Modeling and Evaluating Tutors’ Function using Data Mining and Fuzzy Logic Techniques

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ABSTRACT

In e-learning systems, the tutors play many roles and carry out several tasks that differ from one system to another. The activity of tutoring is influenced by many factors. One factor among them is the assignment of the appropriate profile to the tutor. For this reason, the authors propose a new approach for modeling and evaluating the function of the tutors. This technique facilitates the classification among tutors for adapting tutoring to student’s problems. The component of the proposed tutor model is a set of profiles which are responsible for representing the necessary information about each tutor. A fuzzy logic technique is used in order to define tutor’s tutoring profile. Furthermore, the K nearest neighbor algorithm is used to offer much information for each new tutor based on the models of other similar tutors. This new approach has been tested by tutors from an Algerian University. The first results were very encouraging and sufficient. They indicate that the use of fuzzy logic technique is very useful and estimate the adaptation of the tutoring process according to tutors’ skills.

KEYWORDS
E-learning Systems, Fuzzy Logic, K Nearest Neighbor, Tutoring, Tutor Model, Tutors’ Functions

1. INTRODUCTION

E-learning is a kind of distance learning that is based on complex virtual environments where the learners can interact with each other and with other actors such as: the teachers and the tutors. This mode of learning helps learners to improve their performance.

In distance learning, learners meet some problems due mainly to their isolation. So, learners need assistance and support during their pedagogical activities. These tasks can be done by human actors.
called tutors. Tutoring is a fundamental activity in distance learning, which facilitates and supports the learning process of learners.

In many existing e-learning systems that adopt the tutoring activity, teachers and tutors are responsible for ensuring tutoring functions in addition to their main activities. The teacher is responsible for managing the learning courses. Furthermore, he is a professional who follows a curriculum in a structured learning environment. Whereas, a tutor can done other tasks such as representing the informal method of learning and giving additional explanations; or remedial instruction (Raines, 1994). However, students know the importance of leadership, especially the support of tutors and they appreciate working with them (Gagné et al., 2001). Yet, this actor is poorly defined and there are few tools to assist and guide the implementation of his activity (Garrot, 2008).

Tutors need to detect or anticipate problems within the performances of students. Also, they can analyze and evaluate what happens in order to make improvements in their learning (Romero & Ventura, 2006). One of the most phases of tutors training sessions is the definition of a target profile of tutors (Denis, 2003).

Many research questions are raised concerning the tutoring process: Can a student be tracked with the appropriate tutor? Can the tutor obtain a model according to his characteristics and his competencies? What type of roles which are specific for the tutor’s job? And what does the tutor know?

For addressing these questions, we have integrated a new approach for modeling the tutors according to their knowledge, skills, roles, behavior, and the learners’ needs and requests.

In a previous research work (Bendjebar & Lafifi, 2013), a first definition and a basic structure of the tutor model was proposed, where a certain number of tutors’ characteristics were taken into account. We found that this first proposition ignores some important characteristics of the tutors such as: their tutoring profiles and behavior classes.

The aim of this research is to propose to use an artificial intelligence technique and a data mining technique for better modeling a tutor. In fact, we propose to apply the fuzzy logic technique to extract the tutoring profile of the tutors. This technique is an effective tool for the approximation of uncertain and complex nonlinear dynamic systems that are otherwise difficult to model. Also, it is more consistent with the human-being decision-making processes.

Furthermore, we explore the applicability of a data mining technique, which is the k-nearest neighbors algorithm (K-nn) to define the behavioral class of a new tutor, taking into account tutors who belong to the same class. The aim is to determine one of the components of the tutor model, which is the behavioral profile.

The rest of the paper is organized as follows. In section two, we present a literature review on the identification of tutors’ functions and the application of data mining techniques for user modeling. We describe the structure of our proposed model and its main components in section three. In section four, we show how we can integrate fuzzy logic and K-nn techniques in our tutor model. The results of the experiment that had been conducted at an Algerian University are shown in section five. Finally, we give the conclusion drawn from this work and point out the problems that need to be explored further.

2. LITERATURE REVIEW

In this section, we give a brief overview about the research works that are related to our work: identification of the tutors’ functions and application of data mining techniques for modeling the users.

2.1. Identifying the Tutors’ Functions

What is meant by tutoring is not understood by everyone in the same manner. The primary objective of this activity is to help students or guide them to the point at which they become independent, thus they need a tutor (Derry & Potts, 1998; Naidu, 2006).

After a thorough investigation in the related scientific literature, we mention that “one-to-one human tutoring is extremely effective compared to classroom environments” is a well-known fact
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