Providing Law Students with Intelligent Tools for Structuring and Systematizing Alternative Dispute Resolution in Learning Systems

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Abstract. *The aim of this paper is to propose a computer-generated methodology to assist law students to practice mediation in an alternative dispute resolution class. The approach's strategy is to structure and to systematize parties' discourses providing the learner capabilities to clarify semantic inconsistencies, to clean speech contradictions, and to identify gaps and ambiguities. The learner can explore the ill-defined domains in a constructivist manner by classifying and distinguishing concepts, reasoning logically, elaborating hypotheses and inquiries. A case study was performed from a hypothetical conflict situation related to a commercial dispute.*

1. Introduction

Alternative Dispute Resolution (ADR) refers to procedures for settling disputes by other means than litigation, such as Arbitration and Mediation [Lodder and Walton 2005]. ADR can be seen as a social game where agents (players) are able to interact. In this context, ADR can be enhanced through the use of AI techniques. The work presented here is part of a research project that aims to provide law students with a set of AI tools to be used effectively in ADR domains. This set of AI tools support the students to play the roles of Mediator, Conciliator and Arbitrator in order to help the two players to reach agreements with regard to their conflicts in a social game within the ADR context. ADR can be enhanced through the use of AI techniques.

There is a clear difficulty in teaching ADR skills to law students in a more practical approach. This work proposes a computer-generated methodology to systematize parties' discourses in a dispute resolution. The tool helps the learner to structure and to systematize the dialogues aiming to explain the conflicts.

The project of a reasoning frame and the legal domain share the concepts open-texture characteristic. Legal domain groups rarely have provable correct answers [Lynch et al. 2006]. Likewise, intelligent systems study groups have discussed the variety of ways in what a conceptualization can be structured and systematized [Brewster et al. 2004]. This is a strong clue to the hypotheses that conceptualizations can be used to represent ill-defined knowledge domains.

A case study, related to a commercial dispute, was performed from a hypothetical conflict situation to demonstrate that the conceptualization building process helps stimulating learners to clarify semantic inconsistencies, to clean speech contradictions, to identify gaps and ambiguities. The result allows the learner to draft the discourse in an organized roll of issues to be solved, and interests to be reached, as prescribed in ADR domain.

A model is proposed to build reasoning frames to support law students in these tasks, which, starting from parties' natural language speeches, uses a deep analyze parser including a grammatical and semantic parser, a formal concept analyzer, a synonymy handler and an ontology module.

An approach that has been investigated in legal domain is the Socratic Dialogue [Ashley et al. 2002] [Nobrega 2002]. Instead of telling the learners what is right or wrong, the teacher creates dialectic, through the use of questions, so that students analyze their own arguments having the opportunity to learn with their own contradictions.

This work presents a user-machine interaction methodology to build a reasoning frame starting from natural language text and the paper is organized as follows. The second section presents the learning conceptual model of the proposed solution, and the roles of the ADR process participants. The third section proposes an architecture to support the learner in an ADR context and a case study on a mediation context is performed. Final comments complete this paper.

2. Proposed Solution

In a cooperative working group environment, as proposed in the most recent distributed AI techniques, when agents start working on a problem, they have their own predefined conceptualization of the target context. When they try to communicate, they usually have trouble due to the differences in their conceptualizations. AI's approach to address this matter is to create a unique conceptualization (e.g. ontology, Figure 1(b)), common to all the agents involved, that they can share in order to communicate.

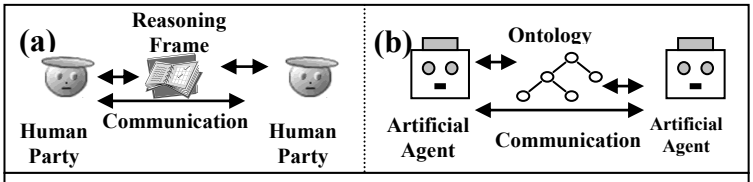


Figure 1. AI techniques brought to human learning domains. (a) Formalizing communication to understand parties. (b) Artificial Agents use ontologies to share information.

