Chapter 5
Experiences from Integrating Collaborative Filtering in a Mobile City Guide

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ABSTRACT
This chapter presents an approach to extend a real world mobile tourist guide running on personal digital assistants (PDAs) with collaborative filtering. The system builds a model of item similarities based on explicit and implicit ratings. This model is then utilized to generate recommendations in several ways. The approach integrates the current user location as context. Experiences gained in two field studies are reported. In the first one, 30 participants – real tourists visiting Prague – used the recommender function and were asked to fill out a questionnaire with promising results. In a second field study analyzing usage log files, an improvement of recommendations based on the collaborative filter in comparison to the pure location-based filter used before was discovered. In addition, recommendations based on implicit ratings derived from audio playback duration outperformed the model based on explicit ratings.

INTRODUCTION
Mobile devices such as smartphones and Personal Digital Assistants (PDAs) are becoming more and more powerful and are increasingly used for tasks other than just making phone calls. Examples include mobile Web browsing, Gaming, Personal Information Management (PIM) and audio and video playback. Tourism and travel are prime application areas for mobile applications. An increasing number of services is offered to support a traveler not only before and after the travel, but also while sightseeing (Ricci, 2010). The development of technologies such as Global
Positioning System (GPS) positioning and ubiquitous availability of wireless communication services has fostered this development.

However, mobile information access still suffers from limited resources regarding input capabilities, displays, network bandwidth and other limitations of small mobile devices. In addition, mobile applications must consider mobile user constraints such as limited attention span while moving, changing locations and contexts, and expectations of quick and easy interactions (Subramanya & Yi, 2007). Furthermore, as the amount of information and online services increases, it becomes more and more difficult for users to find the right information needed to complete a particular task (Ricci, 2010). Therefore, it is desirable to tailor information access to the current user needs (Brusilovsky, Kobsa, & Nejdl, 2007).

Recommender systems are a well-established technique to counter this problem of information overload (Borchers, Herlocker, Konstan, & Riedl, 1998; Kantor, Ricci, Rokach, & Shapira, 2010; Jannach, Zanker, Felfernig, & Friedrich, 2010). These systems suggest items like products, restaurants or other Points-Of-Interests (POIs) based on explicit user ratings or implicitly observed user behavior. In a mobile setting, good and precise recommendations are even more important because of the explained intrinsic obstacles of mobile usage environments. Moreover, the context such as the current user position plays a major role in mobile recommendations.

The considered scenario is a real world mobile city guide running on PDAs with GPS positioning capabilities. The guide is currently available for the Czech city of Prague (http://www.voxcity.de). The mobile application plays audio, video, pictures and (HTML) text of tourist attractions based on the current position. This mobile guide has been extended with a collaborative filtering recommender system based on user ratings. The solution exchanges ratings for POIs among PDAs, computes matrices of item similarity and utilizes them to generate recommendations. The basic idea for taking the current user position into account is to use a weighted combination of the collaborative filtering score with a location score function.

In this chapter, the design and implementation issues to put this mobile recommender system into practice is outlined. In addition, experiences gained in two user studies are presented. The first aimed at the usability of the city guide and the potential benefits of the recommender system from a user perspective. The second field study was performed to investigate the recommendation quality of the approach in more detail.

The rest of the chapter is organized as follows. The next section describes the existing real world mobile city guide and also specifies requirements. Afterwards, fundamentals of recommender systems including the used item-based collaborative filtering algorithm, and properties of context-aware and mobile recommendation are explained. Related work including relevant surveys and systems is then covered. This is followed by a discussion of the system design for the integration of a collaborative recommender in the city guide. The next sections present the findings from the two user studies. Then, some related application areas for context-aware recommender systems in mobile scenarios are explained. Finally, the chapter concludes with a brief summary and outlook on future work.

THE MOBILE CITY GUIDE: BACKGROUND AND REQUIREMENTS FOR EXTENSION

The Existing Mobile City Guide (MCG)

The Mobile City Guide (MCG) was developed by the companies voxcity s.r.o. and jomedia s.r.o. (http://www.voxcity.de). The concept is to rent out mobile devices with GPS positioning capabilities to support tourists (Figure 1). The system runs on Microsoft Windows Mobile devices, version