Chapter 8
Combining the Overlay Model and Bayesian Networks to Determine Learning Styles in AHES

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ABSTRACT

First of all, it is important to note that the work presented here lies within the modeling part of the learner in an adaptive educational system construed as computational modeling of the learner. Modeling the learner in adaptive systems involves different information such as knowledge of the domain, the performance of the learning goals, background, learning styles, etc. Although there are several methods to manage the learner model, like the stereotype model or learner profiles, they do not handle the uncertainty in the dynamic modeling of the learner. The main hypothesis of this work is to show the link between the structure of the learner model and especially the characteristics of a learning profile and the learning style of a learning situation. This chapter shows how the combination of these two approaches to learner modeling can address the dynamic aspect of the problem in the modeling of the learner.

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INTRODUCTION

Despite the different attempts to model the learning that is characterized by a dynamic aspect, we always find it difficult to achieve this goal. The proposed approaches give us just a static view of the learner model, but on practice this model is in full development (the learner knowledge is evolving in the same module). Thus, a dynamic view is essential. Therefore, in order to monitor the behavior of the learner in real time during a learning situation; we must adopt a model for dynamic management of the learning model.

The overlay model responds to the problem of dynamic management of learner model by showing knowledge of the learner as a subset of the knowledge of the system. We also presented in a previous work (Anouar Tadlaoui et al., 2014) how Bayesian networks are considered an effective tool to manage the problem of uncertainty in the model of the learner.

Our work focuses on identifying learning styles in different learning situations. More generally, it focuses on the initialization of a learner model in an adaptive educational hypermedia system. The main objective of this article is modeling the learner by combining Bayesian networks, and the overlay model. We aim in this chapter to use the combination of these two methods, to determine the learning style of each learner in a probabilistic way during the learning situation. And to achieve the, a dynamic e-assessment of each learner based on the learning styles determined.

First, we present the concepts and definitions of the learner's model and the learning styles on which we will base our work. Second, we will define Bayesian networks and overlay model. Then, we will focus on the combination rules on which we based our work to incorporate Bayesian networks with the overlay model. Afterwards, we demonstrate with an example of a learning situation the validity of this combination. Finally, we describe a formal structure for the definition of each learning style for a learning situation. The experiments and results presented in this work are arguments in favor of our hypothesis. This combination can promote also reusing the modeling obtained through systems and similar situations.

BACKGROUND

The technological landscape of the modern e-Learning is dominated by so-called learning management systems, learning management systems are powerful integrated systems that support a number of activities carried out by teachers and students during the e-Learning process. Teachers use e-Learning systems to develop course notes and quizzes on the Web, to communicate with students and to monitor and classify student progress. Students use it for learning, communication and collaboration.

Adaptive e-Learning systems often use learner models. A learner model is an internal representation of the user's properties, through which the system is based to adapt to the needs of each user. Before this model can be used, it must be built. This process requires a lot of effort to collect the required information and ultimately generate a learner model. Thus, an adaptive learning system takes all the properties of adaptive systems. To meet the needs of the application in the field of e-Learning, adaptive e-Learning systems adapt the learning material using user templates. The behavior of an adaptive system varies depending on the data from the learner's model and the learner's profile. Without knowing anything about the learner who uses the system, a system would behave in exactly the same way for all learners.