A taxonomy for user models in adaptive systems: special considerations for learning environments

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Abstract

This paper outlines the educational advantages provided by adaptive systems and stresses the importance of the user model in the task of adaptation. The paper also establishes a general taxonomy of user models thereby enabling classification of any model according to various features related to its structure and management. This taxonomy allows an exhaustive description of all user models, facilitating analysis and design of the corresponding adaptive systems. Subsequently, the taxonomy is used to describe the user modeling process in a concrete adaptive hypermedia system and to analyze the model of a student appropriate for use in a general educational environment.

1 Introduction

Considering the large number and diversity of users of information technologies, it cannot be denied that performing an adaptive process in any computer system would increase user satisfaction. However, in order that the users may take advantage of a system that fits their characteristics, the adaptive process must be carefully designed. Especially, the task of user modeling has a decisive influence on the suitability of the adaptation produced. The user modeling is a complex task, which has been widely studied in intelligent systems (Kok, 1991). Thus, machine learning offers the solution to many problems in user modeling. Though, the application of machine learning algorithms in user modeling is not without complications (Martin, 2004), and remains as an important point where further work is needed.

The areas where user-adaptive systems can be found are very miscellaneous, for example: telecommunications, multimedia, finance, service industries, health care, transportation, and manufacturing industries (Jameson, 2001). In particular, in educational environments where the users aim is to learn a set of concepts and items of information, the adaptive process can reduce the problems of disorientation, lack of comprehension, and discouragement that frequently affect students and can provide an autonomous and reflective learning experience (Alfonseca *et al.*, 2007).

Focusing us on adaptive systems for education, most of current developments arising from the extensive work that had already been conducted into artificial intelligence, more concretely from the fields of adaptive hypermedia systems (AHS) (Brusilovsky, 1996; Höök, 1997) and intelligent tutoring systems (ITS) (Sleeman & Brown, 1982; Bailey *et. al.*, 2007). Both, AHS and ITS, are used for computer-based instruction; however, their strengths lie in different subjects: the first is better suited to the learning of concepts, while the second generally assist in the application of these concepts to solve problems. Consequently, some authors argue the need of provide a full learning environment where both methods of instruction be combined (Nicholas & Martin, 2008).