Mediating Collective Discussions Using an Intelligent Argumentation-Based Framework

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ABSTRACT

This paper briefly describes AMANDA(1), a framework for mediating collective discussions in distance learning environments. The objective of this framework is to help tutors achieve better results from group discussions and improve knowledge transfer among the participants. The overall idea is to organize the group discussion in an argumentation tree and involve the participants in successive discussion activities. The coordination of the discussion is made by a set of intelligent mechanisms which reason over the discussion and propose new interactions among the participants. AMANDA advances the discussion by generating progressive discussion cycles until a desired set of target conditions are observed. At each discussion cycle, the system redistributes discussion tasks among the participants to ensure a desired degree of agreement and participation among them. In this short paper we describe the underlying coordination principles and the use of knowledge models for producing natural language questions.

AN ARGUMENTATION-BASED STRUCTURE FOR THE DISCUSSION

The discussion is organized by an argumentation tree which links questions, answers and arguments. Each question proposed by the system (DE node) is linked to a set of answers (ALT nodes) given by the participants. Each answer has a corresponding sub-tree of arguments (ARG nodes). The ARG nodes express the intention to support or refute a given position presented by another participant. An ARG node is formed by its intention (full/partial support, full/partial refute) and by a free text expressing the proposition that holds the argument. The reasoning over the distribution and the nature of the ARG nodes is the basis for coordinating the discussion.
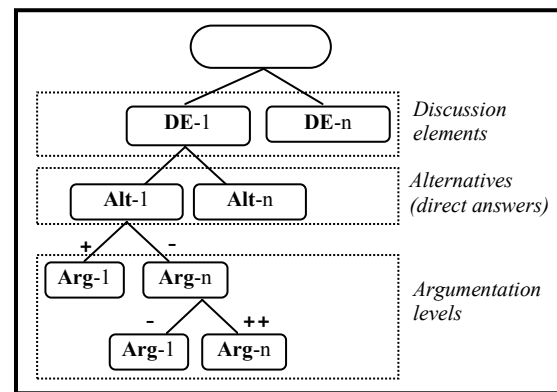

Figure 1: The discussion tree

THE TEMPORAL PROGRESS OF THE DISCUSSION

The discussion advances in periodic cycles, where the system distributes to each participant a specific discussion sheet (figure 3) containing either *questions* to be answered or *propositions* to be analyzed. At each cycle, the system receives the discussion sheets from all participants and builds the next discussion cycle by producing new discussion sheets (figure 4). The construction of a discussion sheet is intentionally made so as to promote the maximum degree of knowledge exchange among the participants. For this purpose, AMANDA uses a set of assignment mechanisms that reason over the discussion tree and propose new interactions among the participants. Some mechanisms attempt to detect potential discussion situations, such as participants that disagree over a certain answer, answers given by different participants to the same question and highly polemic positions. Other mechanisms attempt to assure that each participant takes part of all discussion elements with similar workloads. The discussion is advanced in cycles until a satisfactory set of conditions is achieved.

THE COORDINATION PRINCIPLE

The heart of the system is the way that AMANDA builds the discussion sheets at each discussion cycle. When opening a new discussion cycle, AMANDA analyses the current configuration of the discussion tree and decides to re-launch certain nodes, i.e. to create new nodes and strategically assign them to the participants. The choice among which nodes to re-launch is

done by evaluating each node with respect to its sub-tree and assigning it a "re-launch priority value". The nodes chosen to be re-launched are then assigned to the corresponding participants as a result of the assignment mechanisms, as mentioned above. AMANDA is now ready to build the personal discussion sheets for the new discussion cycle. These discussion sheets are made available in HTML format to be fulfilled and sent back by the participants.

DOMAIN MODELING

The system uses a domain ontology and a task structure to represent the domain of discussion. They are used to produce natural language questions that can be turned into *discussion elements*, i.e. DE nodes for the discussion tree. The questions are produced based on the existing links among the concepts of the ontology, among the sub-tasks of the task structure and between the task structure and the ontology. This feature was proposed to help the tutors elaborate the questions to be launched for collective discussion. In practice, we were surprised how well the system can perform in producing well formulated questions provided that the models are well constructed. We also noticed that the *quality* of a question can also measure the quality of the domain modeling.

