

Christoph Benz Müller
Jens Otten
Revantha Ramanayake (Eds.)

Automated Reasoning in Quantified Non-Classical Logics

**5th International Workshop, ARQNL 2024,
Nancy, France, July 1st, 2024**

Proceedings

**Originally published online by
CEUR Workshop Proceedings (CEUR-WS.org)**

Preface

This volume contains the proceedings of the Fifth International Workshop on *Automated Reasoning in Quantified Non-Classical Logics* (ARQNL 2024), held July 1st, 2024, in Nancy, France. The workshop was affiliated and co-located with the *International Joint Conference on Automated Reasoning* (IJCAR 2024). The aim of the ARQNL 2024 Workshop has been to foster the development of proof calculi, automated theorem proving (ATP) systems and model finders for all sorts of quantified non-classical logics. The ARQNL workshop series provides a forum for researchers to present and discuss recent developments in this area.

Non-classical logics — such as modal logics, conditional logics, intuitionistic logic, description logics, temporal logics, linear logic, multivalued logic, dynamic logic, deontic logic, fuzzy logic, paraconsistent logic, relevance logic, free logic, natural logic — have many applications in Artificial Intelligence, Computer Science, Philosophy, Linguistics, and Mathematics. Hence, the automation of proof search in these logics is a crucial task. It is in particular the aim of the ARQNL workshop series to initiate and foster practical implementations and evaluations of such ATP systems for non-classical logics.

The ARQNL 2024 Workshop received eight paper submissions. Each paper was reviewed by at least three referees, and following an online discussion, all eight research papers were selected to be included in the proceedings. The ARQNL 2024 Workshop included invited talks by Didier Galmiche (“Separation Logics: Semantics and Proofs”) and Amir Akbar Tabatabai (“On the Computational Content of Intuitionistic Modal Proofs”).

We would like to sincerely thank the invited speakers, all authors for their contributions and all active participants of the ARQNL 2024 workshop. We would also like to thank the members of the Program Committee of ARQNL 2024 for their professional work in the reviewing process. Finally, we would like to acknowledge the support of the EasyChair conference management system.

Bamberg, Oslo and Groningen
July 2024

Christoph Benz Müller
Jens Otten
Revantha Ramanayake

Organization

Program Committee

Christoph Benz Müller	University of Bamberg, Germany – co-chair
Ana de Almeida Borges	University of Barcelona, Spain
Camillo Fiorentini	University of Milano, Italy
Marianna Girlando	University of Amsterdam, Netherlands
Andrzej Indrzejczak	University of Lodz, Poland
Annika Kanckos	University of Helsinki, Finland
Dominik Kirst	Ben-Gurion University, Israel
Timo Lang	University College London, UK
Tomer Libal	University of Luxembourg and Enidia AI
Larry Moss	Indiana University Bloomington, USA
Nicola Olivetti	Aix-Marseille University, France
Jens Otten	University of Oslo, Norway – co-chair
Xavier Parent	Vienna University of Technology, Austria
Revantha Ramanayake	University of Groningen, Netherlands – co-chair
Ramaswamy Ramanujam	Institute of Mathematical Sciences, Chennai, India

Editors & Workshop Chairs

Christoph Benz Müller
University of Bamberg (and Freie Universität Berlin)
E-mail: c.benzmueller@gmail.com
Web: <http://christoph-benzmueller.de>

Jens Otten
University of Oslo (and Potassco Solutions)
E-mail: jeotten@jens-otten.de
Web: <https://jens-otten.de>

Revantha Ramanayake
University of Groningen
E-mail: d.r.s.ramanayake@rug.nl
Web: <https://rug.nl/staff/d.r.s.ramanayake/>

Contents

Separation Logics: Semantics and Proofs <i>Didier Galmiche</i>	1–4
On the Computational Content of Intuitionistic Modal Proofs <i>Amir Akbar Tabatabai</i>	5
A Fresh Look at Relevant Number Theory <i>John Slaney</i>	6–13
Implementing Intermediate Logics <i>Bastiaan Haaksema, Jens Otten and Revantha Ramanayake</i>	14–23
Automated Proof Search in Intuitionistic Sentential Logic <i>Didier Galmiche, Brandon Hornbeck and Daniel Méry</i>	24–37
Implementing the Fatio Protocol for Multi-Agent Argumentation in LogiKey <i>Luca Pasetto and Christoph Benzmüller</i>	38–47
Bisquent Calculi for Neutral Free Logic with Definite Descriptions <i>Andrzej Indrzejczak and Yaroslav Petrukhin</i>	48–61
When Epsilon meets Lambda: Extended Leśniewski’s Ontology <i>Andrzej Indrzejczak</i>	62–79
On Regular Relations in Parametric Array Theories <i>Rodrigo Raya</i>	80–91
A Proof-Theoretical Approach to Some Extensions of First Order Quantification <i>Loïc Allègre, Ophélie Lacroix and Christian Retoré</i>	92–107