According to Langley [Langley et all 1987], the formation of taxonomy, qualitative laws of discovery and the building of structured models are discovery activities normally observed in scientific practice. It was observed that the conceptualization building process, itself, when brought from AI's world to human context (Figure 1(a)), as in ADR, clarifies the differences in the parties

conceptualizations and forces them to identify and eliminate gaps, inconsistencies and ambiguities, so that they can communicate to work cooperatively.

A learning conceptual model of LRFB[1] is shown in Figure 2. LRFB is a model to build conceptualizations in specifics problems. The learning process starts from a free text, and creates a thesaurus where synonymy is handled. Then, terms are disposed in a lattice according to their category relations. After that, a reasoning frame is built with their concept relation axioms. At any moment, the learner can return to the text to improve it. To accomplish this task, the learner has to follow a sequence of steps where he uses a set of abilities in each stage (Figure 2):

- The texts composition by the parties: to comprehend and explain concepts with their own words. To relate concepts with the context and expose knowledge, to remember, to organize and to integrate ideas.
- The thesaurus handling: to compare and to apply concepts to new situations, to evaluate concepts.
- The lattice visualizing and handling: to analyze and to systematize the texts, classifying and discerning ideas.
- The frame reasoning analysis and evaluation: to summarize the texts, to reason logically, to elaborate hypotheses, to clarify inconsistencies, gaps, ambiguities and contradictions.

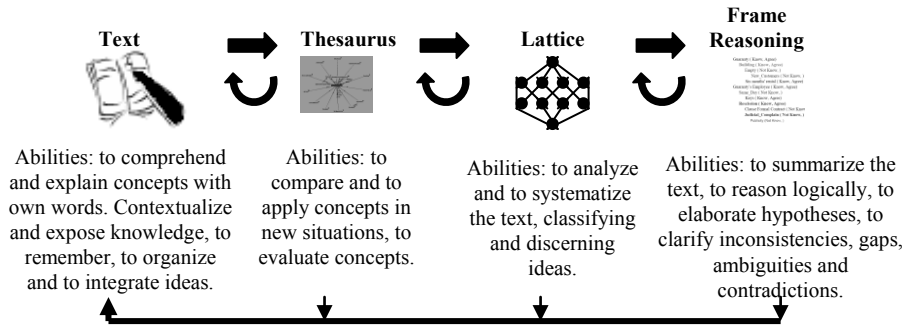


Figure 2. LRFB learning conceptual model. Interaction and iteration processes to build frame reasoning.

This process gives the leaner chances to develop analytical and design abilities of the discourse, and to reorganize ideas. The model has three purposes. (a) To help the learner to write clear texts, reducing ambiguities, contradictions and gaps. (b) To produce a diagrammatical form of text content. This helps the learner to understand the text content in a visual form. (c) To formalize the text content in a formal language, giving the agent conditions to infer the knowledge extracted from text.

The ADR process may be seen as a game, played by two or more parties, with or without assistance from a neutral third party, in which they all have a tool-bag, containing several kinds of computational tools, to help to reach an agreement.
That tool-bag could be compared to what [Lodder and Walton 2005] called the Fourth Party, to denote technology. In this scenery, participant's roles are (Figure 3):

1 LRFB stands for Learning through a Reasoning Frame Building process

- Parties that have a dispute and want to find a solution without going to court, probably worried with their relationship maintenance;
- Mediators chosen by parties to help when they are not able to reach agreement by themselves due to communication, emotional and/or perception issues, for example;
- Conciliators chosen by parties to help when they are not able to reach agreement by themselves due to some lack of information that the neutral experience could supply;
- Arbitrators chosen by parties to decide for them, when the issues involve complex technical matters and/or they have tried all the others ADR options, without success, but want to keep control of the resolution process.

Tools found on the bags could be: communication facilities, group calendar and scheduling programs, mailing list facilities, video conferencing software, argumentation and negotiation tools, information retrieval tools to help to understand their BATNAs[2], and others. LRFB is one of the tools on the bags presented in Figure 3. It supports the student who plays the role of a mediator.

