Aydogan, R.; Sánchez Anguix, V.; Julian Inglada, VJ.; Broekens, J.; Jonker, C. (2014). Computational approaches for conflict resolution in decision making: New advances and developments. Cybernetics and Systems. 45(3):217-221. doi:10.1080/01969722.2014.894844.

Computational Approaches for Conflict Resolution in Decision Making: New Advances and Developments

Reyhan Aydogan[1], Victor Sanchez[2] , Vicente Julian[2] , Joost Broekens[1] and Catholijn Jonker[1]

[1]*Department of Intelligent Systems, Delft University of Technology (TU-Delft), Delft, The Netherlands*

[2]*Departament de Sistemes Informatics i Computacio, Universitat Politecnica de Valencia, Spain*

R.Aydogan@tudelft.nl,{sanguix, vinglada}@dsic.upv.es, joost.broekens@gmail.com, C.M.Jonker@tudelft.nl

COnflict REsolution in DEcision MAking

Conflict is an omnipresent phenomenon in human society. It spans from individual decision making trade-offs such as deciding what to do next (sleep, eat, work, play), to complex scenarios including politics and business. The social sciences, psychology, economy and biology study the nature of conflict, its consequences, and strategies to successfully deal with it. Over the last decades computer science has joined those disciplines and studies conflict from a computational perspective. This special issue presents a selection of the best papers presented at the First Workshop of Conflict Resolution in Decision Making (COREDEMA). The workshop focussed on computational approaches that tackle conflict in order to provide new insights and explore potential applications. The workshop was jointly hosted with the 12th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS), in Salamanca, Spain, from 4th to 6th June 2013..

Keywords: Intelligent Systems; Decision Making; Negotiation; Conflict resolution; Agreement Technologies; Artificial Intelligence

1. Introduction

Conflict is a ubiquitous phenomenon and arises in many areas of our lives. It arises and needs to be dealt with in social settings, such as a group of friends deciding on a vacation or contract negotiation in business and politics [1], as well as in individual settings related to action selection (e.g., how to weigh one's preferences and decide what product to buy) . Even if we are not aware of it, we are continuously facing conflict and attempting to solve it. Conflict resolution has a crucial role in life evidenced by the broad range of disciplines involved in studying it, including psychology [2], management sciences [3], game theory [4], and biology [5].

Recently, computer science, and more specifically artificial intelligence, has emerged as a new source of scholarly works in conflict resolution. The interest of artificial intelligence in conflict resolution lies in diverse reasons.

Firstly, computational systems have gradually shifted towards a distributed paradigm where heterogeneous entities with different goals can enter and leave the system dynamically and interact with each other. The World Wide Web, virtual organizations, and multi-agent systems are examples of this kind of open systems [6,7]. Given the heterogeneity and self-interest of participant entities, conflict is an inevitable phenomenon to arise. For instance, dynamic bandwidth allocation in congested networks [23], and resource or task allocation problem in distributed system [24] are good examples of such conflict. Therefore, computational conflict resolution mechanisms (e.g., agreement technologies [8]) are needed in order to ensure the accomplishment of the global system goal.

Secondly, conflict resolution in human settings is not an easy task. As humans, we have limited reasoning capabilities and even though emotions can play a constructive role in conflict, more often than not we are biased in our judgements by emotions and other psychological factors [9, 20]. Computational approaches can contribute to help humans handle scenarios in which conflict arises. For instance, computational models can be used to advise humans in conflict scenarios, and they can be used to provide predictions about real conflict situations whose insights may be used by humans [10,11, 21]. As another example, buyers and sellers need to decide on the specific characteristics of their contracts in an electronic marketplace [22], and members of a virtual organization may have different sub-goals that at some point may be incompatible with the actions of others.

