Chapter 5

Contextual and Personalized Mobile Recommendation Systems

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ABSTRACT

Mobile devices are becoming ubiquitous. People are getting used to using their phones as a personal concierge to discover what is around and decide what to do. Mobile recommendation therefore becomes important to understand user intent and simplify task completion on the go. Since user intents essentially vary with users and sensor contexts (time and geo-location, for example), mobile recommendation needs to be both contextual and personalized. While rich user mobile data is available, such as mobile query, click-through, and check-in record, there exist two challenges in utilizing them to design a contextual and personalized mobile recommendation system: exploring characteristics from large-scale and heterogeneous mobile data and employing the uncovered characteristics for recommendation. In this chapter, the authors talk about two mobile recommendation techniques that well address the two challenges. (1) One exploits mobile query data for local business recommendation, and (2) one exploits mobile check-in record to assist activity planning.

INTRODUCTION

Mobile devices are becoming ubiquitous these days, which revolutionizes the way people surf information and make decisions. While on the go, people are using their phones as a personal concierge discovering what is around and deciding what to do. Therefore, mobile device has become a recommendation terminal, making it important to understand user intent to simplify task completion on the go.
However, understanding user intent on the go is not trivial. On one hand, user intent is implicit and complicated – sometimes user does not have a very explicit intent in mind, but just wants some suggestions. In this case, user modeling is needed by analyzing user history activities and summarizing their behavior patterns. On the other hand, user intent changes with users and sensor contexts (time and geo-location, for example). It is easy to understand that mobile recommendation should be customized to individuals to meet the personalized requirements. More importantly, user intent is not static but sensitive to contexts – users have different information needs under different circumstances. Therefore, mobile recommendation needs to be both contextual and personalized.

The widespread use of mobile devices has offered opportunity to gain insights on user mobile activity and behavior patterns. Rich mobile data is available, including cellular data (Gonzalez, Hidalgo, & Barabasi, 2008), mobile query log (Zhuang, et al., 2011), click-through history (Nicholas, et al., 2010), check-in record (Anastasios, et al., 2011), etc. There involved two challenges in understanding the complicated user intent to provide contextual and personalized recommendation services. (1) How to explore meaningful characteristics of user behavior patterns from the large-scale, noisy and heterogeneous mobile data, and (2) How to employ the discovered characteristic to perform efficient recommendation customized to contextual and personalized information needs.

In this chapter, we will introduce two mobile recommendation techniques that well address the prior two challenges: one exploits mobile query data for local business recommendation and one exploits mobile check-in record to assist activity planning.

1. **Mobile Query Log-Oriented Local Business Recommendation:** From data analysis on a large-scale real-world mobile query database, we found that much query is related to local business and mobile search is usually personalized and context-aware. The observations motivate a contextual and personalized POI (Point of Interest, i.e., local business) recommendation approach, which consists of three key components: (1) POI crawler which collects POIs with attributes (e.g., cuisine for restaurant) from the Web, (2) POI extraction which detects and recognizes POIs from a query or click-through, and (3) POI ranking which ranks the POIs in a context-sensitive and personalized way without requiring any input. Specifically, a probabilistic entity ranking algorithm is proposed to model the generating probability of a POI by the user conditioned on the mobile context.

2. **Check-in Record-Oriented Activity Planning Assistant:** User activity usually consists of a series of actions, where each action can be referred to one POI. Compared with recommending single POI, when user planning activities, it is more desired to recommend a series of consecutive POIs. In the second work, we move one step beyond to address the problem of serial POI recommendation for activity planning assistant. The rise of online social networks has provided a useful mobile data source - check-in record, where location data, user activity and relationships are available. Based on the analysis of a real-world check-in database, we found significant POI category transition characteristic in consecutive check-in actions. The proposed approach estimates the transition probability from one POI to another, conditioned on current context and check-in history in a Markov chain. To alleviate the context discritization error and sparsity problem, context collaboration and prior information are integrated into the probabilistic formulation.
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