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ALES: An Innovative Argument Learning Environment

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Abstract: The paper presents the development of an intelligent tutoring environment for argument learning (ALES). It uses different mining techniques to manage a highly structured arguments repository. The repository was designed, developed and implemented by us [1,2]. ALES aims to i) guide the students during argument learning, ii) offer an argument classifier agent that retrieves the most relevant results to the subject of search.

Introduction

Argumentation skill is extremely valuable in the educational field; it reflects the student's abilities to outline a claim in a convincing way. Although its importance, students' main barrier appears in following the argument; highlighting the main points of a context [4]. As a response, a number of argument mapping tools [4,6,7] have been developed to foster students' ability to articulate, comprehend and communicate reasoning by producing diagrams of reasoning and argumentation. The main drawback in these tools is the absence of an administrator to constrict the argument diagram process. In other words, guiding the students to understand the relation between scientific theories and analyze arguments based on scientific theories or evidence [4]. Later, Rahwan presents the ArgDf system [5], through which users can create, manipulate, and query arguments using different argumentation schemes. The ArgDf system guides the user during the creation process based on the scheme structure only, the user relies on his efforts and his background to analyze the argument. In this paper, we extend our framework proposed in [1,2] by developing an intelligent learning environment (ALES) that uses mining agent-based ITS for teaching argumentation. ALES uses the highly structured argument repository "RADB" to expose the expert's knowledge. It models the student's argumentation knowledge and skills and conducts a personalized learning process.

1. ALES Architecture

ALES consists of four main parts: the domain model represented as a highly structured argument repertoire [1,2], the pedagogical model that contains three components: a parser, a classifier agent that utilizes different mining techniques to refine the searching and the retrieving processes, and a teaching model, the student model that keeps track of the student performance and assists the pedagogical model in offering the individualized teaching, and finally the interface model "GUI". Not only does ALES teach argument analysis, but also assesses the student and guides him through personalized feedback. For more details about each model, the used mining techniques and the types of feedback see [3].

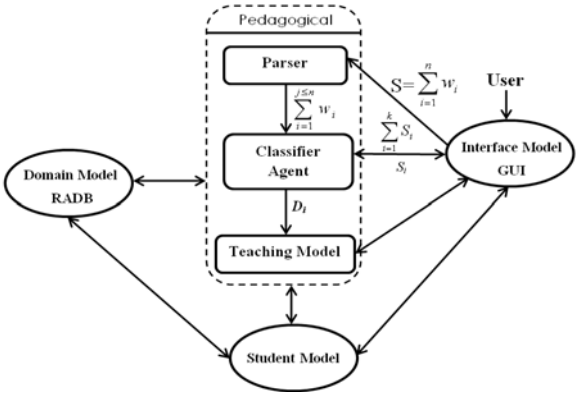

Fig.1: ALES architecture

2. An Illustrative Example

This example shows a complete run for partial feedback in the assessing phase. The system interactions are written in normal font. The student's actions are in bold. My illustrations to some actions will be italicized.

Suppose the student in the assessing phase choosing the partial feedback property. The system will give the student the ability to select specific scheme to be used in his analysis as shown in Fig.2.

