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Abstract: Despite their potential value for learning purposes, e-discussions do not necessarily lead to desirable results, even when moderated. The study of the moderator's role, especially in synchronous, graphical e-discussions, and the development of appropriate tools to assist moderators are the objectives of the ARGUNAUT project. This project aims at unifying awareness and feedback mechanisms in e-discussion environments, presently implemented on two existing platforms. This system is primarily directed to a human moderator and facilitating moderation, but might also help the students monitor their own interactions. At the heart of system are the inter-relations between an off-line AI analysis mechanism and an on-line monitoring module. This is done through a collaboration of technological and pedagogical teams, showing promising preliminary results.

Introduction

One of the important trends in Computer-Supported Collaborative Learning/Working (CSCL/W) is the proliferation of tools to support e-discussion so as to reach learning objectives. Discussions, however, do not necessarily lead to desirable results but often turn out to be ineffective or chaotic when no moderator/tutor is present. The ARGUNAUT project's (IST-2005027728 - Partially funded by the EC under the 6th Framework Program, http://www.argunaut.org) goal is to provide moderators with a computerized tool to support and increase their effectiveness and thereby the quality of the monitored e-discussions. ARGUNAUT aims at delivering a unified mechanism of awareness and feedback to support moderators in multiple e-discussion environments. The tools that are being developed within the project not only help the moderator visualize information about relevant aspects of the discussions taking place ("awareness"), but also pinpoint possible problematic issues, give "advice" to the moderator in real time, and support his/her intervention. In addition, the tools provide the moderator with options for post-discussion reflection and awareness. ARGUNUT supports two existing collaborative learning environments; Digalo (developed on the DUNES project – IST-2001-34153 - http://www.dunes.gr/), and Cool Modes (http://www.UDE.info/).

Since feedback and advice to the moderator regarding the current e-discussion are among the main goals of ARGUNAUT, a primary need was to define criteria for the quality of discussions. Observations of the argumentative practices that developed in classes led to the elaboration of criteria such as participation, responsiveness, and Toulminian criteria for the quality of the arguments (see also Schwarz & Glassner, in press). Walton (1989) types of dialogue and Baker's approach (2003) to the use of argumentation in online dialogue helped us to elaborate criteria for quality. Since the criteria are about dialogical models of reason, at least two levels of analysis were required: an account of intersubjective orientations and an account of ground rules fulfilled during interaction (see Wegerif & Mercer 1997 for the description of ground rules in classroom dialogues). Such criteria inspired us to come up with analysis schemes for e-discussions in the ARGUNAUT context. We present here the ARGUNAUT system, developed in the hope that it will contribute to the moderators in their goal of facilitating good quality e-discussions.

The ARGUNAUT Approach

During the conference, we plan to present the ARGUNAUT approach of supporting moderation, as well as the initial prototype (partial functionality) of the ARGUNAUT system. Various features that have been developed so far will be demonstrated in the context of the pedagogical scenarios.

ARGUNAUT Scenario, Main Components and Architecture

The ARGUNAUT platform incorporates two modules, the "deep loop" and the "shallow loop". The "*shallow loop*" is a module for monitoring ongoing discussion. This module collects data about awareness variables or "indicators" (e.g., participation, social interaction). If a possibly problematic or significant situation (pre-defined as such) is detected, a dialogue appears, giving the moderator the relevant information, plus advice and "remote control" intervention options when applicable. The "*deep loop*" is an off-line analysis mechanism based on machine-learning techniques. This module takes human-annotated examples of past e-discussions (situations, or aspects thereof) and attempts to learn the examples' underlying pattern, or classifiers. These classifiers can then be used to detect similar situations in future discussions. A schematic overview of the architecture is shown in Figure 1.