THE PROTOTYPE

AMANDA was developed in LISP and put into practice in four actual training situations. The results are promising and show that the system can efficiently coordinate a group discussion with very low effort from the tutor and a good degree of knowledge transfer among the participants. The prototype includes a tutor interface to view and edit the discussion tree (figure 2) as well as an editor for building the ontology and the task structure (figure 5). The system also features an HTML module (http server, PHP scripts and html files) which allows access to the system over the Internet. Below are some sample screens of the system.
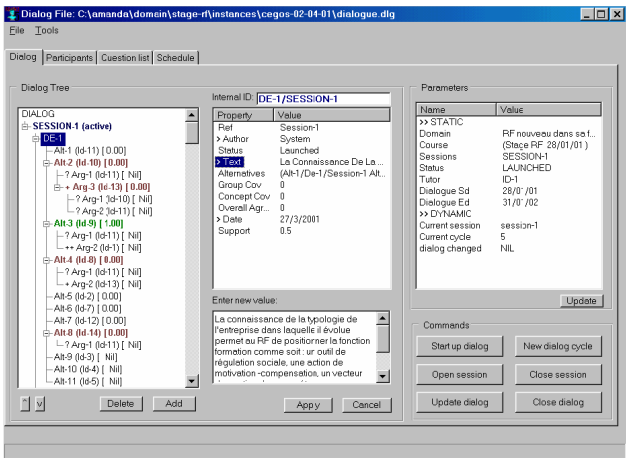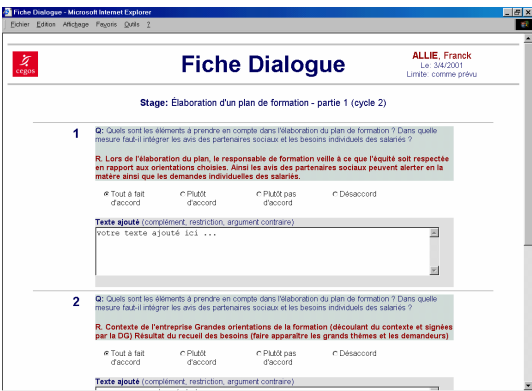

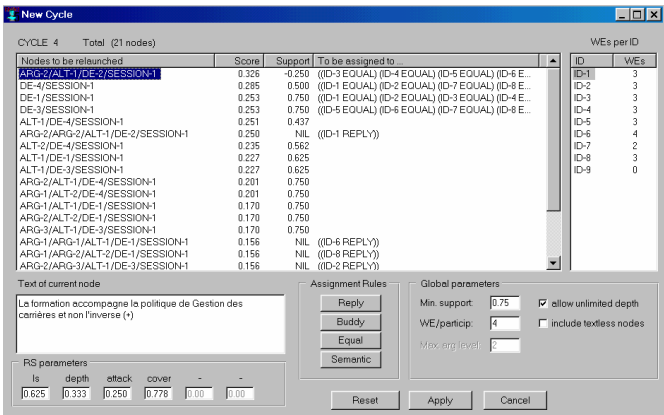**Figure 2**: The tutor interface

Figure 3: A discussion sheet
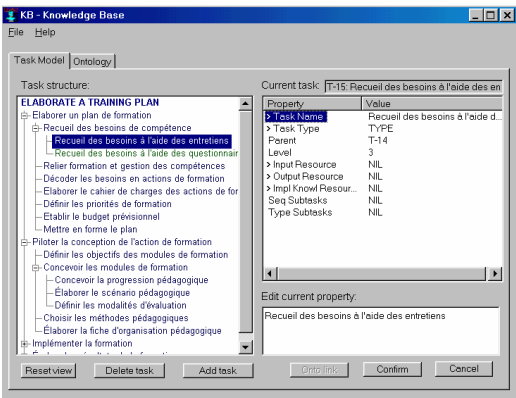

Figure 4: The interface for opening a new discussion cycle

Figure 5: The domain model editor