Lecture Notes in Artificial Intelligence 7132

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel
   University of Alberta, Edmonton, Canada

Yuzuru Tanaka
   Hokkaido University, Sapporo, Japan

Wolfgang Wahlster
   DFKI and Saarland University, Saarbrücken, Germany

LNAI Founding Series Editor

Joerg Siekmann
   DFKI and Saarland University, Saarbrücken, Germany
Theory and Applications of Formal Argumentation

First International Workshop, TAFA 2011
Barcelona, Spain, July 16-17, 2011
Revised Selected Papers
Preface

Recent years have witnessed a rapid growth of interest in formal models of argumentation and their application in diverse sub-fields and domains of application of AI, including reasoning in the presence of inconsistency, non-monotonic reasoning, decision making, inter-agent communication, the Semantic Web, grid applications, ontologies, recommender systems, machine learning, neural networks, trust computing, normative systems, social choice theory, judgement aggregation and game theory, and law and medicine. Argumentation thus shows great promise as a theoretically grounded tool for a wide range of applications.

TAFA-11, the First International Workshop on Theory and Applications of Formal Argumentation, aimed at contributing to the realization of this promise, by promoting and fostering uptake of argumentation as a viable AI paradigm with wide-ranging application, and providing a forum for further development of ideas and the initiation of new and innovative collaborations.

We invited submission of papers on: formal theoretical models of argumentation and application of such models in (sub-fields of) AI; evaluation of models, both theoretical (in terms of formal properties of existing or new formal models) and practical (in concretely developed applications); theories and applications developed through inter-disciplinary collaborations. We received 32 submissions, of which we accepted 9 as full papers and 12 as short papers. Extended and improved versions of all full papers are included in these proceedings, as well as extended and improved versions of eight short papers that were re-reviewed after the workshop.

The papers included in these proceedings cover the following topics:

- Properties of formal models of argumentation
- Instantiations of abstract argumentation frameworks
- Relationships among different argumentation frameworks
- Practical applications of formal models of argumentation
- Argumentation and other artificial intelligence techniques
- Evaluation of formal models of argumentation
- Validation and evaluation of applications of argumentation

In addition to paper presentations, the workshop also included an extended panel session on the topic: “The future of argumentation: what is its added value and how we communicate this to researchers in the artificial intelligence community and beyond.” The panel was conducted by three influential researchers in the area of formal argumentation: Carlos Chesnevar (Universidad Nacional del Sur, Argentina), Martin Caminada (Université du Luxembourg, Luxembourg), and Stefan Woltran (Vienna University of Technology, Austria). The panelists
addressed and debated (with one another and the workshop participants) the following questions:

1. Which main challenges do we need to face for argumentation theory to have a real impact on applications?
2. Are any of the argumentation systems currently available ready for deployment?
3. Have we identified suitable “killer” applications already? If not, which direction should we look at for a “killer” application?
4. Do we need any further theoretical developments to pave the way toward applications and if so in which direction?
5. Which “industry” is most likely to be receptive to our methodologies/techniques?
6. Would it be useful to “team up” with any other field (in AI, or computer science, or elsewhere) in order to have a higher impact/more powerful techniques?

The panel stirred a lively debate among the 25 or so workshop participants. Passions often ran high: a testament not to fundamental divisions within the community, but rather a desire to ensure that “we get things right” and so realize the promise of argumentation.

December 2011

Sanjay Modgil
Nir Oren
Francesca Toni
Organization

TAFA-11 took place at the Universitat de Barcelona, Barcelona, Catalonia (Spain) during July 16–17, 2011, as a workshop at IJCAI-11, the 22nd International Joint Conference on Artificial Intelligence.

