

Thesis Proposal

Title

Group Argumentation System Considering the Affective Context and Satisfaction Evaluation

Abstract

One of the main factors to the success of an organization is the quality of the decisions that are made. The main goal of this research is to improve and assess that factor using Group Decision Support Systems (GDSS). It is intended to explore and study automatic negotiation mechanisms to leverage and facilitate the decision making by groups, namely the argumentation. More specifically we plan to model and simulate (using multi-agent systems) argumentative processes in GDSS, considering the affective context of the participants, and to measure the group and the participants satisfaction at the end of the decision making process. The purpose of the argumentative component is to support the negotiation process by automating it, making it faster and more efficient. The satisfaction analysis will take into account factors like: the problem, the preferences, the expectations and the affective context of the participants, allowing the understanding of the impact of the outcomes and of the process in each group element.

Background

The GDSS (Group Decision Support Systems) emerge with the aim of helping the group decision-making groups, supporting the decision-making process. According to Detmar and Renée a GDSS can be any technology used to improve the quality of group decision-making, the assumption is that GDSS can help groups reach higher quality decisions, stimulate more equitable and useful interactions, and reduce the negative aspects of small group decision-making [1]. Huber defines a Group Decision Support System as an interactive computer-based system that helps solving unstructured [2].

Another very important point in the history of GDSSs is the emergence of the need to examine the satisfaction with the use of such systems, with the process used and the results. Recent studies conducted over the last decade, have sought to understand the participants' satisfaction through the creation of some propositions and assumptions [3], of analysis of emotional spaces [4] and creating hypotheses [5][6].

The satisfaction with a decision resulting from a decision process is something that needs a complex analysis that involves multiple variables. Obviously the satisfaction is related to what we think a good decision is. But what is it a good decision? The classic answer to what makes a decision good concerns outcomes. A good decision has high outcome benefits (it is worthwhile) and low outcome costs (it is worth it) [7]. The benefits include the social benefits of a decision, such as those received from a "politically correct" or ingratiating decision. The costs of attaining the outcomes can also influence whether a decision is perceived as good. The outcome benefits have to be weighed against the costs of attaining the outcomes. The costs include not only the goods or services one must give in exchange for receiving the benefits but also the costs of the decision-making process itself [8]. It was suggested that a purely cognitive approach may be inadequate in modeling satisfaction ratings, so it is particularly important to include emotional variables [9][10][11].

Automatic negotiation can be defined as a discussion between two or more parties with the intent to reach an agreement [12] or seen as a distributed search in a space of possible agreements [13]. Bichler et al concluded that the negotiation is an iterative communication in the decision making process between two or more parties that are not able to reach their objectives from unilateral actions [14]. The automation of the

negotiation has many advantages such as increased efficiency and a faster achievement of an agreement, especially for common and repetitive situations. There are several forms of automatic negotiation depending on the situation in which negotiation partners are involved [15][16]. In particular, the automatic negotiation based on the argumentation allows the justification of refusing an offer to its partners or which part of the offer is problematic or incompatible, which is of particular importance in the context of this PhD work.

Goals

This PhD work aims to explore and study automatic negotiation mechanisms, in particular argumentative processes, to improve and facilitate the group decision making, by modeling, using multi-agent systems, argumentative processes based on argumentation in GDSS, considering the affective context of the participants and measuring the group and the participants' satisfaction at the end of the decision making process.

It is intended to create an argumentation model that considers the problem and the environment, using explanatory arguments, allowing a rational approach of easier perception to the decision makers. The way a GDSS performance influences the various dimensions of satisfaction will also be analyzed. In terms of decision process, different group performance indicators will be analyzed, such as: the decision time or the number of iterations, the complexity of the decision making and the associated affective context. Besides the importance of measuring the groups' satisfaction with the decision making process it is equally relevant to assess the satisfaction with the decision in terms of how much the final decision fits its expectation.

The main goals of this work are:

- To ascertain the state of the art in the following areas: decision processes, automatic negotiation based on argumentation, ubiquitous systems of GDSS and affective computing.
- To solve problems using argumentation, considering the problem and the environment; to create an argumentation model that allows its understanding by the decision maker and the interaction with the automation process;
- Analysis and structuring of metrics to measure the satisfaction with the decision according to the process and the decision itself. The influence of aspects such as the problem, the preferences, the expectations and the participants affective context will be explored;
- The use of arguments considering the satisfaction and the effect that the argument may have on the decision maker;
- Modeling the group decision making problematic using agent based systems considering the following requirements: argumentative faculties, capability of representing incomplete information and affective competences;
- Development of a prototype based in the proposed model, where the effects of the satisfaction with the decision and its connection with the participants' emotion and personality will be analyzed and evaluated.

