Chapter IV

Semantic Web Technologies in the Service of Personalization Tools

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ABSTRACT

The so-called recommender systems have become assistance tools indispensable to the users in domains where the information overload hampers manual search processes. In literature, diverse personalization paradigms have been proposed to match automatically the preferences of each user (which are previously modelled in personal profiles) against the available items. All these paradigms are laid down on a common substratum that uses syntactic matching techniques, which greatly limit the quality of the offered recommendations due to their inflexible nature. To fight these limitations, this chapter explores a novel approach based on reasoning about the semantics of both the users’ preferences and considered items, by resorting to less rigid inference mechanisms borrowed from the Semantic Web.
INTRODUCTION

Recommender systems arose around middle of nineties with the aim of facing the excessive overload of information to which users are exposed in numerous domains of application. Fulfilling the personalization requirements of this kind of systems requires to incorporate three crucial components into its architecture: firstly, a domain-dependant database which stores the available items (e.g. audiovisual contents in Digital TV, commercial products in e-commerce, and educational courses in e-leaning); secondly, profiles where the users’ preferences are modeled; lastly, recommendation strategies to select automatically the suggestions that best match the likings of each user. In this regard, content-based filtering and collaborative filtering are two of the personalization paradigms most widely used in literature (Adomavicius, 2005; Montaner, 2003). Broadly speaking, a content-based filtering approach recommends items similar to those the user liked in the past, whereas the collaborative approaches select items for a given user that individuals with similar likings also appreciated. Both techniques have a common drawback, due to the fact that the selection of the recommendations is based on purely syntactic mechanisms, which dismiss much knowledge about the users’ preferences due to their rigid and inflexible nature.

To overcome such limitations, this chapter explores a theoretical approach based on exploiting the semantics of the application domain of each recommender system, by harnessing the experience gained in the field of Semantic Web. Specifically, our approach takes advantage of several features elemental in the philosophy of this initiative. Firstly, the provision of annotations (metadata) makes it possible to process the meaning of information, thus enabling interoperability among machines and automation of tasks which could be tedious for users (e.g. personalization processes). Secondly, the use of reasoning processes allow to relate the annotated resources to each other by exploring the knowledge hidden behind their semantics. Specifically, this chapter describes the use of two of these semantic reasoning mechanisms in the field of personalization:

- On the one hand, our approach infers complex semantic associations (Anyanwu, 2004) between the items available in the recommender system, which are previously formalized in a domain ontology along with their semantic annotations. We emphasize the use of the semantic associations as reasoning techniques to discover much hidden knowledge about the likings of the users, by exploring the hierarchical relationship and properties formalized in the ontology.
- Besides, we also resort to the so-called Spreading Activation techniques (Crestani, 1997), which are computational mechanisms able to: (i) explore efficiently huge generic networks with interconnected nodes (just like the domain ontology), (ii) process the semantic associations inferred from this kind of conceptualization, and (iii) discover concepts (items) strongly related to the users’ interests. This new knowledge permits to compare in a more flexible way the user’s preferences with the available items, thus leading to more accurate recommendations.

Although the mentioned reasoning mechanisms have been widely adopted in the context of the Semantic Web, their internals must be adapted to deal with the personalization requirements of a recommender system. For that reason, the chapter explores how to extend the existing inference techniques so as to enable: (i) to learn automatically new knowledge about the users’ preferences from the feedback provided after recommendations, (ii) to incorporate this knowledge into the subsequent inferential processes, and (iii) to adapt dynamically the reasoning-based recommendations as the users’ preferences evolve over time.