

25th International Symposium on Temporal Representation and Reasoning

TIME 2018, October 15–17, 2018, Warsaw, Poland

Edited by

**Natasha Alechina
Kjetil Nørvåg
Wojciech Penczek**



Editors

Natasha Alechina
University of Nottingham
UK
natasha.alechina@nottingham.ac.uk

Kjetil Nørvåg
NTNU
Norway
noervaag@ntnu.no

Wojciech Penczek
ICS PAS and UPH
Poland
penczek@ipipan.waw.pl

ACM Classification 2012

Theory of computation → Logic, Information systems → Temporal data, Computing methodologies → Knowledge representation and reasoning

ISBN 978-3-95977-089-7

Published online and open access by

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <http://www.dagstuhl.de/dagpub/978-3-95977-089-7>.

Publication date
October, 2018

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

License

This work is licensed under a Creative Commons Attribution 3.0 Unported license (CC-BY 3.0):
<http://creativecommons.org/licenses/by/3.0/legalcode>.

In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.



Digital Object Identifier: 10.4230/LIPIcs.TIME.2018.0

ISBN 978-3-95977-089-7

ISSN 1868-8969

<http://www.dagstuhl.de/lipics>

LIPICS – Leibniz International Proceedings in Informatics

LIPICS is a series of high-quality conference proceedings across all fields in informatics. LIPICS volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

Editorial Board

- Luca Aceto (*Chair*, Gran Sasso Science Institute and Reykjavik University)
- Susanne Albers (TU München)
- Christel Baier (TU Dresden)
- Javier Esparza (TU München)
- Michael Mitzenmacher (Harvard University)
- Madhavan Mukund (Chennai Mathematical Institute)
- Anca Muscholl (University Bordeaux)
- Catuscia Palamidessi (INRIA)
- Raimund Seidel (Saarland University and Schloss Dagstuhl – Leibniz-Zentrum für Informatik)
- Thomas Schwentick (TU Dortmund)
- Reinhard Wilhelm (Saarland University)

ISSN 1868-8969

<http://www.dagstuhl.de/lipics>

Contents

Preface <i>Natasha Alechina, Kjetil Nørvåg, and Wojciech Penczek</i>	0:xiii
Invited Papers	
On Temporal and Separation Logics <i>Stéphane Demri</i>	1:1–1:4
Database Technology for Processing Temporal Data <i>Michael H. Böhlen, Anton Dignös, Johann Gamper, and Christian S. Jensen</i>	2:1–2:7
Model Checking Strategic Ability – Why, What, and Especially: How? <i>Wojciech Jamroga</i>	3:1–3:10
Regular Papers	
Predicting the Evolution of Communities with Online Inductive Logic Programming <i>George Athanasopoulos, George Paliouras, Dimitrios Vogiatzis, Grigoris Tzortzis, and Nikos Katzouris</i>	4:1–4:20
Extending Fairness Expressibility of ECTL ⁺ : A Tree-Style One-Pass Tableau Approach <i>Alexander Bolotov, Montserrat Hermo, and Paqui Lucio</i>	5:1–5:22
Results on Alternating-Time Temporal Logics with Linear Past <i>Laura Bozzelli, Aniello Murano, and Loredana Sorrentino</i>	6:1–6:22
Extracting Interval Temporal Logic Rules: A First Approach <i>Davide Bresolin, Enrico Cominato, Simone Gnani, Emilio Muñoz-Velasco, and Guido Sciavicco</i>	7:1–7:15
Faster Dynamic Controllability Checking for Simple Temporal Networks with Uncertainty <i>Massimo Cairo, Luke Hunsberger, and Romeo Rizzi</i>	8:1–8:16
Extending Conditional Simple Temporal Networks with Partially Shrinkable Uncertainty <i>Carlo Combi and Roberto Posenato</i>	9:1–9:16
On Restricted Disjunctive Temporal Problems: Faster Algorithms and Tractability Frontier <i>Carlo Comin and Romeo Rizzi</i>	10:1–10:20
Algebraic Operators for Processing Sets of Temporal Intervals in Relational Databases <i>Andreas Dohr, Christiane Engels, and Andreas Behrend</i>	11:1–11:16
Deciding the Consistency of Branching Time Interval Networks <i>Marco Gavanelli, Alessandro Passantino, and Guido Sciavicco</i>	12:1–12:15