LRFB aims to support and improve the mediation learner reasoning abilities. The first step is gathering information about the conflict. It begins with the parties describing the situation to the third party, the mediation learner. Parties tell the facts from their point of view. It is about reality, the way they see it. So, the facts that each party states have a different referential.

The stories they tell, at this moment, are usually impregnated with their emotions, as it is natural on human speeches. Emotional aspects of speech commonly are communicated by what is called, in negotiation theory, non-verbal language[3]. Besides, people frequently skip parts of the stories they tell, mainly if there are strong emotions involved. So, if examined alone, the verbal language will probably have a lot of gaps.

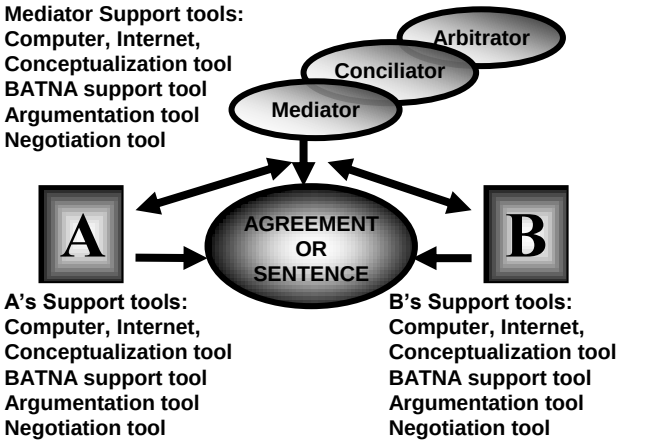


Figure 3. ADR roles and tools.

Words in natural language have some characteristics such as synonymy, ambiguity and inconsistency. All of these matters interfere with the parties'

2 BATNA stands for best alternative to a negotiated agreement: Before entering a negotiation process, one must be aware of the results he could obtain if the negotiations are not successful.

3 Gestures and body language.

understanding of the conflict and, consequently, with the resolution process. If they do not understand the issues, probably they will not be able to solve the conflict.

The mediation learner addresses this problem by dialogue. He talks to the parties about the facts, clarifying their points of view, trying to understand the other's, completing the gaps found, working to eliminate contradictions and ambiguities. The most important mediation technique teachers use to help is the Socratic dialogue. Through the use of questions, without giving "correct answers", they guide the parties to observe their contradictions and reformulate their visions, according to those perceptions. This is the first task the tool presented in this paper intends to support: learning how to help the parties to clarify their stories, so that they can have a common and complete understanding of the conflict.

The next step is to identify the issues to be solved and the interests the parties have. As people are much more familiar with Positional Bargaining, they generally talk in terms of positions, instead of in terms of interests, to protect themselves. It does not align with the solution building process. It is important to find out the real interests people are worried about.

At this point in negotiation procedure, parties dialogue about their dispute, aiming to find out their true interests related to each issue involved, so that they can build a clear roll of issues and interests. As he did before, a mediation learner could use the dialogue and the Socratic approach to help parties doing so. This is the second task the tool presented and is meant to support: organizing the conflict in terms of issues and interests (Figure 4). These tasks are of great help to solve the conflict. As Earl Nightingale once said a well-defined problem is already half solved. Based on these theories, this research aims to help mediation learner to organize issues and identify interests.

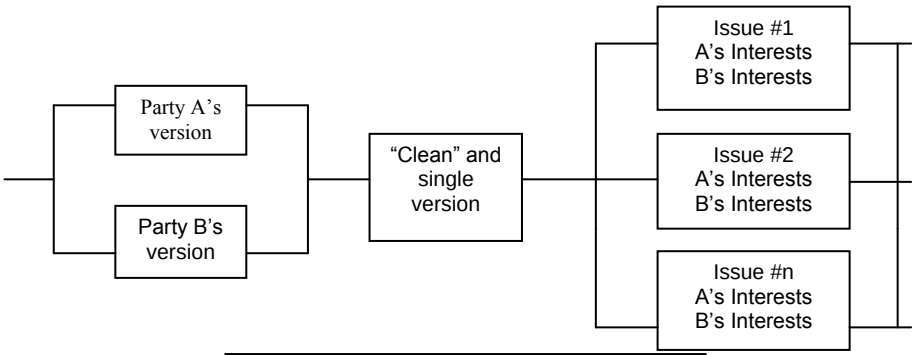


Figure 4. Tasks supported by the proposed tool.

