Chapter 7
A Learner Model Based on Multi-Entity Bayesian Networks in Adaptive Hypermedia Educational Systems

ABSTRACT

This chapter presents a probabilistic and dynamic learner model based on multi-entity Bayesian networks and artificial intelligence. There are several methods for modelling the learner in AHES, but they're based on the initial profile of the learner created in his entry into the learning situation. They do not handle the uncertainty in the dynamic modelling of the learner based on the actions of the learner. The main purpose of this chapter is the management of the learner model based on MEBN and artificial intelligence, taking into account the different actions that the learner could take during his/her whole learning path. The approach that the authors followed in this chapter is marked initially by modelling the learner model in three levels: they started with the conceptual level of modelling with the unified modelling language, followed by the model based on Bayesian networks to be able to achieve probabilistic modelling in the three phases of learner modelling.

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INTRODUCTION

We have shown in previous works (Anouar Tadlaoui et al., 2017), that the learner model in adaptive hypermedia is characterized by its complexity, large data size, dynamic evolution, and relativities. We have also presented a very precise approach to its management by using a combination of methods, models and techniques to try to treat dynamically and probabilistically its evolution (Anouar Tadlaoui et al., 2016).

We will focus in this chapter on modeling the learner model in a dynamic and probabilistic way, we will propose in this work the use of the notion of fragments and M-theory to lead to a Multi-Entity Bayesian networks. The use of this Bayesian method can handle the whole course of a learner as well as all of its shares in an adaptive educational hypermedia.

The main hypothesis of this chapter is the management of the learner model based on multi-entity Bayesian networks. To achieve this goal, one must first ask the following questions: Why and how can one model the learner model with a probabilistic method? What is the approach to go from a conceptual modeling of this model to dynamic modeling? Is this taking into account experimentally justified?

First, we will return to the learner model that we first modeled using the Unified Modeling Language Use Case Diagram, and then we will present the Bayesian network of the learner model that we have developed. Then, we will explain the approach followed in this chapter for modeling the learner model with multi-entity Bayesian networks, beginning with the presentation of MEBNs and their composition, then explaining the notions of fragments and theories. Finally, and in order to dismantle the validity of our hypothesis, we will present the fragments of each node of our network, its random variables, and then present our multi-entity Bayesian network in a complete way.

LEARNER MODELING IN ADAPTIVE HYPERMEDIA

In this section, we will come back to the steps to follow when modeling the learner in an adaptive education system using UML, from the user’s Meta model and in the use case diagram. Gathering all the learner’s actions in the adaptive system.
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