Chapter 2

Automatic Personalization in E–Learning Based on Recommendation Systems: An Overview

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ABSTRACT

Web based learning environments are being increasingly used at a large scale in the education area. This situation has brought a dramatic growth in the amount of educational resources and services incorporated continuously in these systems, and related access and usage of this educational content by a diversity of learners. However, the delivery of this educational content is generally done in the same way for all learners without giving any special attention to the different consumption styles or differences between their profiles and individual needs. Therefore, providing personalization in e-learning systems has to be considered as a necessity and not an option. Recommending suitable links represents an instance of adaptive navigation support technology. E-learning recommender systems are used to locate relevant educational Web objects that better match the learner’s profile and interests, this requires the ability of a system to predict learner’s needs and preferences. Therefore, recommendation systems need to use Web mining techniques in one or more phases of the recommendation process, especially in the modelling and pattern discovery phase. Most emergent recommendation systems in e-learning tend to rely on automated detection of student’s preferences and needs since it is more efficient and attractive to provide needed support to students without requesting any explicit information from them. In this chapter, we present an overview of personalization in e-learning based on recommendation systems and Web mining techniques.

DOI: 10.4018/978-1-60960-842-2.ch002
INTRODUCTION

Recent years have witnessed an increasing interest in the benefits of personalization in the e-learning domain. Several works have addressed the need for personalization in e-learning. However, most of the current e-learning platforms used at a “massive” scale are still delivering the same educational resources in the same way to learners with different profiles. Besides, most of adaptive systems have relied on explicit information given by a learner in one or more phases of the personalization process (application form, questionnaire, etc.) and have applied known methods and techniques of adapting the presentation and navigation, as in the case of adaptive educational hypermedia systems (Farzan, 2006).

Adaptive systems based on the use of automatic personalization aim to provide users with suitable items without asking them explicitly for them (Mulvenna, 2000). Making automatic personalization in the Web area refers basically to the recommendation of content (hyperlinks, text, items, products, etc.) deemed to be suitable for the user’s needs and interests.

More recently, the interest in applying Web mining techniques in e-learning personalization has increased. For instance, e-learning recommender systems apply web mining techniques, mainly, in the modeling and pattern discovery phase in order to suggest the appropriate content or optimal browsing pathways to a learner, based on his/her preferences, knowledge, and browsing history as well as the history of other learners with similar characteristics. The data mining techniques that have been used so far include classification, clustering, prediction, association rule mining, and sequential pattern mining.

In this chapter, we present an overview of automatic personalization techniques in e-learning systems that are based on recommendation engines. We provide firstly a brief review of the concept of personalization and recommendation systems. Furthermore, we discuss automatic personalization in e-learning systems based on web mining techniques. Lastly, we focus on e-learning recommender systems and describe several existing examples of these systems in the literature.

AUTOMATIC PERSONALIZATION

Three main approaches have been used in automatic personalization, namely content-based filtering, collaborative filtering, and rule-based filtering techniques. These different techniques are distinguished by the type of input data collected to build user profiles, by the strategies used to build these profiles, and by the method used to make predictions or generally to provide personalized content.

Sources of the Collected data include (Eirinaki et al., 2003):

- Content data referring to all web objects (pages, items, text, images, etc.)
- Structure data which concerns hyperlinks connecting web pages to each other
- Usage data representing users’ log history as a set of records containing web pages visits, time of visit and many other attributes. Such data can be collected from web server logs, cookies, system logs, several session tracking tools, etc.
- User profile data which consists of a set of attributes describing a user such as demographic information and preferences. This information can be collected either explicitly (via questionnaires, forms, etc.) or implicitly (web server logs and system logs).

It is worth noting here that learning from collected data can be done online (Memory based learning) while the system is accomplishing the personalization task or offline before the personalization phase (Model based learning). Memory based systems tend to simply store all data and later utilize it at the time of providing recommen-