Chapter 14

Ontology-Based Database Approach for Handling Preferences

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ABSTRACT

Information systems now manage huge amount of data. Users are overwhelmed by the numerous results provided in response to their requests. These results must often be sorted and filtered in order to be usable. Moreover, the “one size fits all” approach has shown its limitation for information searching in many applications, particularly in the e-commerce domain. The capture and exploitation of user preferences have been proposed as a solution to overcome this problem. However, the existing approaches usually define preferences for a particular application. Thus, it is difficult to share and reuse the handled preferences in other contexts. In this chapter, we propose a sharable, formal and generic model to represent user’s preferences. The model gathers several preferences models proposed in the Database and Semantic Web communities. The novelty of our approach is that the defined preferences are attached to the ontologies which describe the semantic of the data manipulated by the applications. Moreover, the proposed model offers a persistence mechanism and a dedicated language; it is implemented using Ontology-Based Databases (OBDB) system extended in order to take into account preferences. OBDB manage both ontologies and the data instances. The preference model is formally defined using the EXPRESS data modelling language which ensures us a free ambiguity definition and the approach is illustrated through a case study in the tourism domain.

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INTRODUCTION

The rapid growth and the wide adoption of internet technology make available a huge amount of data managed by various information systems. When searching over these disseminated data, users are often submerged by the numerous returned results in response to their requests. These results must often be sorted and filtered in order to identify the relevant information. Despite the fact that the “one size fits all” approach has shown its limitation in many applications particularly in the e-commerce domain, our targeted application domain, most information systems do not take into account the variety of users’ need and preferences.

Capturing and exploiting user’s preferences have been proposed as a solution to this problem in many domains including database systems (Kießling and Kostler, 2000; Kießling, 2002; Chomicki, 2003; Agrawal and Wimmers, 2000; Koutrika and Ioannidis, 2004; Viappiani et al., 2006; Das et al., 2006), Data Warehouse (Belletreche et al., 2005), the Semantic Web (Siberski et al., 2006; Gurský et al., 2008; Toninelli et al., 2008), Information Retrieval (Daoud et al., 2007) and Human Computer Interaction (Cherniack et al., 2003). Although preferences are defined using an ontology in some approaches, most of the previously cited work, and particularly in the Database domain, the preferences and their model are defined according to the logical model underlying the targeted system. The use of the preferences requires having knowledge of this logical model.

Preferences express the sense of wishes and preference based search is a popular approach for helping consumers to find relevant items. Users would like to find the best matches between their wishes and the reality. Modelling preferences is difficult because human preferences are complex, multiple, heterogeneous, changing, and even contradictory. Moreover, they are complex to evaluate and according to the user’s goals and his/her current task, they should be evaluated in the context they have been expressed.

Within most existing information systems, even if the notion of preference has been integrated in various application domains, it is not explicitly modelled. They are often hard encoded and disseminated throughout the applications that exploit these information systems. Therefore, they can not be shared and must be defined and updated for each application. This is a burden for users and yields to another layer of heterogeneous modelling.

To overcome these drawbacks, we propose an ontology based approach of preference model which relies on an ontology based database system (OBDB), namely OntoDB (Dehainsala et al., 2007; Pierra et al., 2005). The proposed model is formally described using the EXPRESS modelling language and the approach takes benefits from the OntoDB system which offers a flexible mechanism for storing together an ontology, its model and its instances. Nowadays, ontologies are well accepted as formal knowledge organisation systems which describe the explicit semantics of entities manipulated in a given domain (Gruber, 2003). Domain ontologies are used to provide definitions and specifications of these manipulated entities. These entities are defined following the ontology model.

Our contribution in this article is twofold. Firstly, we propose a shared and generic model to represent user preferences. Then, we describe how preferences model can be attached to an ontology and manipulated on the meta-model level. The sharable preferences model has been formally defined using the EXPRESS modelling language in order to make its definition ambiguity free. Indeed, EXPRESS is equipped with a powerful constraints language allowing defining precisely the semantics of the defined model.

The rest of the chapter is subdivided as follows. The next section gives an overview of the preferences handling in the database, Semantic Web and Data Warehouse areas. In addition, to make the chapter self-explanatory, we give an overview of the different ODBD existing approaches and we