

Chapter 4

An Ontology Network for Educational Recommender Systems

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ABSTRACT

This chapter presents how an ontology network can be used to explicitly specify the relevant features of Semantic Educational Recommender Systems. This ontology network conceptualizes the different domains and features involved in these kind of systems in a set of interrelated ontologies. Basically, this chapter presents a detailed study of the semantic relationships that exist among the ontologies in the network considering learners and educators goals and taking also into account relevance feedback by users. One important contribution of this work is to show how the ontology-based reasoning mechanism can be used to validate the recommendation criteria and to assure flexibility for tailoring the educational resource adequacy features (called Educational Resource Quality).

INTRODUCTION

The large number of educational material currently available through the Web requires the presence of Educational Recommender Systems which not

only reflect the most appropriate educational resource provision for a student, taking into account their preferences and personal characteristics, but also considering the educator point of view. The resource and student properties are generally modeled by corresponding ontologies. Nowadays, autonomously developed ontologies emerge quite

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naturally in different domains (health, tourism, learning, quality of services, etc.). These ontologies, each one built for different purposes, are used together in complex applications. However, how they are combined is usually hidden in the application code. Particularly, the modeling of educational recommender systems involves the combination of many features: specific educational domain, quality assurance domain, and user context domain, among others. Therefore, when specifying an educational recommendation system, the proper interrelationship of all these features must be ensured. In this sense, this chapter focuses on showing how the different ontologies involved in an educational recommender system can be modeled as an ontology network in order to explicitly specify the recommendation system. One of the main contributions of this chapter is the specification of an ontology-network and the use of ontology reasoning mechanisms on that network to validate the recommendation criteria.

The remainder of the chapter is organized as follows. The next section describes background notions on semantic recommendation systems, ontology networks and ontology validations. In the following section, the desired aspects of a recommender system within the educational environment are discussed. After that, details about educational resource quality, user goals and relevance feedback are given. These aspects help to identify the component ontologies of the framework. Then, it is described the role of the ontology-network within a Semantic Educational Recommender System. Finally, some future research directions and conclusions are discussed.

BACKGROUND

This section presents background material on semantic recommender systems, ontology-networks and ontology validation.

Semantic Recommendation Systems Background

Previous works on semantic recommendation systems, specially tailored for the e-commerce and digital libraries area, use ontologies to determine semantically similar items following the widely known content-based recommendation technique. Porcel, Moreno and Herrera-Viedma (2010) present four different classes of recommendation techniques: (1) *content-based systems*, based on the terms used about resources (2) *collaborative systems* that consider the user preferences, (3) *Demographic systems* that represent the different user profiles and (4) *knowledge-based systems*, based on inferences about resources that satisfy the users. These authors proposed a hybrid approach that combines content-based and collaborative techniques. Recently, in (Bellogín, Cantador, Castells, & Ortigosa, 2010), the construction of a recommender system is presented, which is described as an iterative process where at each iteration a model representing the preferential characteristics for the recommendation is obtained. That system is an ontology-based recommendation process that produces semantic recommendations by applying content-based, context-aware and collaborative criteria.

Even though the idea of semantic recommender systems for the e-learning domain has been employed for around a decade, there are only few approaches that use the full reasoning capabilities of the ontology model. It is common that for semantic educational recommender systems the ontology is used for the point of view of a vocabulary-based recommender system, to specify semantic content either for the educational resources and for the learner profile, model hierarchical classification of items or to enhance semantic descriptions. Some works in this direction are those from Yu, Nakamura, Jang, Kajita, and Mase (2007), Oufaida & Nouali (2009) and Zhuhadar, Nasraoui, Wyatt & Romero (2009).

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