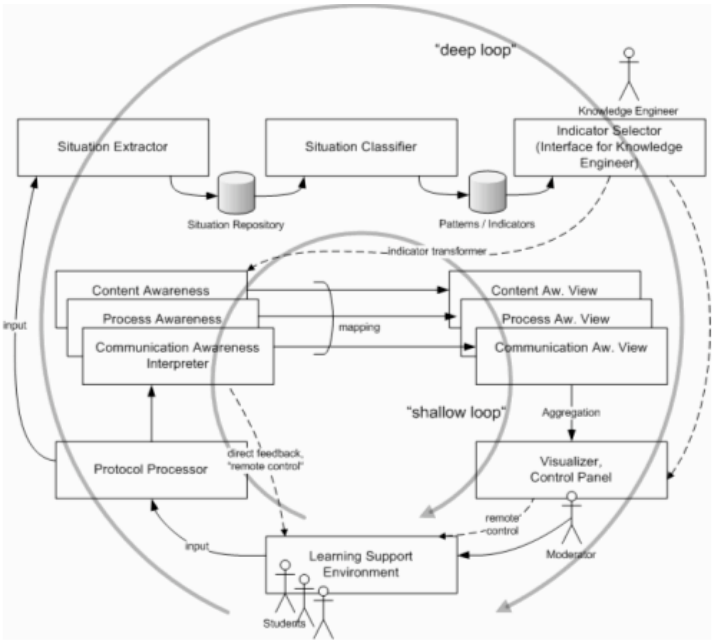

Figure 1. Planned System Architecture

The 'Indicators for Deep and Shallow Loop Classification' Approach

The offline analysis module – the deep loop- is designed to derive situation indicators. The underlying approach used by the deep loop is classification learning, i.e. induction of classifiers from labeled examples, which can later be used to classify new and previously unseen examples. According to this approach, (a) our experts and researchers pre-define a typology for classification according to specific concepts (e.g., 'critical reasoning', a central concept for e-discussions in education); (b) discussions then are annotated according to these typologies or schemes, and these annotations are analyzed offline; (c) the output of the offline analysis is a set of situation classifiers, which may then be incorporated as indicators into the visualization and awareness components of ARGUNAUT. These modules are planned to also enable induction of relations between the indicators and generation of feedback for the moderator (and the learners), explaining the situation and offering advice. These possibilities will rely on "post-processing" of indicators produced automatically by the system, and increase the usefulness of the indicators for participants in the electronic discussions.

The on-the-fly analysis and visualization module – the "shallow loop"- provides methods that are "lighter" with respect to computability and complexity and thus can be utilized on-the-fly. These methods provide the moderator with awareness feedback: information about specific characteristics of the monitored e-discussions. This information can be categorized into three types of awareness: a) *process awareness*: related to temporal traits of the discussion, such as phases, key events; b) *content awareness*: content-related properties, such as foci of interest within the discussion, relations between contributions, etc.); and c) *communication/social awareness*: related to the social interrelations between the participants of a discussion, such as typical patterns of interaction between specific participants. Each time an "interpreter" component produces new information based on activities within the learning support system(s), the data is sent to the

corresponding view(s) and integrated into the user interface that is available for the moderator, using elaborated visualization features.

The shallow and deep loops together enhance the capabilities of the moderator by explicitly marking situations of interest. The moderator may also further annotate discussions on the fly (or after the discussion), relying (among other things, on the indicators produced by the offline analysis. The moderator's annotations may in turn be used for further refinement of these indicators.

Steps towards Implementation: First Results

Cross-System Interoperability and the Moderator's Interface

The ARGUNAUT system is designed to achieve interoperability, that is to say, serve more than one e-discussion end user environment (EUE). Since actions, objects and users are logged differently across e-discussion tools, there was a need for a "common format", a unified representation schema for action logs from both EUEs handled by the project. This was achieved via the use of transformational approaches converting the action logging of the EUEs to common format XML logs. The ARGUNAUT 'Moderator's Interface' includes a unified graphical representation and a cross-system replay system based on this common format, which allows the moderators to monitor the discussion in progress, regardless of the concrete EUE the students are using. It also includes the ability to make content keyword queries, annotate discussions, and intervene in the students' EUEs via remote control capabilities (see Figure 2).

