



ABCDE



Scientific Report

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Period of the fellowship	01/10/2011 to 30/09/2012

I – SCIENTIFIC ACTIVITY DURING THE FELLOWSHIP

During my ERCIM fellowship I was hosted by “Individual and Collective Reasoning” research group (ICR), which is the part of Computer Science and Communication research unit. My research was in the area of reasoning with inconsistent and uncertain information, computational models of argumentation theory, decision making and epistemic logic.

My main research results during the ERCIM fellowship (Oct 2011 – Sept 2012) can be resumed as follows:

*I studied the **link between argumentation-based and non argumentation-based reasoning**. By argumentation-based approach, we refer to a reasoning framework based on construction and evaluation of arguments. This line of research is important since it helps to better understand the result obtained by an argumentation-based approach and to explore its expressive power [publications 1 and 2]. I also worked on technical problems related to representing the knowledge in form of arguments, more particularly, **how to represent n-ary conflicts by a binary attack relation** between arguments [publication 3].*

*I participated in the development of an **on-line tool for argumentation-based decision making**. The software is still in the beta-testing phase, but it can be accessed online at thesynergy.org [publication 4].*

*I also worked on a **logical language to describe and reason about the beliefs of agents in a multi-agent system** where agents have different knowledge, more particularly, where every agent is aware of a different set of arguments [publication 5].*

The work in progress is a paper about how to make formal properties of argumentation theory more easily understandable for non-experts. This paper proposes to see acceptability of an argument as a game and studies the related computational complexity problems [publication 6 – in progress].

II – PUBLICATION(S) DURING THE FELLOWSHIP

Paperst published during the fellowship:

(1) Srdjan Vesic. *Maxi-Consistent Operator s in Argumentation*. In 20th European Conference on Artificial Intelligence, [ECAI 2012](#), Montpellier - France, 27-31 August 2012. Frontiers in Artificial Intelligence and Applications, IOS Press, 2012. [[pdf*](#)] [[bibtex](#)]

Abstract. This paper studies an instantiation of Dung-style argumentation system with classical propositional logic. Our goal is to explore the link between the result obtained by using argumentation to deal with an inconsistent knowledge base and the result obtained by using maximal consistent subsets of the same knowledge base. Namely, for a given attack relation and semantics, we study the question: does every extension of the argumentation system correspond to exactly one maximal consistent subset of the knowledge base? We study the class of attack relations which satisfy that condition. We show that such a relation must be conflict-dependent, must not be valid, must not be conflict-complete, must not be symmetric etc. Then, we show that some attack relations serve as lower or upper bounds with respect to the condition we study (e.g. we show that if an attack relation contains “canonical undercut” then it does not satisfy this condition). By using our results, we show for each attack relation and each semantics whether or not they satisfy the aforementioned condition. Finally, we interpret our results and discuss more general questions, like does (and when) this link is a desirable property. This work will help us obtain our long-term goal, which is to better understand the role of argumentation and, more particularly, the expressivity of logic-based instantiations of Dung-style argumentation frameworks.

(2) Srdjan Vesic, Leendert van der Torre. *Beyond Maxi-Consistent Argumentation Operators*. In 13th European Conference on Logics in Artificial Intelligence, [JELIA 2012](#), Toulouse - France, 26-28 September 2012. Lecture Notes in Artificial Intelligence / Lecture Notes in Computer Science, Springer, 2012. [[pdf*](#)] [[bibtex](#)]

Abstract. The question whether Dung’s abstract argumentation theory can be instantiated with classical propositional logic has drawn a considerable amount of attention among scientists in recent years. It was shown by Cayrol in 1995 that if *direct undercut* is used, then stable extensions of an argumentation system correspond exactly to maximal (for set inclusion) consistent subsets of the knowledge base from which the argumentation system was constructed. Until now, no other correspondences were found between the extensions of an argumentation framework and its knowledge base (except if preferences are also given at the input of the system). This paper’s contribution is twofold. First, we identify four intuitive conditions describing a class of attack relations which return extensions corresponding exactly to the maximal (for set inclusion) consistent subsets of the knowledge base. Second, we show that if we relax those conditions, it is possible to instantiate Dung’s abstract argumentation theory with

classical propositional logic and obtain a meaningful result which does not correspond to the maximal consistent subsets of the knowledge base used for constructing arguments. Indeed, we define a whole class of instantiations that return different results. Furthermore, we show that these instantiations are sound in the sense that they satisfy the postulates from argumentation literature (e.g. consistency, closure). In order to illustrate our results, we present one particular instantiation from this class, which is based on cardinalities of minimal inconsistent sets a formula belongs to.

