

ABSTRACT

The one-size-fits-all teaching approach can be applied in a diverse classroom, yet it should be more personalized to fit the diversity. In educational technology, there is a system named an Intelligent Tutoring System (ITS) which provides personalized learning experience for the students. One of the methods in ITS is by delivering adaptive exercise based on the students' knowledge level. The system is usually providing a set of previously-tagged questions in detail or in depth by human experts (deep tagging). This thesis proposes an approach to reduce the need of deep tagging by using a combination of shallow tagging and following generative paths, namely good-learner paths, recorded in the ITS. The approach is based on Social Learning Theory, which states that learning can be acquired through observation and imitation of competent models. Using this principle, experiments were designed to observe the exercises done by students, detected which students were considered as good learners and modeled them into good-learner paths. Having obtained the prior knowledge of the students and the records of good-learner paths, the proposed ITS analyzed and offered the appropriate paths of sequences need to be taken by the students.

The proposed system applies Hidden Markov Model (HMM) for student modeling and Markov Decision Process (MDP) for adaptation model. The HMM modeled the student's skill based on the basic programming's assessments and the MDP modeled the good-learner paths from their correctly completed exercises in ITS. The resulted model represents sequencing of questions, which will be used to guide the students working on basic programming exercises. To obtain the real-world dataset and measure the reliability of the proposed approach, a series of experimental study was conducted in the Introduction to Programming course in an Indonesian university, comparing the conventional deep tagging approach and the proposed shallow tagging approach. The approach performance is indicated by increased percentages of good learners. It can be seen from the experimental results that the performance gap between the conventional and the proposed approach is getting closer over time. This shows that the application can predict which exercises are more appropriate for certain students, using minimum help from the experts.

Keywords: Exercise sequencing, user model, adaptation model, good learner, hidden markov model, markov decision process, intelligent tutoring system