Methods and Techniques of Adaptive Hypermedia

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Abstract. Adaptive hypermedia is a new direction of research within the area of adaptive and user model-based interfaces. Adaptive hypermedia (AH) systems build a model of the individual user and apply it for adaptation to that user, for example, to adapt the content of a hypermedia page to the user’s knowledge and goals, or to suggest the most relevant links to follow. AH systems are used now in several application areas where the hyperspace is reasonably large and where a hypermedia application is expected to be used by individuals with different goals, knowledge and backgrounds. This paper is a review of existing work on adaptive hypermedia. The paper is centered around a set of identified methods and techniques of AH. It introduces several dimensions of classification of AH systems, methods and techniques and describes the most important of them.

Key words: Adaptive hypermedia, navigation support, collaborative user modeling, adaptive text presentation, intelligent tutoring systems, student models.

1. Introduction

Hypermedia systems have become increasingly popular in the last five years as tools for user-driven access to information. Adaptive hypermedia is a new direction of research within the area of user-adaptive systems. The goal of this research is to increase the functionality of hypermedia by making it personalized. Adaptive hypermedia (AH) systems build a model of the goals, preferences and knowledge of the individual user and use this throughout the interaction for adaptation to the needs of that user.

AH systems can be useful in any application area where the system is expected to be used by people with different goals and knowledge and where the hyperspace is reasonably big. Users with different goals and knowledge may be interested in different pieces of information presented on a hypermedia page and may use different links for navigation. AH tries to overcome this problem by using knowledge represented in the user model to adapt the information and links being presented to the given user. Adaptation can also assist the user in a navigational sense, which is particularly relevant for a large hyperspace. Knowing user goals and knowledge, AH systems can support users in their navigation by limiting browsing space, suggesting most relevant links to follow, or providing adaptive comments to visible links. The goal of this paper is to provide an overview of recent work on the development of adaptive hypermedia systems.
Since this area of research is very new, the concept of adaptive hypermedia systems has not been clearly defined yet. To make the scope of the review more clear we use in this paper the following working definition:

by adaptive hypermedia systems we mean all hypertext and hypermedia systems which reflect some features of the user in the user model and apply this model to adapt various visible aspects of the system to the user.

In other words, the system should satisfy three criteria: it should be a hypertext or hypermedia system, it should have a user model, and it should be able to adapt the hypermedia using this model (i.e. the same system can look different to the users with different models). We have identified more than 20 systems which can be named as adaptive hypermedia systems according to our criteria (Appendix 1). The analysis of these systems is the main content of our review. Note that not all known systems which are named or referred to as adaptive hypermedia satisfy our definition. Some of them are not full-fledged hypermedia systems (Brusilovsky, 1992b; Yetim, 1993; André & Rist, 1996); some of them are not really adaptive, but rather adaptable (Waterworth, 1996) (this distinction will be made clearer later). There are also some projects which suggest interesting relevant ideas but have not yet reached the implementation stage (Tomek, Maurer & Nassar, 1993; Zyryanov, 1996). All these works, however, contain interesting ideas and we refer to them when it is relevant to the main line of presentation.

In this paper, the critical feature of adaptive hypermedia systems is the possibility of providing hypermedia adaptation on the basis of the user model. Therefore, the paper is centered around the problems of adaptation, the second part of the overall adaptation process in adaptive computer systems (Figure 1). The main content of the paper (Sections 2–6) is a review of existing methods and techniques of adaptation in AH systems. The problems of user modeling, i.e. building and updating the user model in AH systems, are not a focus of the paper because they are not as critical for AH systems as a subclass of adaptive computer systems. Specific problems of user