Lecture Notes in Computer Science 13266

Founding Editors

Gerhard Goos
Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis
Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino
Purdue University, West Lafayette, IN, USA

Wen Gao
Peking University, Beijing, China

Bernhard Steffen
TU Dortmund University, Dortmund, Germany

Moti Yung
Columbia University, New York, NY, USA

More information about this series at https://link.springer.com/bookseries/558

Pascal Caron · Ludovic Mignot (Eds.)

Implementation and Application of Automata

26th International Conference, CIAA 2022 Rouen, France, June 28 – July 1, 2022 Proceedings

Springer

Editors
Pascal Caron
UFR. des Sciences et Techniques
University of Rouen
Saint-Étienne du Rouvray Cedex, France

Ludovic Mignot
UFR. des Sciences et Techniques
University of Rouen
Saint-Étienne du Rouvray Cedex, France

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-031-07468-4 ISBN 978-3-031-07469-1 (eBook)
https://doi.org/10.1007/978-3-031-07469-1

© Springer Nature Switzerland AG 2022
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The 26th International Conference on Implementation and Application of Automata (CIAA 2022) was organized by the Groupe de Recherche Rouennais en Informatique Fondamentale (GR^2IF) and the Laboratoire d'Informatique, de Traitement de l'Information et des Systèmes (LITIS) of the Université de Rouen Normandie. The conference took place during June 28 to July 1, 2022.

The CIAA conference series brings together researchers in the field of automata theory and implementation and allows the dissemination of results in these research areas.

This volume of Lecture Notes in Computer Science contains the scientific papers presented at CIAA 2022. The volume also includes extended abstracts of the three invited talks presented by Markus Holzer, Nelma Moreira and Yo-Sub Han, we wish to warmly thank.

The 16 regular papers were selected from 26 submissions covering various fields in the application, implementation, and theory of automata and related structures. Each paper was reviewed by three Program Committee members with the assistance of external referees and thoroughly discussed by the Program Committee.

Papers were submitted by authors from the following countries: Canada, France, Germany, Israel, Japan, Poland, Russia, Slovakia, South Africa, South Korea, Sweden, Taiwan, Turkey, United Kingdom, United States of America.

We wish to thank everybody who contributed to the success of this conference: the authors for submitting their carefully prepared manuscripts, the Program Committee members and external referees for their valuable judgment of the submitted manuscripts, and the invited speakers for their excellent presentations of topics related to the theme of the conference. Last but not least, we would like to express our sincere thanks to the local organizers Solène Guérin, Jean-Gabriel Luque, Florent Nicart and Bruno Patrou.

April 2022

Pascal Caron
Ludovic Mignot

Organization

Organization Committee

Pascal Caron (Chair)	Université de Rouen Normandie, France
Jean-Gabriel Luque	Université de Rouen Normandie, France
Ludovic Mignot	Université de Rouen Normandie, France
Florent Nicart	Université de Rouen Normandie, France
Bruno Patrou	Université de Rouen Normandie, France

Program Committee Chairs

Pascal Caron	Université de Rouen Normandie, France
Ludovic Mignot	Université de Rouen Normandie, France

Steering Committee

Markus Holzer (Chair)	Justus Liebig University Giessen, Germany
Oscar Ibarra	University of California, USA
Sylvain Lombardy	Institut Polytechnique de Bordeaux, France
Nelma Moreira	University of Porto, Portugal
Kai T. Salomaa (Vice-chair)	Queen's University, Canada
Hsu-Chun Yen	National Taiwan University, Taiwan

Program Committee

Marie-Pierre Béal	Université Paris-Est Marne-la-Vallée, France
Francine Blanchet-Sadri	University of North Carolina, USA
Cezar Câmpeanu	University of Prince Edward Island, Canada
Pascal Caron	Université de Rouen Normandie, France
Jan Daciuk	Gdańsk University of Technology, Poland
Mike Domaratzki	University of Manitoba, Canada
Emmanuel Filiot	Université Libre de Bruxelles, Belgium
Yo-Sub Han	Yonsei University, South-Korea
Jan Holub	Czech Technical University in Prague, Czech Republic
Markus Holzer	University of Giessen, Germany
Jarkko Kari	University of Turku, Finland
Galina Jiraskova	Slovak Academy of Sciences, Slovakia

