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# Logics in Artificial Intelligence

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# Preface

JELIA is the European Conference on Logics in Artificial Intelligence. The acronym actually stands for its French translation *Journées Européennes sur la Logique en Intelligence Artificielle*: the conference series started back in 1988 as a small workshop that was held in Roscoff, France. The theme of the workshop was the use of logic as a formal basis for theoretical and practical studies in artificial intelligence. Since then, the number of applications and their importance have grown significantly, and theory and methods of logic for artificial intelligence have evolved a lot. Many fields like theorem proving or belief revision have matured, while new domains such as description logic or answer set programming have emerged. As from the second meeting, JELIA has adopted English and has published its proceedings in Springer's LNAI series.

Over the last three decades, JELIA has been organized biennially in many European countries: three times in Germany, twice in the UK and Portugal, and once in the Netherlands, Italy, Spain, and Finland. This year JELIA finally returned to France, taking place in Toulouse, "*la ville rose*", September 26–28, 2012.

This volume contains the papers selected for presentation at JELIA 2012. Competition was very high this year. We received 107 submissions from 31 countries (97 regular papers and 10 system descriptions). Only 36 regular papers and 5 system descriptions were selected for inclusion in the proceedings. The program included three invited talks whose abstracts can be found below:

- Leila Amgoud and Philippe Besnard "Logical Limits of Dung's Abstract Argumentation Framework"
- Ulrich Furbach "Extensions of Hyper Tableaux"
- Wiebe van der Hoek "On Two Results in Contemporary Modal Logic: Local Definability and Succinctness"

Many people contributed to making JELIA 2012 a success. We would like to thank the authors of the 107 submitted papers, which were of high quality and covered a broad range of topics. We also would like to thank the PC members for their hard work, as well as all the additional experts who made it possible to achieve a thorough reviewing process within a rather short time frame. Thanks are also due to IRIT (Institut de Recherche en Informatique de Toulouse), CNRS (Centre National de la Recherche Scientifique), UPS (Université Paul Sabatier), and LEA IREP (French Spanish Laboratory for Advanced Studies in Information, Representation and Processing) for their financial support. A final word of thanks goes to the JELIA 2012 organizing committee, in particular to Véronique Debats and Sabyne Lartigue for their precious support.

September 2012

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# Invited Talks

**Leila Amgoud and Philippe Besnard (IRIT-CNRS, University of Toulouse, France), *Logical Limits of Dung's Abstract Argumentation Framework***

A Dung's abstract argumentation framework takes as input a set of arguments and a binary relation encoding attacks between these arguments, and returns arguments gathered in some so-called extensions. General indications lack on how to instantiate this setting from a logical formalism, i.e., how to build arguments from a given *logical* knowledge base and how to choose an appropriate attack relation. This leads in some cases to undesirable results like inconsistent extensions (i.e., the set of logical formulas underlying an extension is inconsistent). This is due to the gap between the abstract setting and the knowledge base from which it is specified.

We first propose to fill in this gap by extending Dung's framework. The idea is to consider all the ingredients involved in an argumentation problem. We start with the notion of an abstract monotonic logic which consists of a language (defining the formulas) and a consequence operator. We show how to build, in a systematic way, arguments from a knowledge base formalised in such a logic.

When starting from a logical knowledge base, this takes care of defining *the* arguments. As evidenced by the literature, it often happens that people take a *syntax-based* subset of the arguments and a specific attack relation to form an argumentation framework that they claim to capture the argumentative information represented in the logical knowledge base. We show that such need not be the case, in particular with the mostly overrated undercut relation.

**Ulrich Furbach (Department of Computer Science, University of Koblenz-Landau, Germany), *Extensions of Hyper Tableaux***

At JELIA 1996 Hyper Tableaux were introduced as a first order calculus which combined ideas from hyper resolution and tableaux calculi. The first part of this talk reviews a number of extensions, which are implemented in the prover E-KRHyper. One of them incorporates efficient equality handling by the use of an adapted version of the well known superposition inference rule. Other extensions include a form of negation as failure, PROLOG-like data structures and arithmetic and a unique name assumption. By using a transformation from the description logic $\mathcal{SHIQ}$ to DL-clauses the prover E-KRHyper can also be used as a decision procedure for $\mathcal{SHIQ}$. The second part of the talk depicts the embedding of E-KRHyper within the natural language question answering system loganswer.de. We discuss the requirements which stem from such a time critical and knowledge intensive application, and we discuss how such a system can be evaluated.

**Wiebe van der Hoek (Department of Computer Science, University of Liverpool, UK)** ***On Two Results in Contemporary Modal Logic: Local Definability and Succinctness***

In this invited talk, I present two kinds of results and methods in modal logic. The first concerns *local definability*, and is joint work with Hans van Ditmarsch and Barteld Kooi. In modal logic, when adding a syntactic property to an axiomatisation, this property becomes true in all models, in all situations, under all circumstances. For instance, adding a property like $K_a p \rightarrow K_b p$ (agent $b$ knows at least what agent $a$ knows) to an axiomatisation of some epistemic logic has as an effect that such a property becomes *globally* true, i.e., it will hold in all states, at all time points (in a temporal setting), after every action (in a dynamic setting) and after any communication (in an update setting), and every agent will know that it holds, it will even be common knowledge. We propose a way to express that a property like the above only needs to hold *locally*: it may hold in the actual state, but not in all states. We achieve this by adding relational atoms to the language that represent (implicitly) quantification over all formulas, as in $\forall p(K_a p \rightarrow K_b p)$. We show how this can be done for a rich class of modal logics and a variety of syntactic properties.

The second theme concerns that of succinctness, and is joint work with Tim French, Petar Iliev and Barteld Kooi. One way of comparing knowledge representation formalisms is in terms of *representational succinctness,* i.e., we can ask whether one of the formalisms allows for a more 'economical' encoding of information than the other. Proving that one language is more succinct than another becomes harder when the underlying semantics is stronger. We propose to use *Formula Size Games* (as put forward by Adler and Immerman), games that are played on two *sets* of models, and that directly link the *length* of play with the *size* of the formula. Using Formula Size Games, we prove the following succinctness results for $m$-dimensional modal logic: (1) on general Kripke models , a notion of 'everybody knows' makes the resulting language exponentially more succinct for $m > 1$; (2) on epistemic models, the same language becomes more succinct for $m > 3$, (3) the results for the language with 'everybody knows' also hold of a language with 'somebody knows', and (4) on epistemic models, Public Announcement Logic is exponentially more succinct than epistemic logic, if $m > 3$. The latter settles an open problem raised by Lutz.

# Table of Contents

## Regular Papers

## System Descriptions