(3) Martin Caminada and Srdjan Vesic. *On extended conflict-freeness in argumentation*. In 24th Benelux Conference on Artificial Intelligence, [BNAIC 2012](#), Maastricht - The Netherlands, 25-26 October 2012. [[pdf*](#)] [[bibtex](#)]

Abstract. This paper studies a possibility to represent n -ary conflicts within an argumentation framework having only binary attacks. We show that different instantiations of the abstract argumentation framework defined by Dung use very similar constructs for dealing with n -ary conflicts. We start by studying this procedure on two fully-instantiated systems from the argumentation literature and then show that it can also be formalised on the abstract level. We argue that this way of handling n -ary conflicts has two benefits. First, it allows to represent all the information within a standard argumentation framework, only by using arguments and attacks (e.g. without adding a new component to store the sets of conflicts). Second, all the added arguments have an intuitive interpretation, i.e. their meaning on the instantiated and on the abstract level is conceptually clear.

(4) Srdjan Vesic, Mykhailo Ianchuk and Andrii Rubtsov. *The Synergy: A Platform for Argumentation-Based Group Decision Making*. (extended abstract) In 4th International Conference on Computational Models of Argument, [COMMA 2012](#), Vienna - Austria, 10-12 September 2012. Frontiers in Artificial Intelligence and Applications, IOS Press, 2012. [[pdf*](#)] [[bibtex](#)]

Abstract. “The Synergy” is an on-line collaborative argument-based decision making platform. Our goal is to create a system allowing for both user-driven (the users themselves can vote “for” and “against” any particular option) and machine-driven (the system can propose an order of options based on the arguments provided by users) decision making. For the second option, we implemented existing and newly developed decision-making criteria. The basic concepts of our system are an option, a goal and an argument. An argument links an option with a goal. It can be in favour of or against an option and it can be attached a probability measure, which we believe is necessary for representing numerous scenarios in decision making under uncertainty. Our long term goal is to have pre-made answers for some general decisions: like Wikipedia collects data, we will collect PROS and CONS of possible decisions.

(5) François Schwarzentruber, Srdjan Vesic and Tjitze Rienstra. *Building an Epistemic Logic for Argumentation*. In 13th European Conference on Logics in Artificial Intelligence, [JELIA 2012](#), Toulouse - France, 26-28 September 2012. Lecture Notes in Artificial Intelligence / Lecture Notes in Computer Science, Springer, 2012. [[pdf*](#)] [[bibtex](#)]

Abstract. In this paper, we study a multi-agent setting in which each agent is aware of a set of arguments. The agents can discuss and persuade each other by putting forward arguments and

counter-arguments. In such a setting, what an agent will do, i.e. what argument she will utter, may depend on what she knows about the knowledge of other agents. For example, an agent does not want to put forward an argument that can easily be attacked, unless she believes that she is able to defend her argument against possible attackers. We propose a logical framework for reasoning about the sets of arguments owned by other agents, their knowledge about other agents' arguments, etc. We do this by defining an epistemic logic for representing their knowledge, which allows us to express a wide range of scenarios.

In preparation:

(6) Martin Caminada, Wolfgang Dvořák and Srdjan Vesic. *Preferred Semantics as Socratic Discussion*. To be submitted to an international journal.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

- *CMNA: 12th International Workshop On Computational Models of Natural Argument, August 27, 2012, Montpellier*
- *WL4AI: International Workshop on Weighted Logics for AI, August 28, 2012, Montpellier*
- *ECAI: European Conference on Artificial Intelligence, August 29-31, 2012, Montpellier*
- *COMMA: 4th International Conference on Computational Models of Argument, September 10-12, 2012, Vienna*
- *JELIA: 13th European Conference on Logics in Artificial Intelligence, September 26-28, 2012, Toulouse*

IV – RESEARCH EXCHANGE PROGRAMME (REP)

- First REP: Technical University of Vienna, Database and Artificial Intelligence Group, local host: Stefan Woltran, January 22-29, 2012
- Second REP: INRIA Sophia Antipolis, WIMMICS team, local host: Serena Villata, February 14-21, 2012.

My experience with REP is very positive. It allowed me to discover in more detail what type of research is done in the two teams I visited and to make contacts with many researchers. During my first visit, I worked with Stefan Woltran, Wolfgang Dvořák, Johannes Peter Wallner and Sarah Gaggl. During my second visit, I mostly worked with Serena Villata and Rakebul Hasan. I also had discussions with other team members (Maxime Lefrançois, Elena Cabrio, Nicolas Delaforge).