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Chapter 8

Information Imperfection as an Inherent Characteristic of Adaptive Hypermedia: Imprecise Models of Users and Interactions

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Abstract

Adaptive hypermedia applications are aimed at tailoring hypermedia structures according to some form of user model, in an attempt to increase the usability and utility of the application for each individual or group. Existing research in the field has resulted in many systems, techniques, and paradigms, both for modelling user data and for the subsequent exploitation of such model for the sake of personalisation. As a matter of fact, the majority of adaptive hypermedia systems work with user models that are imperfect in some way, and the theories or hypotheses that guide adaptation are also often of a heuristic or approximate nature. Although some existing systems provide explicit means for dealing with imperfection in one or several of its multiple facets, there exists a lack of support for information imperfection in adaptive hypermedia models and architectures. In an attempt to provide such conceptual support, the MAZE model

was proposed as a generalisation of an existing abstract hypermedia model, providing built-in support for fuzzy set-theoretic notions. This chapter provides an overall account of the MAZE model, along with its rationale, and an overview of a possible instance of a MAZE-based architecture. In addition, the use of MAZE to model common adaptive hypermedia technologies is illustrated through a concrete case study.

Introduction

Adaptive hypermedia can be defined succinctly as the technology that allows the personalisation of hypermedia applications according to an elaborated record of the characteristics of their users. Thus, it is the degree of comprehensiveness and accuracy of the user model which determines the space and effect of the possible adaptations. In other words, the outcomes of *user modelling* processes determines the subsequent *adaptation* tasks, in terms of the definitions provided by Brusilovsky (1996, 2001) when describing the "classic loop" of adaptive systems. This fact leads to the consideration of both the knowledge representation languages, and the collection and elaboration techniques that are currently used in adaptive systems, in an attempt to come up with a figure of the level of adequacy and accuracy of user models. As a matter of fact, implicit user modelling techniques are used in many cases, so that the raw data collected are indicators (e.g., visiting a concrete page for a given amount of time) that must be later interpreted by the system to elaborate the user model from them. To view it from another perspective — described in more detail in Sicilia (2003a) — adaptive systems usually observe their users by annotating their navigation history (often called the "click-stream") and later hypothesising about the characteristics, objectives, goals, or knowledge that the users have, but without asking them directly about such constructs and psychological traits. This certainly entails that some degree of uncertainty, imprecision, and even inconsistency is unavoidable when constructing user models. In some specific cases, the knowledge or beliefs that drive adaptation are of an uncertain and vague nature, as occurs in e-commerce applications that use an estimation of relationship value (Sheth & Parvatiyar, 2000) as a driver for personalised customer treatment (Sicilia & García, 2003). Of course, some systems actually use explicit questions to collect information from its users, but even in these cases, the answers provided are often provided in linguistic form. For example, some systems use a Likert scale to ask their users about their degree of interest in some given topics.

Given this picture regarding the sources of user information and the beliefs that designers put into adaptive systems to elaborate it, imperfection in its diverse facets — Smets' taxonomy (Smets, 1997) provides a comprehensive account of them — should be considered an inherent property of personalised systems, which emanates from user profiling and user modelling techniques. In addition, the subsequent adaptation tasks are forced to handle such imperfections, at the risk of oversimplifying the available data, producing dissonances between the user model and the outcomes of adaptation.

In recent years, a number of mathematical frameworks for imperfect information — including probability — have been investigated and matured, and their relationships