Workshop Chairs

Sanjay Modgil  
King’s College London, UK

Nir Oren  
University of Aberdeen, UK

Francesca Toni  
Imperial College London, UK

Program Committee

Leila Amgoud  
IRIT, Toulouse, France

Katie Atkinson  
University of Liverpool, UK

Pietro Baroni  
University of Brescia, Italy

Floris Bex  
University of Dundee, UK

Elizabeth Black  
University of Utrecht, The Netherlands

Guido Boella  
University of Turin, Italy

Ivan Bratko  
University of Ljubljana, Slovenia

Gerhard Brewka  
University of Leipzig, Germany

Martin Caminada  
University of Luxembourg, Luxembourg

Carlos Chesnevar  
Universidad Nacional del Sur, Argentina

Sylvie Doutre  
University of Toulouse 1, France

Phan Minh Dung  
Asian Institute of Technology, Thailand

Paul Dunne  
University of Liverpool, UK

Dov Gabbay  
King’s College London, UK

Massimiliano Giacomin  
University of Brescia, Italy

Tom Gordon  
Fraunhofer FOKUS, Germany

Anthony Hunter  
University College London, UK

Antonis Kakas  
University of Cyprus, Cyprus

Nicolas Maudet  
Université Paris Dauphine, France

Peter McBurney  
University of Liverpool, UK

Sanjay Modgil  
King’s College London, UK

Pavlos Moraitis  
Paris Descartes University, France

Timothy J. Norman  
University of Aberdeen, UK

Nir Oren  
University of Aberdeen, UK

Simon Parsons  
City University of New York, USA

Henry Prakken  
Utrecht University and University of Groningen, The Netherlands
VIII  Organization

Iyad Rahwan  Masdar Institute, UAE and Massachusetts Institute of Technology, USA
Chris Reed  University of Dundee, UK
Nicolas Rotstein  University of Aberdeen, UK
Guillermo Simari  Universidad Nacional del Sur, Argentina
Francesca Toni  Imperial College London, UK
Leon van der Torre  University of Luxembourg, Luxembourg
Serena Villata  University of Turin, Italy
Simon Wells  University of Dundee, UK
Stefan Woltran  Vienna University of Technology, Austria

Additional Referees

Mark Snaith

Sponsoring Institutions

TAFA-11 was endorsed by the Agreement Technologies COST action.
# Table of Contents

Theory and Applications of Formal Argumentation

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probabilistic Argumentation Frameworks</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
  *Hengfei Li, Nir Oren, and Timothy J. Norman* |
| Splitting Argumentation Frameworks: An Empirical Evaluation | 17 |
|  
  *Ringo Baumann, Gerhard Brewka, and Renata Wong* |
| On the Complexity of Computing the Justification Status of an Argument | 32 |
|  
  *Wolfgang Dvorák* |
| Arguments over Co-operative Plans | 50 |
|  
  *Rolando Medellin-Gasque, Katie Atkinson, Peter McBurney, and Trevor Bench-Capon* |
| An Implemented Dialogue System for Inquiry and Persuasion | 67 |
|  
  *Luke Riley, Katie Atkinson, Terry Payne, and Elizabeth Black* |
| An Argumentation Framework for Qualitative Multi-criteria Preferences | 85 |
|  
  *Wietske Visser, Koen V. Hindriks, and Catholijn M. Jonker* |
| Modeling and Solving AFs with a Constraint-Based Tool: ConArg | 99 |
|  
  *Stefano Bistarelli and Francesco Santini* |
| Resource Boundedness and Argumentation | 117 |
|  
  *Nicola D. Rotstein, Nir Oren, and Timothy J. Norman* |
| An Empirical Study of a Deliberation Dialogue System | 132 |
|  
  *Elizabeth Black and Katie Bentley* |
| Selective Revision by Deductive Argumentation | 147 |
|  
  *Patrick Krümpelmann, Matthias Thimm, Marcelo A. Falappa, Alejandro J. García, Gabriele Kern-Isberner, and Guillermo R. Simari* |
| A Three-Layer Argumentation Framework | 163 |
|  
  *Paulo Maio and Nuno Silva* |
| Stable Extensions in Timed Argumentation Frameworks | 181 |
|  
  *Maria Laura Cobo, Diego C. Martinez, and Guillermo R. Simari* |
## Table of Contents

Computing with Infinite Argumentation Frameworks: The Case of AFRAs .......................... 197

*Pietro Baroni, Federico Cerutti, Paul E. Dunne, and Massimiliano Giacomin*

Multi-sorted Argumentation ........................................ 215

*Tjitze Rienstra, Alan Perotti, Serena Villata, Dov M. Gabbay, and Leendert van der Torre*

Conditional Labelling for Abstract Argumentation ................. 232

*Guido Boella, Dov M. Gabbay, Alan Perotti, Leendert van der Torre, and Serena Villata*

Bottom-Up Argumentation ........................................ 249

*Francesca Toni and Paolo Torroni*

A First Step towards Argumentation Dialogues for Discovery .......... 263

*Xiuyi Fan and Francesca Toni*

**Author Index** .................................................. 281