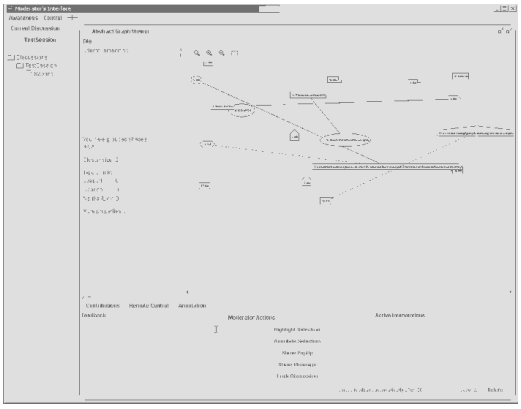

Figure 2. ARGUNAUT's Moderator Interface

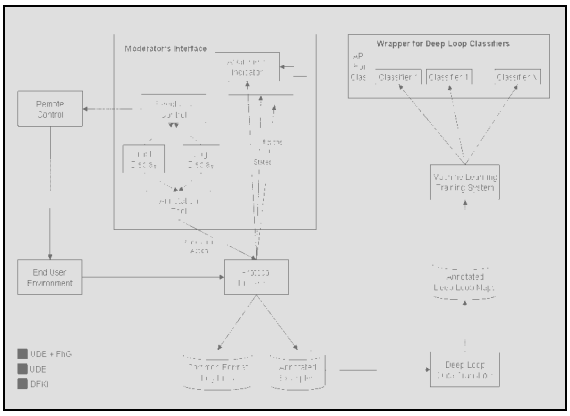

Figure 3. The Integration of the Deep and Shallow Loops

Offline Analysis and Annotation of E-Discussions

At this stage, we have not determined absolute criteria for quality of e-discussions. Rather, we have focused on identifying and annotating phenomena relevant to the analysis and evaluation of such discussions. Our initial experiences would suggest that actions, objects and attributes in the discussion log files, can be successfully used to capture these more meaningful theoretical phenomena. This can be achieved by the combination of structural and process-oriented elements (e.g., ontologies of shapes, types of connectors, logged actions) with content elements (the text of the discussion itself). One direction for this is the training of machine-learning classifiers to classify discussion units (shapes and paired-shapes) into pre-defined theoretical categories, using structural and process-oriented attributes. The classifiers are trained with examples categorized by humans, based on content and some contextual cues. At this point we already have a few classifiers for phenomena such as 'critical reasoning' and 'question and answer', showing high overall accuracy (86-95%). A second direction is the use of a PROLOG-based pattern matching tool (Harrer, Vetter, Thür, & Brauckmann, 2005) in conjunction with e-discussion XML log files to generate "rules" in order to look for "patterns" that combine user actions (e.g., create shape, delete link) and structural elements with content key words.

Integration of Deep Loop Classifiers with the Online Shallow Loop

As described above, the AI module of ARGUNAUT (the "deep loop") has been successful in generating some classifiers. We are now in advanced stages of integrating these classifiers with the online monitoring module (the "shallow loop"), as shown in Figure 3.

References

Baker, M. J. (2003). Les dialogues avec, autour et au travers des technologies éducatives. *L'Orientation Scolaire et Professionnelle, 32*(3), 359-397.

Harrer, A., Vetter, M., Thür, S., Brauckmann, J. (2005) Discovery of Patterns in Learner Actions. In *Proc. of Artificial Intelligence in Education (AIED)*, IOS Press, Amsterdam, pp. 816-818.

Schwarz, B. B. & Glassner, A. (in press). The role of CSCL argumentative environments for broadening and deepening understanding of the space of debate. In R. Saljo (Ed.), *Information Technologies and Transformation of Knowledge*.

Walton, D. N. (1989). Informal *Logic: a handbook for critical argumentation*. Cambridge: Cambridge University Press.

Wegerif, R., & Mercer, N. (1997). Using computer-based text analysis to integrate quantitative and qualitative methods in the investigation of collaborative learning. *Language and Education, 11*(4), 271-287.