Despite the fact that computational approaches for conflict resolution have mainly emerged in the last decades, scholars have been prolific with the variety of methods proposed to solve this ubiquitous phenomenon. Different communities have emerged with conflict resolution as their main research goal. For instance, automated negotiation approaches have been proposed as set of algorithms and protocols whose mission is providing effective deals in electronic marketplaces [12,13,14]. Researchers in argumentation aim to solve conflicts by means of dialogue games, speech particles and information rebuttal [16]. Researchers in multi agent systems use computational models for conflict resolution in cooperation mechanisms for multi-robot settings [17]. In these scenarios, robots have to carry out tasks to achieve a global goal. Conflict may be present when the action of one robot disables the actions of another robot. Therefore, coordination and cooperation mechanism are of extreme importance. Decision support systems have also been proposed as software tools that help human negotiators reach an agreement in real world settings [18]. Furthermore, scholars in computational social choice have studied how groups of agents may decide, as fairly as possible, over a set of possible outcomes [19].

This editorial presents a selection of the best papers presented at the 1st Workshop of Conflict Resolution in Decision Making (COREDEMA), which was jointly organized with the 12th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS), in Salamanca, Spain, from 4th to 6th June. This workshop was the first attempt to gather different scholars from multiple areas of knowledge tackling conflict resolution.

The first selected article, from Del Val et al., presents a mechanism that combines incentives and local structural changes to promote cooperation in service discovery. The work also analyzes different strategies to distribute incentives among

agents. The results show that, even in scenarios where the predominant behavior is not collaborative, cooperation emerges.

The second article, from Pablo G. Esteban and David Ríos Insua, provides a framework to support the decision making process of a robotic agent when it interacts with other agents and users. The proposal avoids the common knowledge game theoretic assumptions.

The third article, from Pierpaolo Dondio, presents a probabilistic argumentation framework to compute the probability of acceptance of arguments under grounded and preferred semantics. Specifically, the author proposes an algorithm which allows the study of the sensitivity to changes in presence of reinstatement.

The fourth article, from Marco Gomes et al., is based on the hypothesis that the attitude of a human user during a negotiation process can be inferred from context information, and that this information could be used to provide feedback to the users in order to guide them to a more successful outcome. In this sense, it presents an empirical study that attempts to explore the role of stress in the negotiation style and, thus, on the negotiation dynamics. With that purpose, the work also includes an infrastructure that allows capturing different low level reactions from negotiators. Hence, this work contributes to the understanding of how electronic systems can help real negotiators.

The fifth article, from Alberola et al., focuses on how intelligent storage systems can be built to achieve optimal configurations in the smart grid. In more detail, authors propose a self-configuration mechanism in order to provide distributed energy storage systems with intelligent storage for improving the efficiency level. This mechanism focuses on determining which devices are charging and supplying energy to the system at each moment. The objective of this process is aimed at scheduling the supplying and charging periods in order to reduce the costs for purchasing the energy demanded.

To sum up, this special issue presents articles that deal with conflict in a variety of ways. We have contributions that propose computational systems that aid to solve conflict between humans (Gomes et al.), contributions that study how to solve conflict between argumentation agents (Dondio), works that study how decisions should be taken at the individual level by software agents (Esteban and Rios), and contributions show how conflict should be solved in computational systems composed of a large number of self-interested entities (Del Val et al., and Alberola et al.).

Acknowledgements

The editors would like to thank all the people that helped to bring about COREDEMA 2013 and, specially, the editors of the Cybernetics & Systems journal. First of all, thanks to the authors for ensuring the richness of the workshop and the members of the program committee for their professionalism and dedication. Furthermore, we owe particular gratitude to the PAAMS organizing committee.

References

[1] Browder, G. (2000), 'An analysis of the negotiations for the 1995 mekong agreement', International Negotiation 5(2), 237–261.

[2] De Dreu, C. K., Beersma, B., Steinel, W., & Van Kleef, G. A. (2007). The psychology of negotiation: Principles and basic processes.

[3] Thomas, K. W. (1992). Conflict and conflict management: Reflections and update. Journal of Organizational Behavior, 13(3), 265-274.

[4] Shoham, Y. and Leyton-Brown, K. (2008), Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press

[5] Thierry, B., Aureli, F., Nunn, C.L., Petit, O., Abegg, C. , and de Waal, F. B.M. (2008), “A comparative study of conflict resolution in macaques: insights into the nature of trait covariation”, Animal Behaviour 75(3), 847- 860.

[6] Argente, E., Botti, V., Carrascosa, C., Giret, A., Julian, V., & Rebollo, M. (2011). An abstract architecture for virtual organizations: The THOMAS approach. Knowledge and Information Systems, 29(2), 379-403.