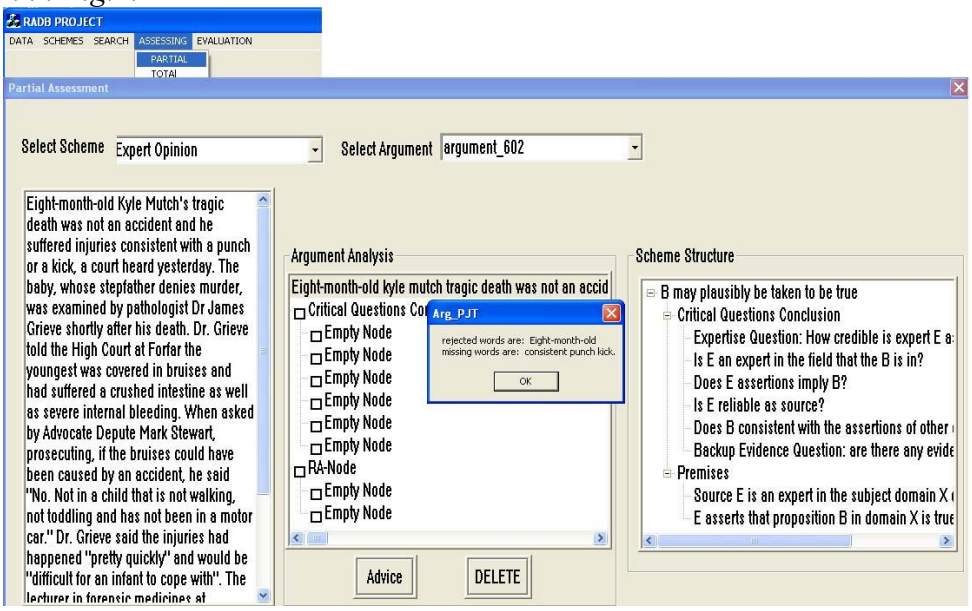

Fig.2: The partial assessment form

User>> "expert opinion scheme".

The whole arguments, that use the "expert opinion scheme" in its analysis, will be listed such that the priority is to the contexts that have not been accessed yet during learning.

System>> [argument_602, argument_1, argument_214].

User>> picks up one of the listed arguments, argument_602 as example.

System>> presents the transcript of the chosen argument as shown in Fig.2.

User>> start the analysis by writing "final decision is the death was not accident" in the root/final conclusion node, then press "Advice".

System>>divides the user statement into tokens {final, decision, death, accident}, then records the error ratios comparing with the expert analysis for the same node.

System>>shows out the following message "your analysis is partially correct try to use the words { Kyle Mutch, tragic, suffered, punch}, in your node analysis, rather than the words {final,decision,....} that have been used in the current analysis".

User>>reanalyze the current node adding the advised keywords.
System>>compares again the current context node with the pre-existing analysis and negotiate again, guiding the user, till he reaches to the correct analysis.
User>> fills the other nodes.
System>>negotiates based on the pre-existing analysis guiding the user.
After the user finishes his analysis to the whole context, filling the suitable analysis for each node, the system will record the error ratio for the first analysis of each node. Then based on the whole analysis ratio, the system will advice the student either to go to the evaluation phase or return to the learning phase.

3. Discussion

ALES enjoys certain advantages over the others, it monitors the user actions and guides him not only by the scheme structure but also by crucial hints devolved through the appropriate feedback. Accordingly, the analysis process is restricted by comparing the contrasting reconstruction of the user's analysis and the pre-existing one. Such restriction helps in refining the user's underlying classification. Regarding the searching process, ALES searches the existing arguments not only by specifying text in the premises or the conclusion but also by providing different strategies based on different mining techniques in order to: refine the learning environment by adding more flexible interoperability, guarantee the retrieval of the most convenient hypotheses relevant to the subject of search, facilitate the search process by providing a different search criteria. At last, ALES can trace the users progress and produce representative reports, as shown in Fig.3., about the learner analysis history, which in turn excavate the proper weakness points in the learners' analysis skills.

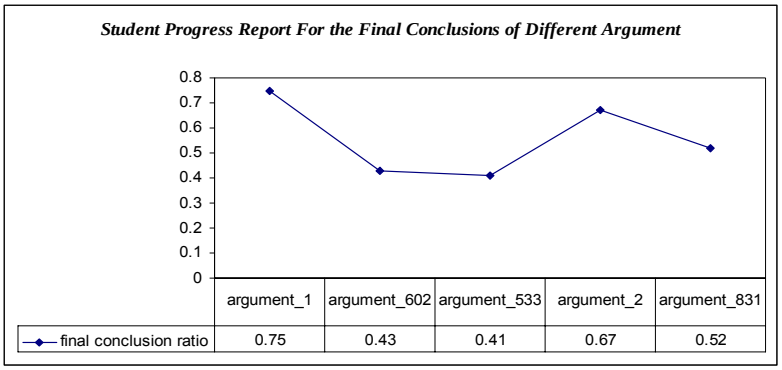

Fig.3. The resulted progress report regarding the final conclusion

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