Exploring the Influence of Contexts for Mobile Recommendation

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ABSTRACT

With the rapid development of mobile internet, it is difficult to obtain high-quality recommendation in such a complicated mobile environment, just depending on traditional user-item binary information. How to use multiple contexts to generate satisfying recommendation has been a hot topic in some fields like e-commerce, tourism and news. Context aware recommender system (CARS) imports contexts into recommender to generate ubiquitous and personalized recommendation. In this paper, the basic information of CARS, such as the definition of context, the process of CARS and evaluation are introduced carefully. In order to explore whether contexts have a great influence on recommendation or not, the authors conduct experiments on real datasets. Experimental results show recommender that incorporates contexts significantly improves performance over the traditional recommender. Finally, State of the art about CARS is detailed.

KEYWORDS

Context Aware Recommender System, Context Model, Mobile Environment, Personalized Recommender, Social Network

INTRODUCTION

With the development of mobile internet and devices, a large number of services are released on the mobile network. These services are no longer limited to traditional web services, but cover all aspects of life, such as taking a taxi, shopping and tourism. However, when it brings us convenience, it also gives us great burden of information, namely, mobile information overload (Meng, Hu, Wang, & Zhang, 2013; Meng, Wang, Shi, & Zhang, 2014; Ricci, Rokach, Shapira, & Kantor, 2011; Wang, Meng, & Zhang, 2012; Zeng, Li, Li, Wen, & Wu, 2016). As one of the effective ways to relieve information overload, recommender system (RS) has attracted wide attention in academia and industry. Because the mobile environment is dynamic and changing, it is unreasonable that traditional recommendation methods are directly utilized into mobile recommendation. Therefore, more and more researchers focus on mobile RS (Wang, Meng, & Zhang, 2011; Liu & Meng, 2014, 2015). Compared with traditional RS, mobile RS must be ubiquitous and personalized (Meng et al., 2013).

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Many research institutes have developed context aware recommender system (CARS) for a long term, such as Beijing University of Post and Telecommunications, University of Science and Technology of China, Microsoft Research Asia and Nanyang Technological University. Lots of works about CARS are published. For example, some researches about emotions, personality and deep learning have been utilized for CARS (Gao, Tang, Hu, & Liu, 2015; Gao, Gao, Yang, & Wang, 2015; Oord, Den, Dieleman, & Schrauwen, 2013; Elkahk, Song, & He, 2015). Liu et al. (2013) provided a survey about the notion, approaches modeling contexts, applications and key issues of CARS. This work focused on collecting mobile context and model them via some technologies, like clustering, classification and low-rank factorization. Considering data sparsity, cold start, and scalability and other challenges, Assad, Zhang, & Khan (2015) elaborate the CARS around each of the Computational Intelligence (CI) techniques, such as fuzzy sets, evolutionary computing and swarm intelligence. The survey highlighted the ability of each of the CI techniques to deal with the aforesaid challenges. However, these works always indulge in empty talk with a nominal emphasis on the theory. In this paper, the authors systematically study the CARS. The most notable is, a case study is carried out on real datasets to vividly show how contexts improve recommendation. Furthermore, state-of-the-art introduction is detailed.

The rest of this paper is organized as follows. First, basic RS in mobile environment is introduced. Then, the authors summarize the general notion, including the definition, classification, process and the evaluation for mobile CARS. Furthermore, some practical applications of CARS are shown. Meanwhile, a case study on mobile recommendation is showed. Finally, the developments and challenges of CARS are analyzed deeply.

MOBILE RECOMMENDER SYSTEM

At present, mobile devices are widely used in people’ daily life. It has been able to replace traditional PC devices in some respects, which mainly reflects in two aspects: the continuous development of basic functions and the utilization of multi resources.

Compared with traditional desktop environment, mobile environment is more complex. On the one hand, rich components collect multi-source data that can’t be easily acquired in PC machine. For example, mobile device can easily get users’ environment information in real-time, such as location, brightness and temperature, via multiple sensors, like GPS, light sensor and temperature sensor (Baldauf, Dustdar, & Rosenberg, 2007). Vital signs even can be available by some specific sensors. On the other hand, mobile devices have small screen, fragile wireless network and inadequate computational ability. It is not good at large scale data processing and stable performance.

CARS in mobile environment is developing continuously on the basis of the traditional RS, mobile devices and the usage of contexts (Meng et al., 2013). Generating better recommendation in mobile environment has great prospect and values.

CONTEXT AWARE RECOMMENDER SYSTEM IN MOBILE ENVIRONMENT

Context Information

The Definition of Context

Users’ behaviors always occur in a particular scenario containing a series of contexts. These contexts describe users’ current status, such as surrounding, companion and position. Dividing scenarios into different context sequences is helpful for analyzing the influence of different contexts for user decision making.

At present, the definition of context is still not clear and absolute. Some researchers referred to context as locations, identities of nearby people and items and their changes (Dey, 2005). The most widely used definition is the one Dey (2005) gave, “Context is any information that can be used to
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