Methodology

This PhD will continue and expand the work developed in the ISEP's (Instituto Superior de Engenharia do Porto) research center GECAD (Grupo de Investigação em Engenharia do Conhecimento e Apoio à Decisão) within the "ArgEmotionAgents" (POSI/EIA/56259/2004) and "GIGADESSEA" (PTDC/EGE-GES/108524/2008) projects, in the Group Decision Making and Group Decision Support Systems areas, with the scientific

coordination of Goreti Marreiros (ISEP/IPP), expert in GDSS and affective computing, and the participation of Paulo Novais (Universidade do Minho), expert in argumentation systems [18][19][20].

The environment to be developed is a Ubiquitous Group Decision Support System that shall be able to adequately represent each one of the meeting participants. These represented participants must be a “live” element in the environment since it is intended that the inferred knowledge about each intervenient becomes more assertive over time, using data from the several meeting processes that will exist.

This project aims at supporting the decision makers and enhancing the attainment of agreements, with the ability to measure the participants and the group satisfaction with the decision made and the underlying process.

Initially, the system must allow the modeling of the problem to the participants. At this stage it should be possible to gather all the information needed to understand the participant’s preferences in the typical questions of multi-criteria problems.

It is intended that each participant uses argumentative processes in the decision process, demonstrating and inducing the other participants to accept his points of view. The argumentative processes used by the agents must be well explained and understood by the participants, helping in the understanding of the process. The generation, selection and evaluation of arguments will take into account affective aspects such as: personality, emotions, mood and expectations. The negotiation process shall be automated, becoming faster and more efficient in the resolution of a certain problem.

At the end it should be able to measure each participant’s and the group satisfaction, taking into account the initial context and the process itself, being studied the influence of considering the satisfaction in the different facets of the group decision making processes.

This project aims to involve areas such as: Group Decision Support Systems, Ubiquitous Computing, Satisfaction Analysis, Argumentation (Automatic Negotiation) and Psychology aspects that characterize human beings, their attitudes and behaviors.

Its applicability in the context of the group decision making must be emphasized in addition to the development of theoretical models for the satisfaction analysis in argumentative processes

Work Plan

The objectives aforementioned will be achieved through the implementation of a research methodology based on the action. This method consists on identifying the problem and constructing hypothesis so the development can be planned. Subsequently the information is recompiled, organized and analyzed, creating a proposal to solve the identified problem. Finally, the results obtained during the research propel to the conclusions. In the context of this model six stages were defined to achieve the planned objectives. The defined stages are described next:

Phase 1: State of the art Duration: 6 months	Study of all the relevant architecture: automatic negotiation based on argumentation, decision satisfaction, Ubiquitous Group Decision Support System, Affective Computing and Psychology aspects that characterize human beings, their attitudes and behaviors. At the end of this phase technical reports with the conclusions drawn will be developed,
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	gathering the state of the research in these areas and the path to be followed, taking into account the existing flaws and the identified needs.
Phase 2: Model definition Duration: 5 months	Creation of the satisfaction and argumentation models that achieve the desired objectives. Its functioning and action sequences should be reasoned and object of reflection. A technical report will be developed for each model, describing how the model should be applied and why it should be applied in that way.
Phase 3: Models analysis and validation Duration: 5 months	To check if the models are using a proper procedure, they will be discussed with experts from other fields, namely from Psychology and Sociology. Opinions and advices that should be taken into account will be gathered.
Phase 4: Definition and implementation of the architecture Duration: 8 months	Definition and implementation of the architecture, taking into account the models developed in phases 2 and 3. To describe in detail the findings, at the end of this phase a technical report will be developed.
Phase 5: Tests and platform evaluation Duration: 6 months	The system developed in phase 4 will be tested with several case studies and the results validated. The system performance will also be analyzed to test its suitability. The thesis writing process will also start in this phase.
Phase 6: Analysis and diffusion of results Duration: 6 months	In this phase conclusions will be drawn according to the results obtained in the previous phase. Scientific papers will be written. Termination of the thesis writing process.

