Novel Approaches
to Acquisition and Maintenance of User Model

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1. INTRODUCTION

User model represent the basis for any personalization, which becomes important for effective information accessing by means of adaptive web-based applications. The user model in adaptive web-based applications consists of identifying user's characteristics that are used for personalization of *layout*, *navigation* or *content*. The more characteristics about the user are available, the more accurate personalization can be provided. However, there is one more aspect which should be considered – user characteristics' *currency*. The user changes (e.g., gains new knowledge or gets more experienced) over time, therefore, the user model must always reflect these changes to maintain effectiveness in enhancing the personalization. However, there is not enough attention paid to acquisition and maintenance of user characteristics, since the way the characteristics are changed in the user model is usually not directly visible on the application's presentation layer. We have proposed novel approaches to automatic acquisition (i.e., the user model is populated with new characteristics) and maintenance (i.e., existing characteristics are kept up to date) of the user characteristics that employ semantics provided by ontological representation.

2. ACQUISITION AND MAINTENANCE OF USER MODEL

There are methods that use explicit or implicit approaches, or their combination to acquire user characteristics and keep them up to date. We propose three novel methods for acquisition and maintenance of user characteristics in the user model.

The first *method is based on generating questions* in the natural language (here English) to be used for acquisition and/or maintenance of the user model. Particular questions are generated automatically according to the attributes of information concepts that are the subject of the specific application domain and afterwards answers are transformed into

characteristics in the user model. The entire process of asking questions (i.e., *when* and *what* question needs to be generated) is driven by user defined rules and can be further restricted by question's priority.

The second *method is based on the content analysis* and assumes that comparing attributes of documents, which were found interesting for a user, can be a source for discovering information about user's interests. The method compares instances of ontological concepts. It is based on the recursive traversing of an instance's structure. The final similarity is the aggregate result of the individual similarities computed for particular properties while their type is considered to select a suitable similarity metric for each property. The introduction of similarity metrics for properties allows us to take advantage of semantics provided by ontological representation, which allowed us to extend similarity with personalized weights reflecting users' individuality. Moreover, we impute reasons that might have caused user's interest in the content.

The third and last *method is based on spreading activation*. If there are connections between information concepts of the domain model (e.g., learning objects in an educational application), user's characteristics can be utilized even for concepts that have not been visited yet. In such a way, more accurate and responsive information retrieval capabilities for the user become available. The educational domain provides us with better defined relationships among learning objects and their fragments for spreading activation. However, it does not restrict applying the method only for educational domains.

3. CONCLUSIONS

We briefly presented a contribution to the current state of the art in the user modeling area, namely we focused on creation and maintenance of the user model. The main contribution of this work is a proposal of three novel methods to automatic acquisition and maintenance of user characteristics that employ semantics provided by ontological representation. Another contribution of this work is its aim at the methods for acquisition and maintenance of user characteristics. Currently, there is less attention paid to the user model adaptation (in comparison to adaptive navigation or presentation) in the adaptive hypermedia field. One of the reasons is that changes of the user model are rather considered as a support for the personalization and are not directly visible on presentation layer.

The methods were evaluated by software tools that were incorporated in research projects aimed at job offers (`nazou.fiit.stuba.sk`), digital libraries (`mapekus.fiit.stuba.sk`) and learning programming domains (`pewepro.fiit.stuba.sk`) that have been conducted successfully at the Institute of Informatics and Software Engineering, Slovak University of Technology in Bratislava in the period of 2004–2009.

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