

Talk, Tutor, Explore, Learn: Intelligent Tutoring and Exploration for Robust Learning

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Abstract. It is widely acknowledged that many children have difficulty learning fractions. Accordingly, we are developing the iTalk2Learn system (www.italk2learn.eu), which aims to facilitate the robust learning of fractions by children in primary and early secondary education. The iTalk2Learn system integrates structured, practice-based tasks with exploratory, conceptually-oriented tasks, and intelligent affect-aware support. The system focusses on natural interaction via intuitive user interfaces, which includes speech recognition, and speech production.

1 Introduction

iTalk2Learn is a learning platform for children aged 8-12 years old who are learning fractions. It combines structured tasks from pre-existing intelligent tutoring systems with more open-ended tasks in an exploratory environment developed by the project. The platform is designed to detect children’s speech in real time, which, together with the children’s interactions, is analysed in order to provide adaptive and affect-aware support.

2 The iTalk2Learn system

2.1 Combining structured and exploratory learning environments

We have designed and implemented a novel exploratory learning environment for fractions, Fractions Lab, that allows students to explore different representations of fractions while they engage with a wide variety of guided fractions tasks. The platform monitors the children’s interaction and speech, which is analysed in order to provide two-dimensions of task-dependent feedback [1] and affect-aware task independent support [2]. The children’s interaction and speech are also used to determine the individual child’s learning path, either presenting them with more- or less-challenging exploratory tasks, or switching to mapped tasks from pre-existing practice-based Intelligent Tutoring Systems.

2.2 Speech and learning

It is well known that encouraging students to reflect aloud on their learning helps support that learning. Accordingly, the iTalk2Learn system asks students to reflect aloud on their strategies as they engage with the tasks. In addition, the automatic speech recognition uses novel techniques to draw inferences about the students' affective states while they engage with the learning situation (which in turn is used to determine appropriate support and learning paths). Additional input for affect detection comes from prosodic cues in speech. A perceived Task Difficulty Classifier (pTDC) uses raw speech data to determine whether students are under-, over-, or appropriately challenged [3].

2.3 Intelligent support

Based on the students' interaction with the learning environment as well as the result of the speech recognition and pTDC, the intelligent support classifies the affective state of the student. This is used to adapt feedback, which aims to enhance a student's affective state, in order to enhance the learning experience. The adaptation is based on a dynamic Bayesian network [2], which is trained with data gathered from several Wizard-of-Oz studies where the effect of feedback on students' affective state was investigated [4].

3 Conclusion

We have developed a novel adaptive system, which is able to facilitate robust learning, by combining structured and exploratory learning. It enables natural interaction through speech, which is used to detect the affective state of the student. This is then used to adapt feedback according to the affective state.

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