Conferences

European Conference on Artificial Intelligence – ECAI

Intelligent Environments – IE

Argumentation in Multi-Agent Systems – ArgMAS

Journals

IEEE Intelligent Systems – IS

Journal of Ambient Intelligence and Smart Environments – JAISE

Artificial Intelligence Review – AIR

References

1. Detmar, W., Renée, A.: Current and Future Uses of GDSS Technology: Report on a Recent Empirical Study (1988)

2. Huber, G. P.: Issues in the Design of Group Decision Support Systems, Vol. 8, No. 3, pp. 195-204, (1984)
3. Briggs, O., Vreede, G., Reinig, B.: A Theory and Measurement of Meeting Satisfaction (2002)
4. Tian, X., Hou, W., Yuan, K.: A Study on the Method of Satisfaction Measurement Based on Emotion Space (2008)
5. Souren, P., Priya, S., Ramamurthy, K.: User Satisfaction with System, Decision Process, and Outcome in GDSS Based Meeting: An Experimental Investigation (2004)
6. Carneiro, J., Santos, R., Marreiros, G., Laranjeira, J. A Theory to Measure Participant Satisfaction in a Meeting Supported by a GDSS. EPIA, Lisboa, Portugal (2011)
7. Higgins, E. T.: Making a Good Decision: Value From Fit (2000)
8. Babin, J. B., Griffin, M. The Nature of Satisfaction: An Update Examination and Analysis. Journal of Business Research 41, 127-136, New York, EUA (1998)
9. Liljander, V., Strandvik, T.: Emotions in Service Satisfaction, International Journal of Service Industry Management, 8(2), pp. 148-169 (1997)
10. Oliver, R. L., Rust, R. T., Varki, S.: Customer Delight: Foudations Findings, and Managerial Insight, Journal of Retailing, 73(3), pp. 311-336 (1997)
11. Wirtz, J., Bateson, J. E. G.: Consumer Satisfaction with Services: Integrating the Environment Perspective in Services Marketing into the Traditional Disconfirmation Paradigm, Journal of Business Research, 44, pp. 55-66 (1999)
12. Kersten, G. E-negotiations: Towards engineering of technology-based social processes. Research Paper INR 02/04 InterNeg. 31 (2003)
13. Jennings, N.R., Faratin, P., Lomuscio, A.R., Parsons, S., Sierra, C. & Wooldridge, M.J. Automated negotiation: prospects, methods and challenges. Inter- national Journal of Group Decision and Negotiation, 10, 199-215. 11, 31, 33 (2001)
14. Bichler, M., Kersten, G. & Strecker, S. Toward a structured design of electronic negotiations. Group Decision and Negotiation, 12, 311- 335. 31 (2003)
15. Rosenschein, J. & Zlotkin, G. Rules of Encounter: Designing Conventions for Automated Negotiation Among Computers. MIT Press. 10, 31 (1994)
16. Rahwan, I.; Ramchurn, S.; Jennings, N.; McBurney, P.; Parsons, S. e Sonenberg, L. Argumentation-based negotiation. Knowledge Engineering Review, Vol. 18, No. 4, pp. 343-375 (2003)
17. Santos, R., Marreiros, G., Ramos, C., Neves, J., Bulas-Cruz, J. Using Personality Types to Support Argumentation. Lecture Notes in Computer Science vol 6057 pp. 292-304 (2010)
18. Novais P., Brito L., Neves J., Pre-Argumentative Reasoning, The Knowledge-Based Systems Journal, vol. 18 N° 2-3, pp 79-88, ISSN 0950-7051, Elsevier Science BV (2005)
19. Marreiros, G., Santos, R., Ramos, C., Neves, J. Context-Aware Emotion-Based Model for Group Decision Making. IEEE Intelligent Systems, March 2010 , pp. 31-39 (2010)
20. Marreiros, G., Santos, R., Ramos, C., Neves, J., Novais, P., Machado, J., Bulas-Cruz, J. Ambient Intelligence in Emotion Based Ubiquitous Decision Making. Artificial Intelligence Techniques for Ambient Intelligence, pp. 86-91, IJCAI'07 - Twentieth International Joint Conference on Artificial Intelligence. Hyderabad, India, 6 a 12 Janeiro de (2007)

Research Unit

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