3. LRFB Architecture to Case Study

Some diagrammatic knowledge bases conception approaches, e.g. Conceptual Sowa Graphs [Sowa 2000], try to reproduce the totality knowledge extracted from texts in natural language. This paper's approach uses the two representation formats, diagram and text, in a complementary way, taking advantage of the benefits each one can offer. In a diagram a single word identifies a concept that normally appears several times in the text. This helps to remove ambiguities in speech. A hierarchic organization (taxonomy) also helps to remove inconsistencies and gaps from the text. On the other

hand, in natural language, speech appears in an organized sequence, forming a rhetoric that facilitates the contextual understanding of the knowledge it expresses (pragmatic).

Making an analogy between these two forms of representation: a photo (as text) is able to express all details, providing sensation; the map (as a diagram) shows the geographic position of places and their relative position to other references. Together, the sensation and the logical reasoning provide a better understanding of speech. For the dispute resolution process, both aspects are important: the cognitive learning and the behavioral one (e.g. attitudes and values).

The architecture is shown in Figure 5. The agent receives a text in natural language and transfers it to the inference engine. NLP Module makes a grammatical analysis (VISL[4]), separating the names, in its canonic form, in a column and the words consisting of verb groups in another column. The following items were considered names: object, numerals, adverbial and complement. Therefore the subject and adjective, for example, are treated as a unique name. The adverb of negation preceding a verb is concatenated to it. The article, preposition, conjunction and infinite marker are discarded. The NLP module gives personal conjunctions and pronouns special treatment - identifying the name to which the pronouns are related, and replacing it.

In this phase a lexicon is generated with terms related to the nouns and verbs. The artificial agent searches the WorldNet[5]. If it finds synonymous nouns in the text, it asks the learner to unify them. In case the learner approves the change, the system asks him to choose one of them to keep in the text. In the same step, the grammatical analyzer asks the student about any word it did not understand, it asks him to correct thus reducing possible errors.

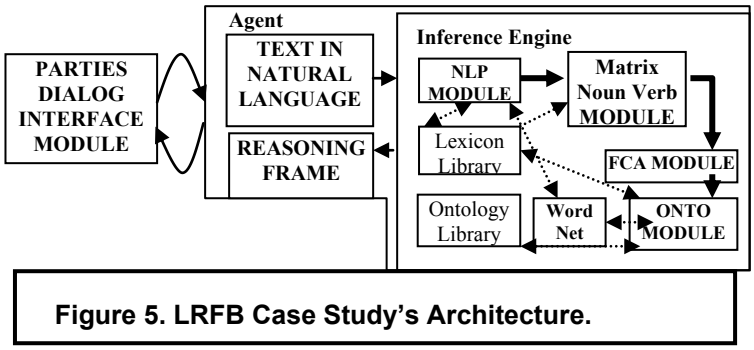


Figure 5. LRFB Case Study's Architecture.

The agent generates a matrix with the nouns, related to its verb groups. The inference machine transfers the generated matrix to the FCA[6] module where the nouns are treated as objects and the verbs as attributes.

The focus of this analysis is the speech, generating a lattice that reflects the relationship between objects and attributes and hierarchically organizing them by the number of times they have been cited. Objects are shown bottom-up and attributes are shown top-down.

4 [http://visl.sdu.dk/visl/en/]. The grammatical vocabulary used in this section refer to this site.
5 [http://wordnet.princeton.edu/]
6 FCA corresponds to Formal Concept Analysis [Priss 2004]

The inference machine sends the lattice to the Ontology Module. This module classifies the concepts according to the Agreement_Ontology (Figure 6), the *Verb_NotKnow*_Lexicon and the *Verb_Agree*_Ontology. The *Verb_NotKnow*_Lexicon contains the verbs considered determinative to classify the noun in the text as not_know.