25th International Symposium on Temporal Representation and Reasoning (TIME 2018).
Editors: Natasha Alechina, Kjetil Nørvåg, and Wojciech Penczek



LIPICS

Leibniz International Proceedings in Informatics

Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

A Game-Theoretic Approach to Timeline-Based Planning with Uncertainty <i>Nicola Gigante, Angelo Montanari, Marta Cialdea Mayer, Andrea Orlandini, and Mark Reynolds</i>	13:1–13:17
Sound-and-Complete Algorithms for Checking the Dynamic Controllability of Conditional Simple Temporal Networks with Uncertainty <i>Luke Hunsberger and Roberto Posenato</i>	14:1–14:17
Reducing ϵ -DC Checking for Conditional Simple Temporal Networks to DC Checking <i>Luke Hunsberger and Roberto Posenato</i>	15:1–15:15
On the Expressive Power of Hybrid Branching-Time Logics <i>Daniel Kernberger and Martin Lange</i>	16:1–16:18
A Temporal Logic for Modelling Activities of Daily Living <i>Malte S. Kließ, Catholijn M. Jonker, and M. Birna van Riemsdijk</i>	17:1–17:15
GSM+T: A Timed Artifact-Centric Process Model <i>Julius Köpke, Johann Eder, and Jianwen Su</i>	18:1–18:15
Learning Qualitative Constraint Networks <i>Malek Mouhoub, Hamad Al Marri, and Eisa Alanazi</i>	19:1–19:13
A Stream Reasoning System for Maritime Monitoring <i>Georgios M. Santipantakis, Akrivi Vlachou, Christos Doulkeridis, Alexander Artikis, Ioannis Kontopoulos, and George A. Vouros</i>	20:1–20:17
An Empirical Study on Bidirectional Recurrent Neural Networks for Human Motion Recognition <i>Pattreeya Tanisaro and Gunther Heidemann</i>	21:1–21:19
Population Based Methods for Optimising Infinite Behaviours of Timed Automata <i>Lewis Tolonen, Tim French, and Mark Reynolds</i>	22:1–22:22
Computational Complexity of a Core Fragment of Halpern-Shoham Logic <i>Przemysław Andrzej Walega</i>	23:1–23:18

Preface

The 25th International Symposium on Temporal Representation and Reasoning (TIME 2018), held 15–17 October 2018 in Warsaw, Poland, was hosted by the Institute of Computer Science of the Polish Academy of Sciences.

TIME is a well-established symposium series which brings together researchers interested in reasoning about temporal aspects of information in all areas of computer science. The symposium has a wide remit and is devoted to both theoretical aspects and well-founded applications. One of the key aspects of the symposium is its interdisciplinarity, with attendees from different areas such as artificial intelligence, database management, logic and verification, and beyond.

Following the call for papers of TIME 2018, a total of 27 full papers were submitted. Each submitted paper was reviewed by at least three, in exceptional circumstances two, members of the program committee, and the reviews were followed by an additional discussion to select among those papers. The members of the program committee and the external reviewers did an excellent job that enabled a high-quality selection process, and we thank them for their commitment and dedication. In the end, 20 papers were selected for publication in the proceedings and presentation at the symposium. In addition to the contributed talks, this year's program featured three invited speakers: Stéphane Demri (LSV, CNRS & ENS de Cachan, France), Johann Gamper (Free University of Bozen-Bolzano, Italy), and Wojciech Jamroga (Institute of Computer Science, PAS, Warsaw, Poland). We are delighted that they were able to accept our invitation, and grateful for their contribution.

These are the second TIME proceedings published in the Dagstuhl/LIPIcs series. We would like to thank dr. Wagner and the LIPIcs team for all the help and support. Finally, we would like to thank the following organizations for patronage and sponsoring the event: Institute of Computer Science PAS, Committee of Informatics of the Polish Academy of Sciences, and NaviParking.

Natasha Alechina
Kjetil Nørvåg
Wojciech Penczek



25th International Symposium on Temporal Representation and Reasoning (TIME 2018).

