Delivering Tutoring Feedback using Persuasive Dialogues

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Abstract. We are developing a general argumentation framework for implementing tutoring feedback in the form of persuasive dialogues. The objective is to have an intelligent tutoring system capable of arguing with the student to convince him of the rationale of the feedback provided to him. The application domain is that of medical diagnosis skill learning.

Key words: intelligent tutoring system, argumentation, persuasive dialogue

1 Introduction

Many current intelligent tutoring systems (ITS) implement tutoring feedback using dialogues [1–3]. It has already been argued that engaging the students in argumentative dialogues would efficiently foster their knowledge construction, by making them think about the content and sequence of arguments they put forward [4]. Through argumentation, the ITS could provide persuasive tutoring feedback by giving students the opportunity to challenge feedback provided by the ITS as well as the opportunity to defends their position in problem solving. However, so far argumentation was involved in ITS only as a skill to learn [2, 5] –that is, the ITS teaches how to argue – as opposed to using argumentation as a persuasive dialogue delivering tutoring feedback on a given problem solving or skill learning task.

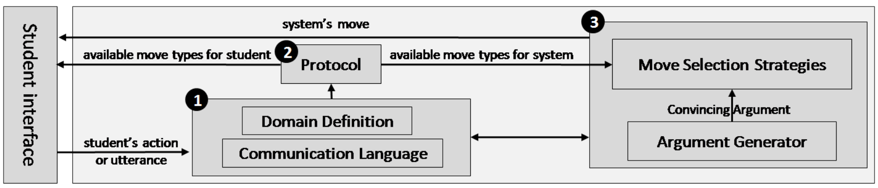
In our approach, every problem solving action (PSA) performed by a student to solve a problem is considered as an argument. The ITS intervenes to help the students also by making arguments. Errors made by the student are considered as disagreements and the ITS tries to help the student remedy them through an argumentation. Our focus is on the structural level of dialogues, and we are not concerned with speech generation, speech recognition and natural language understanding, even though we acknowledge the important contribution of these approaches in learning.

2 Argumentation Framework

As figure 1.(a) presents, the framework has three main components represented by the black circles. The first component defines the representation of dialogue moves. A typical dialogue move specifies the content of an argument or a propositional attitude in the exchange of arguments. Any PSA or utterance has a predefined argument template. A move type is a template operator described by a precondition specifying when the move is feasible and an effect specifying the update of the dialogue state.

At any point during the interaction, each arguer (ITS or student) is committed to of his own arguments he has previously asserted (either by making PSAs or by making utterances during verbal exchanges) and has not withdrawn yet; and to his opponent's arguments that he has accepted. A structure called the "Commitment Store" keeps track of the current commitments. As argued by [6], the commitment concept provides a means to settle a conflict between arguers by making the opponent commit to the proponent's assertion or the proponent withdraws of its assertion.

(a)



(b)

Player	Utterance	Move Types
Collected Evidence: Acute Lower abdominal pain Working Hypothesis: Urinary Infection (UI)		
1. Student:	Do you have a sexual partner(SP)?	ASSERT
2. TM Pedagogue:	You cannot ask such a question.	REJECT
3. Student:	Why?	CHALLENGE
4. TM Pedagogue:	It is not related to the working hypothesis UI.	ASSERT
5. Student:	But I can.	REJECT
6. TM Pedagogue:	Why?	CHALLENGE
7. Student:	Because I investigate Sexual Transmitted Disease (STD).	ASSERT

Fig. 1. (a)Architecture of the system; (b)An example scenario

The second component, the protocol, uses hierarchical state diagrams to regulate the moves and define the permitted move sequences in an argumentation dialogue. The third component calculates arguments which are persuasive for the student. For this, given an assertion made by the student, we follow Walton's argumentation theory [7] by specifying rules expressing how to respond to arguments made by the opposing party in a two-participant argumentation. These argument generation rules (AGR), called test questions by Walton, specify arguments that can challenge assertions made by the student - PSAs as well as utterances during a conflict settling dialogue. A counterargument is also subjected to AGRs and this process continues until no match is found for AGRs.

A convincing argument exists among this set of generated arguments if it defeats the student's argument but it is not defeated by any counterargument. To calculate such argument we adapted a decision-theoretic argumentation method from [8].

Given a convincing argument and a set of moves, the ITS uses a dialogue strategy to select its current move. We specify a dialogue strategy by following a three-level methodology, inspired from [9]. The Higher level includes some strategic rules that we use as domain dependent tactic to select a move based on a pedagogic goal. For instance, figure 1.(b) is an excerpt from a medical diagnosis learning scenario adapted from [3] and modified to reflect the argumentative capability that we are aiming for. In this scenario, the student is in the process of diagnosing a simulated patient and she has so far gathered a number of evidences and has formulated a list of hypotheses. At line 1 of this scenario ITS notices inconsistencies between the evidences and the hypotheses formulated by the student. This matches a counter-argument which spawns further argumentation with the student (line 1 to 7) to settle the disagreement.

3 Conclusion

Our paper appearing in the 2010 Intelligent Tutoring Systems conference provides details on the current implementation of our approach and its present capabilities.

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