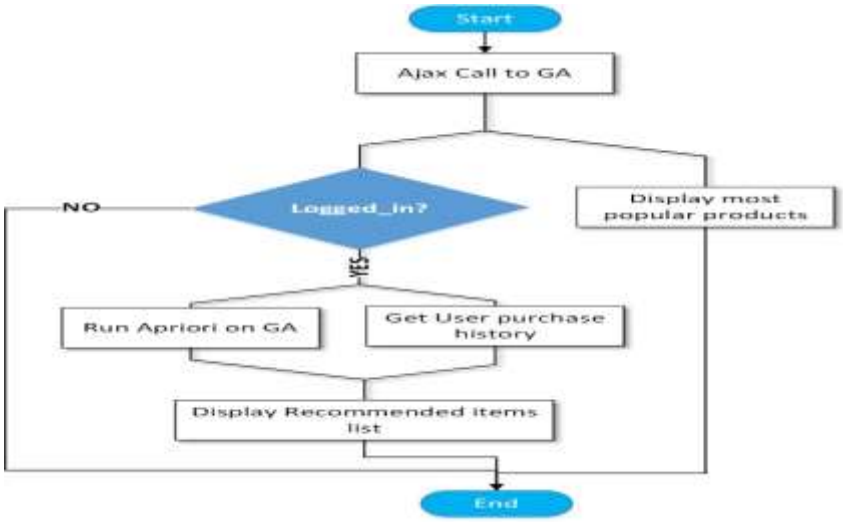

Figure (1): proposed system flow

The result of applying Apriori, will be stored in "*Recommendation Table*", this table includes several columns: (items, recommended, and confidence). When a customer buys an item, the system will look up and match these items in "purchases table" in the "Recommendation Table". If match, then it will display the recommended items to this customer as shown in figure (2).

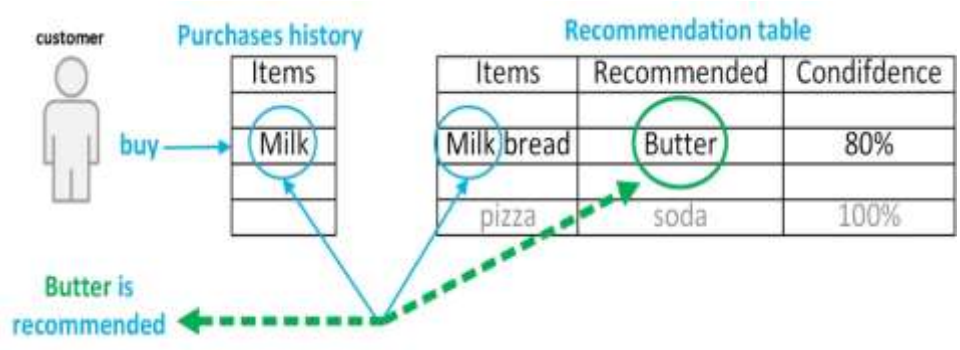

Figure (2): Recommending Example

If the customer buys "Milk" for example, the system will search the "Recommendation table" for "Milk". If found it will display the "Recommended" column value to the customer as a suggested

item. In this case "Butter" will be suggested as recommendation since people who purchased "Milk" always had purchased "Butter", in other word, the confidence of existing rule {"Milk" => "Butter"} is strong enough.

7. Results Evaluation

The system generates recommendation items depending on Apriori Algorithm, which takes the Transaction table as an input. This Transaction table includes all items that have been purchased by other customers. Results of Apriori will be saved in a recommendation table. Proposed system will try to locate or match the customers' purchased items with the items in the recommendation table, if there is a match, the system will suggest items for those customers depending on the match results. The suggested items differently personalized for each individual customer.

To illustrate the process, we suppose the following scenario: a customer buys an "iPhone7" item, proposed system will recommend "charger" item for this customer. The reason behind suggesting "Charger" item is that in Transaction table most people who have purchased "iPhone7" also have purchased "charger" together, in other meaning, the confidence of existing *{"iPhone"} => {"charger"}* is accepted confidence value. To show the result, a comparison (before and after) is used to compare results between the items that are displayed when a user buys an

"iPhone" before and after applying the proposed work, as in figure (3).

In (A), random products and unrelated to "iPhone" are shown to

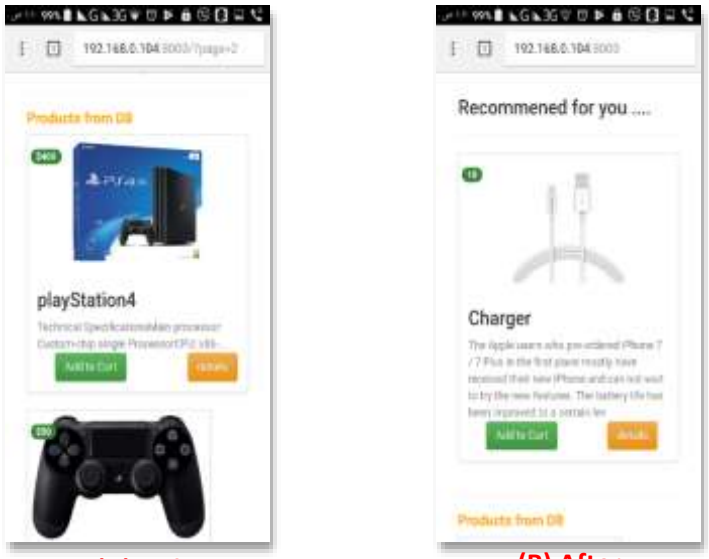

Figure (3): Items list comparison

the users, while in (B) after applying the proposed work, the system suggests a "Charger" item, which is related recommended products to the user who buys "iPhone".

8. Conclusions

In this paper, we have proposed a personalized recommender system for personalizing m-commerce website depending on data that is provided by the integrated Google Analytics service. Integrating Google Analytics in ecommerce will provide us lot of features used to track, analyze and measure the traffic of the business workflow. Google Analytics is a promising multipurpose tool uses to monitor how much and how the customers are interacting in the website that allows us to personalize the website to fit customers' interests.

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