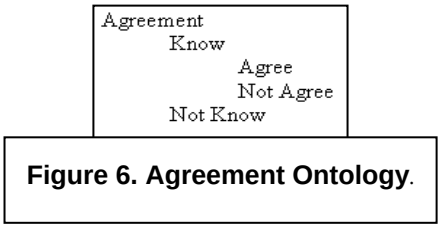


Figure 6. Agreement Ontology.

For example, the verb ignore is classified as *Verb_NotKnow*_Lexicon. In the *Verb_Agree*_Ontology, verbs are classified as *agree* or *not_agree*. When the verb is preceded by not, the inference machine inverts the final result. Thus, if a verb is extracted as *not_worry*, the agent first takes the not off, then infers that the verb worry corresponds to agree in the *Verb_Agree*_Ontology. It then inverts the result, classifying the extracted verb as *not_agree*.

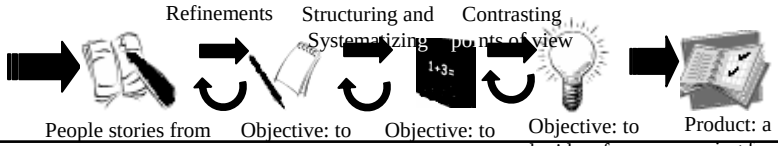
The agent only checks the *Verb_Agree*_Ontology if the verb is not in the *Verb_NotKnow*_Lexicon. If the verb is not found in lexicon or in ontology, the agent searches WordNet for a synonymous verb and classifies it according to Agreement_Ontology. However, if it does not find a synonym, the agent asks the learner to classify the verb.

The agent generates a reasoning frame for the learner, which evaluates it, modifying any necessary items in the interface. At this point, the learner contrasts the source text with the reasoning frame generated to eliminate ambiguities, inconsistencies and gaps. This is an interactive and iterative process, which goes on until the learner is satisfied with the result.

4. Case Study on a Mediation context

In this case study, on alternative dispute resolution context, the mediation learner is supported by LRFB. The goal is to endow the third neutral learner with an important ability to mediate a dispute: understanding and helping parties to understand their stories.

In the presented case [Murdock 2001], the two parties had previously tried a negotiation, without success, and had requested the help of a mediator. The mediation learner, after listening to each party's version of the conflict, generates two explanatory texts with the LRFB's support. Each one of the texts is generated under the point of view of the party. The texts building process follows the guidelines presented of Figure 7.



The refinement of the texts is an iterative process, where the learner's work is supported by LRFB with synonyms, pronouns and grammatical analysis, resulting in a cleaner text (Figure 8).

MARCOS

Marcos rented a building from Guaranty to run his business.
Two years after starting his business, he looked for a bigger place.
Marcos informed Guaranty's employee the rescission and gave him the keys. He didn't get a receipt.
Marcos was charged by Guaranty the debt for the six months' rental.
Marcos doesn't worry about formalities. He's worried about the quality.
So, he ignored the clause about formal rescission of the contract.
As he didn't agree with the debt he asked to negotiate with Guaranty's.

Figure 8. One of the texts composed by the mediation learner after the refinement stage.

LRFB uses FCA to organize the text, creating a lattice, as shown on Figure 9.

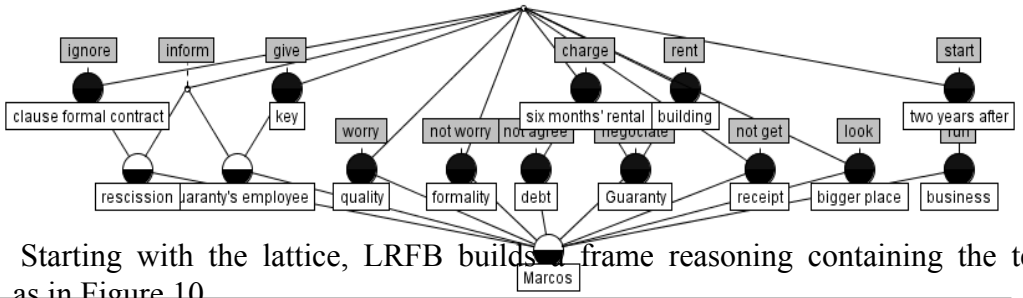


Figure 9. Text Lattice to represent Figure 9.