Editors: Natasha Alechina, Kjetil Nørvåg, and Wojciech Penczek



LIPICS

Leibniz International Proceedings in Informatics

Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

■ Organization

Program Committee Chairs

- Natasha Alechina (University of Nottingham, UK)
- Kjetil Nørvåg (Norwegian University of Science and Technology, Norway)
- Wojciech Penczek (ICS PAS, Poland)

Program Committee

- Patricia Bouyer (CNRS, Cachan, France)
- Christos Doulkeridis (University of Piraeus, Greece)
- Rajeev Gore (Australian National University, Australia)
- Fabio Grandi (University of Bologna, Italy)
- Keijo Heljanko (Aalto University, Finland)
- Adam Jatowt (Kyoto University, Japan)
- Marcin Jurdziński (University of Warwick, UK)
- Roman Kontchakov (Birkbeck, University of London, UK)
- Martin Lange (University of Kassel, Germany)
- Francois Laroussinie (LIAFA, Univ. Paris 7, CNRS, France)
- Aniello Murano (University of Napoli "Federico II", Italy)
- Doron Peled (Bar Ilan University, Israel)
- R. Ramanujam (Institute of Mathematical Sciences, Chennai, India)
- Peter Z. Revesz (University of Nebraska-Lincoln, USA)
- Mark Reynolds (University of Western Australia, Australia)
- Sven Schewe (University of Liverpool, UK)
- Renate A. Schmidt (University of Manchester, UK)
- Kostas Stefanidis (University of Tampere, Finland)
- Andrzej Szałas (Warsaw University, Poland, and University of Linköping, Sweden)
- Kristian Torp (Aalborg University, Denmark)
- Bożena Woźna-Szcześniak (Jan Długosz University, Częstochowa, Poland)
- Bin Yang (Aalborg University, Denmark)
- Neil Yorke-Smith (TU Delft, The Netherlands)

Local Organizers

- Wojciech Penczek (ICS PAS, Poland) - Chair
- Michał Ciesiolka (ICS PAS, Poland)
- Waldemar Ślonina (ICS PAS, Poland)
- Teofil Sidoruk (ICS PAS, Poland)
- Jan Ziolkowski (ICS PAS, Poland)

25th International Symposium on Temporal Representation and Reasoning (TIME 2018).

Editors: Natasha Alechina, Kjetil Nørvåg, and Wojciech Penczek



LIPICS Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

List of Authors

Alexander Bolotov
University of Westminster
United Kingdom
A.Bolotov@wmin.ac.uk

Hamad Al Marri
University of Regina
Canada
almarrih@uregina.ca

Eisa Alanazi
Um Al Qura University
Saudi Arabia
eaanazi@uqu.edu.sa

Natasha Alechina
University of Nottingham
United Kingdom
natasha.alechina@nottingham.ac.uk

Alexander Artikis
University of Piraeus and NCSR
“Demokritos”
Greece
a.artikis@unipi.gr

George Athanasopoulos
University of Athens
Greece
gathanas@di.uoa.gr

Andreas Behrend
University of Bonn
Germany
behrend@cs.uni-bonn.de

Michael H. Böhlen
University of Zurich
Switzerland
boehlen@ifi.uzh.ch

Laura Bozzelli
University of Napoli “Federico II”
Italy
lr.bozzelli@gmail.com

Davide Bresolin
University of Padova
Italy
davide.bresolin@unipd.it

Massimo Cairo
University of Trento
Italy
massimo.cairo@unitn.it

Marta Cialdea Mayer
University of Roma Tre
Italy
cialdea@ing.uniroma3.it

Carlo Combi
University of Verona
Italy
carlo.combi@univr.it

Carlo Comin
University of Verona
Italy
carlo.comin.86@gmail.com

Enrico Cominato
University of Udine
Italy
enrico.cominato@gmail.com

Stéphane Demri
CNRS
France
demri@lsv.fr

Anton Dignös
Free University of Bozen-Bolzano
Italy
dignoes@inf.unibz.it

Andreas Dohr
University of Bonn
Germany
andreas.dohr@uni-bonn.de

Christos Doulkeridis
University of Piraeus
Greece
cdoulk@unipi.gr

Johann Eder
University of Klagenfurt
Austria
johann.eder@aau.at

25th International Symposium on Temporal Representation and Reasoning (TIME 2018).
Editors: Natasha Alechina, Kjetil Nørvåg, and Wojciech Penczek



