Chapter VIII

InteliWeb: The E-Learning System that Recognizes Aspects of Self-Efficacy

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ABSTRACT

This chapter presents the InteliWeb environment that combines agents, fuzzy logic, and student model to recognize aspects of student's self-efficacy beliefs to improve the effectiveness of e-learning systems. The self-efficacy construct means the student's belief on his/her own capacity of performing a task. This belief affects his/her behavior, motivation, affectivity, and the choices he/she makes. We use fuzzy theory for dealing with uncertainty in the assessment of the students and the incomplete knowledge about his/her self-efficacy. The InteliWeb offers instruction material on biological sciences.

INTRODUCTION

In this chapter, our goal is to present an intelligent e-learning system (ILE), called InteliWeb, composed of two agents: the self-efficacy mediator agent (SEM) and the Pedagogical and Affective Tutor (PAT) (Jaques, Pesty, Sylvie; Bonneville, JF.; Viccari, 2004; Jaques & Viccari, 2007). The student model comprises cognition and affectivity, which will be constantly analyzed. The cognition is represented by self-efficacy beliefs, proposed in the motivational model by Bandura (Bandura, 1997).

According to Bandura, self-efficacy represents “beliefs of individuals on their capacities of mobilizing the cognitive resources, the motivation and the course of actions, a process required to control the task requirements.” The student’s knowledge is constantly changing during the dynamic process of learning and it is therefore quite difficult to be certain about his/her current mental state. It is obvious that the development of
a reliable method for student diagnosis is based on successful handling of uncertainty.

Thus we contribute in this work by presenting a combination of intelligent agent and fuzzy logic. Accordingly, the agent technology being used to implement different ILE (Chou, Chan, Lin, 2003), and the multiagent approach are an interesting alternative for the construction of teaching environments because it makes possible to integrate different components of the learning environment, such as in the distance between students and professors, and the partnership among the different actors (agents) of the system, either human or artificial. In the case of the student model, the technology associated with the cognitive agent enables the construction of more robust models.

We proposed the fuzzy logic (Zadeh, 1965) technique to model and adapt self-efficacy beliefs. The fuzzy relations with subjective, vague, and uncertain information compose the process. The self-efficacy beliefs have all these attributes.

In the present chapter we design and model the self-efficacy beliefs in the student model that allows an agent to detect the beliefs through variables from the behaviors such as learning objective, effort, persistence, and performance. Our focus is to detect the student’s self-efficacy through these variables and attempt to promote his/her motivation during his/her learning over the Web.

The InteliWeb holds instructional material on FLOWER (in which a flower is the part of the plant that makes the seeds). This content is part of the material covered in the vegetal anatomy of the biological sciences undergraduate course at the Federal University do Rio Grande do Sul (UFRGS) in Brazil. The topics are presented in three different forms and two types of tests.

The student chooses his/her learning objective through the interface and, during the study session, the SEM agent monitors the student’s actions from the database log captured through the interface. It is from this log that the agent captures the variables to carry out the process of self-efficacy inference, as well as as it updates it in the student’s model. After the self-efficacy value is inferred, the SEM agent activates the PAT (Jaques et al., 2004, 2007), which will provide an affective feedback. Thus, PAT demonstrates, throughout an affective behavior, a feedback that will be coherent with the self-efficacy measure. PAT should increase his/her self-efficacy and, as a consequence, motivate the student.

Our scientific presupposes is that capturing and monitoring self-efficacy by an agent can help the student to self-regulate his/her own learning. We have described a way to introduce self-efficacy into the student model in the ILE context. This way we present a computation model of self-efficacy without the use of scales or the questionnaires to infer itself.

This work is inserted in the context of personalization in Web education. The student’s learning is sometimes associated with the level of his/her interest on the topics. The interest factor varies among individuals and student. Also, the student engagement is detected during his/her learning and content acquisition. Web teaching and learning achieves its goals only if it can adapt itself to the students and approach them individually. Our goal is to develop an e-learning system that has these abilities. We believe that the system should be able to (1) presents different presentation forms to the same teaching material, (2) captures the behavioral variables from students choices on the interface system to elaborate the student’s cognitive modeling for each student, and (3) supplies appropriate feedback to individual students’ cognitive state. The environment evaluation is being conducted systematically in stages.

In this chapter, we focus on the following. First, we introduce concepts about self-efficacy construct and the fuzzy logic. Also, we describe some differences among our approach and related works. Second, we describe the InteliWeb project, including the interface, instruction material and
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