Chapter VI
Ontology-Based User Competencies Modeling for E-Learning Recommender Systems

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ABSTRACT

Inside the e-learning platforms, it is important to manage the user competencies profile and to recommend to each user the most suitable documents and persons, according to his or her acquired knowledge, to their long-term interests, but also according to his very current goals. The authors of this chapter explore a Semantic Web-based modeling approach for the document annotations and user competencies profile development, based on the same domain ontology set. The ontologies constitute the binder between the materials and users. For the user profile development and for the personalized recommendations facilities, the authors’ solution propose a hybrid recommender approach: first the user navigation inside the ontology is monitored (instead of user navigation inside the e-learning platform) and the next concept of interest is recommended through a collaborative filtering method; then a content-based recommendation of documents is provided to the user, according the selected concept and his competencies profile. In both phases, a variant of the nearest neighbor algorithm is applied.
INTRODUCTION

An E-learning platform is a real source of knowledge due to the available materials, but also to its users competencies. The demands for personalization are very important in this context. There are two main application types which provide personalization: Hypermedia Adaptive Systems and Recommender Systems. Each of them make use or develop personalization techniques which are specific to the World Wide Web space, but also there is a beginning in adopting the semantic Web specific techniques.

The Adaptive Systems and Recommender Systems are focused in exploring a certain hypermedia structure in order to help user finding the best way for their interests, while the Recommender Systems are focused on a network of Web resources, bind by existing or virtual relations, aiming to provide users with individual views on Web data (Baldoni et al., 2005). For acquiring this, Web Mining techniques are applied, both over the Web usage and Web content.

In this paper we explore the user modeling and user model development for recommender systems by using Web semantic techniques, especially the ontology-related ones. Our purpose is to develop a competence-oriented user model which to accompany the corresponding person in various on-line communities, with a focus on e-learning systems. We will consider the case in which the competencies are expressed through ontological constructs. On the strength of this model the recommendations will be made. A further service-oriented solution could enable the migration of the recommender module from a system to another.

Unlike the e-commerce or on-line news sites, where the content-based recommendations explore especially the user navigational activity, an e-learning platform could exploit its specific supplementary information available about users, namely the users knowledge and their long-term interests, beside their current goals illustrated by the navigational activity. We structured this information into a three-layered user competence profile, which constitutes a complex framework for providing recommendations to the user, especially when the profile as well as the documents annotations have an ontology-based model.

The particularity of our approach consists in considering the user conceptual navigation into ontology instead of the site navigation for providing him with recommendations. For monitoring the conceptual navigation and selecting the next focused concept into the ontology, a collaborative filtering approach is used, based on the nearest neighbors algorithm. In order to effectively recommend documents corresponding to the selected concept, a content-based recommendation is accomplished, considering the user competencies profile, and also applying a nearest neighbor algorithm. The advantage of our ontology-oriented approach consists in the possibility of migrating the user profile from a system to another, and also in the platform-independent character of the recommendation system itself.

Our paper explores various existing approaches for ontology-based document and user models, presenting the proposed models based on the e-learning specific standards. Then, the existing ontology-based recommendation techniques are presented, followed by our hybrid recommendation approach which combines a collaborative filtering technique and a content-based method. The conclusions are then exposed together with further work directions.

USING DOMAIN ONTOLOGIES FOR USER MODELING AND CONTENT ANNOTATION

The Current Modeling Approaches

The idea of managing competencies through one or more ontologies was explored by multiple ontology-driven applications.
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