Starting with the lattice, LRFB builds a frame reasoning containing the text terms, as in Figure 10.

When concepts at one side are not present on the other side, they are imported from one text to another. In this case, the property_know is taken as Not_Know to the other side, and the property_Agree assumes nounless. To verify the veracity of the reasoning frame, the mediation learner presents parties the questions below and updates information:

- Property_know: Did you know about this concept?
- Property_agree: Do you agree with this concept?

The mediation learner uses the knowledge about these unknown facts on the frame to clarify party's point of view, looking for a common and complete understanding of the conflict. The properties Not_Agree are the issues identified by the mediation learner to be solved and the hierarchical relationships are the interests involved in negotiation. The differences in category level of concepts indicates to mediation learner the probable inconsistencies.

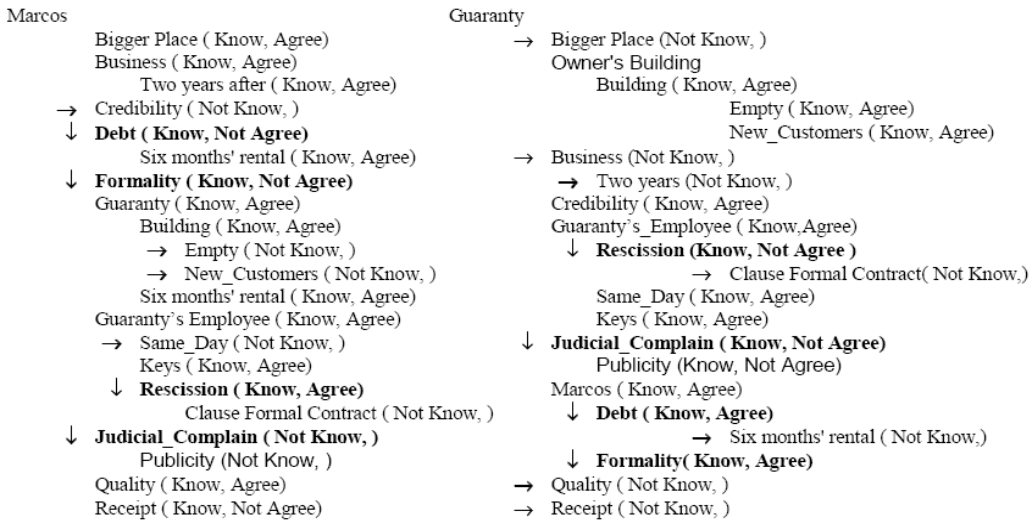


Figure 10. Frame reasoning produced by LRFB.
↓ Not Agree means issues to be solved.
→ Concepts imported from the other text.

5. Final Remarks

The first steps of a new approach to support ADR domain have been presented here. The use of the suggested LRFB model showed that elaborating two conceptualization structures clarifies the parties' different points of view, identifying hidden information, inconsistencies and ambiguities. It helps the mediation learner to conduct the Socratic dialogue to guide parties towards a better understanding of the conflict, their needs and interests. This is an important step towards reaching agreement.

The FCA used to organize hierarchically the speech matched the mediation learner needs, as it was applied to a simple example. The relation between verbs and nouns was enough to model the parties' stories. This research group is spending efforts to develop AI techniques to apply in Socratic dialogues and in the hierarchy structuring of the LRFB model. Results showed the need of more specific resources on grammatical analysis, better adapted to LRFB architecture. Newer NLP tolls are being studied to implement broader tests, aiming to reach more quantitative results. The role of the teacher is not presented in this work. In [Prata and Costa 2004] this issue is discussed with a framework to formative assessment of essays, and it has been adapted to ADR contexts.

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