[7] Wooldridge, M. (2009), An Introduction to Multiagent Systems, John Wiley & Sons, Ltd.

[8] Sierra, C., Botti, V., & Ossowski, S. (2011). Agreement computing. KI-Künstliche Intelligenz, 25(1), 57-61.

[9] Van Kleef, G. A., De Dreu, C. K., & Manstead, A. S. (2004). The interpersonal effects of emotions in negotiations: a motivated information processing approach. Journal of personality and social psychology, 87(4), 510.

[10] Core, M., Traum, D., Lane, H. C., Swartout, W., Gratch, J., Van Lent, M., & Marsella, S. (2006). Teaching negotiation skills through practice and reflection with virtual humans. Simulation, 82(11), 685-701.

[11] Ziebart, B., Dudík, M., Gordon, G., Sycara, K., Adair, W., & Brett, J. (2012, January). Identifying culture and leveraging cultural differences for negotiation agents. In System Science (HICSS), 2012 45th Hawaii International Conference on (pp. 618-627). IEEE.

[12] Jennings, N. R., Faratin, P., Lomuscio, A. R., Parsons, S., Wooldridge, M. J., and Sierra, C. (2001). Automated negotiation: prospects, methods and challenges. Group Decision and Negotiation, 10(2), 199-215.

[13] Parsons, S., Rodriguez-Aguilar, J. A., & Klein, M. (2011). Auctions and bidding: A guide for computer scientists. ACM Computing Surveys (CSUR),43(2), 10.

[14] Sanchez-Anguix, V., Julian, V., Julian, Botti, V., Botti and García-Fornes, A., Tasks for agent-based negotiation teams: Analysis, review, and challenges, Engineering Applications of Artificial Intelligence, Volume 26, Issue 10, November 2013, Pages 2480-2494.

[15] Marsa-Maestre, I., Klein, M., Jonker, C. M., and Aydoğan, R. (2013), "From problems to protocols: Towards a negotiation handbook, Decision Support Systems", 2013.

[16] Rahwan, I., Ramchurn, S. D., Jennings, N. R., Mcburney, P., Parsons, S., & Sonenberg, L. (2003). Argumentation-based negotiation. The Knowledge Engineering Review, 18(04), 343-375.

[17] Tambe, M., Bowring, E., Jung, H., Kaminka, G., Maheswaran, R., Marecki, J., ... & Varakantham, P. (2005, July). Conflicts in teamwork: Hybrids to the rescue. In Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems (pp. 3-10). ACM.

[18] Foroughi, A. (2011). A survey of the use of computer support for negotiation.Journal of Applied Business Research (JABR), 11(2), 121-134.

[19] Chevaleyre, Y., Endriss, U., Lang, J. and Maudet, N. (2007). A Short Introduction to Computational Social Choice. In SOFSEM 2007: Theory and Practice of Computer Science (pp. 51-69). Springer Berlin Heidelberg

[20] Broekens, J., Jonker, C. M., & Meyer, J.-J. C. (2010). Affective negotiation support systems. J. Ambient Intell. Smart Environ., 2(2), 121-144.

[21] Broekens, J., Harbers, M., Brinkman, W.-P., Jonker, C., Bosch, K., & Meyer, J.-J. (2012). Virtual Reality Negotiation Training Increases Negotiation Knowledge and Skill. In Y. Nakano, M. Neff, A. Paiva & M. Walker (Eds.), Intelligent Virtual Agents (Vol. 7502, pp. 218-230): Springer Berlin Heidelberg.

[22] He, M., Jennings, N. R., & Leung, H. F. (2003). On agent-mediated electronic commerce. Knowledge and Data Engineering, IEEE Transactions on, 15(4), 985-1003.

[23] Maillé, P., & Tuffin, B. (2004, March). Multibid auctions for bandwidth allocation in communication networks. In INFOCOM 2004. Twenty-third AnnualJoint Conference of the IEEE Computer and Communications Societies (Vol. 1). IEEE.

[24] Krainin, M., An, B., & Lesser, V. (2007, November). An application of automated negotiation to distributed task allocation. In Proceedings of the 2007 IEEE/WIC/ACM international conference on intelligent agent technology (pp. 138-145). IEEE Computer Society.