Markus Lohrey	University of Siegen, Germany
Sylvain Lombardy	Institut Polytechnique de Bordeaux, France
Andreas Maletti	University of Leipzig, Germany
Sebastian Maneth	University of Bremen, Germany
Ludovic Mignot	Université de Rouen Normandie, France
Dirk Nowotka	University of Kiel, Germany
Alexander Okhotin	St. Petersburg State University, Russia
Giovanni Pighizzini	University of Milan, Italy
Daniel Reidenbach	Loughborough University, UK
Rogério Reis	University of Porto, Portugal
Michel Rigo	University of Liege, Belgium
Kai Salomaa	Queen's University, Canada
Shinnosuke Seki	University of Electro-Communications, Japan
Jeffrey Shallit	University of Waterloo, Canada
Bruce Watson	Stellenbosch University, South Africa
Hsu-Chun Yen	National Taiwan University, Taiwan

Additional Reviewers

Fan Feng
Pamela Fleischmann
Hermann Gruber
Sang-Ki Ko
Florent Koechlin
Dominik Köppl
Martin Kutrib
Thierry Lecroq
Jean-Gabriel Luque
Nelma Moreira
Štěpán Plachý
Luca Prigioniero
Gabriele Puppis
Narad Rampersad
Andrew Ryzhikov
Lena Katharina Schiffer
Hiroyuki Seki
Kevin Stier
Marek Szykuła
Matthias Wendlandt
Sarah Winter

Contents

Invited Lectures

On 25 Years of CIAA Through the Lens of Data Science 3
Hermann Gruber, Markus Holzer, and Christian Rauch

Manipulation of Regular Expressions Using Derivatives: An Overview 19
Nelma Moreira and Rogério Reis

How to Settle the ReDoS Problem: Back to the Classical Automata Theory 34
Sicheol Sung, Hyunjoon Cheon, and Yo-Sub Han

Conference Papers

Ordered Context-Free Grammars 53
Brink van der Merwe and Martin Berglund

Symbolic Weighted Language Models, Quantitative Parsing and Automated Music Transcription 67
Florent Jacquemard and Lydia Rodriguez de la Nava

A Similarity Measure for Formal Languages Based on Convergent Geometric Series 80
Florian Bruse, Maurice Herwig, and Martin Lange

Hybrid Tree Automata and the Yield Theorem for Constituent Tree Automata 93
Frank Drewes, Richard Mörbitz, and Heiko Vogler

Some Results Concerning Careful Synchronization of Partial Automata and Subset Synchronization of DFA's 106
Jakub Ruszil

A Toolkit for Parikh Matrices 116
Laura K. Hutchinson, Robert Mercaş, and Daniel Reidenbach

Syntax Checking Either Way 128
Martin Kutrib and Uwe Meyer

On the Power of Pushing or Stationary Moves for Input-Driven Pushdown Automata 140
Martin Kutrib, Andreas Malcher, and Matthias Wendlandt

The Cut Operation in Subclasses of Convex Languages (Extended Abstract) ... 152
Michal Hospodár and Viktor Olejár

Variations of the Separating Words Problem 165
Nicholas Tran

Homomorphisms on Graph-Walking Automata 177
Olga Martynova and Alexander Okhotin

Nondeterministic State Complexity of Site-Directed Deletion 189
Oliver A. S. Lyon and Kai Salomaa

Energy Complexity of Regular Language Recognition 200
Öykü Yılmaz, Fırat Kıyak, Meriç Üngör, and A. C. Cem Say

Real-Time, Constant-Space, Constant-Randomness Verifiers 212
Özdeniz Dolu, Nevzat Ersoy, M. Utkan Gezer, and A. C. Cem Say

Constrained Synchronization for Monotonic and Solvable Automata and Automata with Simple Idempotents 225
Stefan Hoffmann

An Ambiguity Hierarchy of Weighted Context-Free Grammars 238
Yusuke Inoue, Kenji Hashimoto, and Hiroyuki Seki

Author Index 251