LIPICS Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Christiane Engels
University of Bonn
Germany
engelsc@cs.uni-bonn.de

Tim French
The University of Western Australia
Australia
tim.french@uwa.edu.au

Johann Gamper
Free University of Bozen-Bolzano
Italy
gamper@inf.unibz.it

Marco Gavanelli
University of Ferrara
Italy
marco.gavanelli@unife.it

Nicola Gigante
University of Udine
Italy
gigante.nicola@spes.uniud.it

Simone Gnani
University of Ferrara
Italy
simone.gnani@student.unife.it

Gunther Heidemann
University of Osnabrueck
Germany
gheidema@uni-osnabrueck.de

Montserrat Hermo
University of the Basque Country
Spain
montserrat.hermo@ehu.eus

Luke Hunsberger
Vassar College, Poughkeepsie
USA
hunsberger@vassar.edu

Wojciech Jamroga
Institute of Computer Science, Polish
Academy of Sciences
Poland
w.jamroga@ipipan.waw.pl

Christian S. Jensen
Aalborg University
Denmark
csj@cs.aau.dk

Catholijn M. Jonker
Delft University of Technology
The Netherlands
c.m.jonker@tudelft.nl

Nikos Katzouris
NCSR “Demokritos”
Greece
nkatz@iit.demokritos.gr

Daniel Kernberger
University of Kassel
Germany
daniel.kernberger@uni-kassel.de

Malte S. Kließ
Delft University of Technology
The Netherlands
m.s.kliess@tudelft.nl

Julius Köpke
University of Klagenfurt
Austria
julius.koepke@aau.at

Ioannis Kontopoulos
NCSR “Demokritos”
Greece
ikon@iit.demokritos.gr

Martin Lange
University of Kassel
Germany
martin.lange@uni-kassel.de

Paqui Lucio
University of the Basque Country
Spain
paqui.lucio@ehu.eus

Angelo Montanari
University of Udine
Italy
angelo.montanari@uniud.it

Malek Mouhoub
University of Regina
Canada
mouhoubm@uregina.ca

Emilio Muñoz-Velasco
University of Malaga
Spain
ejmunoz@uma.es

Aniello Murano
University of Napoli “Federico II”
Italy
murano@na.infn.it

Kjetil Nørvåg
Norwegian University of Science and
Technology
Norway
noervaag@ntnu.no

Andrea Orlandini
National Research Council - ISTC
Italy
andrea.orlandini@istc.cnr.it

George Paliouras
NCSR “Demokritos”
Greece
paliourg@iit.demokritos.gr

Alessandro Passantino
University of Ferrara
Italy
alessandr.passantino@student.unife.it

Wojciech Penczek
Institute of Computer Science, Polish
Academy of Sciences and Siedlce University
Poland
penczek@ipipan.waw.pl

Roberto Posenato
University of Verona
Italy
roberto.posenato@univr.it

Mark Reynolds
The University of Western Australia
Australia
mark.reynolds@uwa.edu.au

M. Birna van Riemsdijk
Delft University of Technology
The Netherlands
m.b.vanriemsdijk@tudelft.nl

Romeo Rizzi
University of Verona
Italy
romeo.rizzi@univr.it

Georgios M. Santipantakis
University of Piraeus
Greece
gsant@unipi.gr

Guido Sciavicco
University of Ferrara
Italy
guido.sciavicco@unife.it

Loredana Sorrentino
University of Napoli “Federico II”
Italy
loredana.sorrentino@unina.it

Jianwen Su
University of California at Santa Barbara
USA
su@cs.ucsb.edu

Pattreeya Tanisaro
University of Osnabrueck
Germany
pattanisaro@uni-osnabrueck.de

Lewis Tolonen
The University of Western Australia
Australia

Grigorios Tzortzis
NCSR “Demokritos”
Greece
gtzortzi@iit.demokritos.gr

Akrivi Vlachou
University of Piraeus
Greece
avlachou@unipi.gr

Dimitrios Vogiatzis
NCSR “Demokritos”
Greece
dimitrv@iit.demokritos.gr

Przemysław A. Wałęga
University of Warsaw and University of
Oxford
Poland, United Kingdom
p.a.walega@gmail.com

