

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Oscar H. Ibarra Bala Ravikumar (Eds.)

Implementation and Application of Automata

13th International Conference, CIAA 2008
San Francisco, California, USA, July 21-24, 2008
Proceedings



Springer

Volume Editors

Oscar H. Ibarra
University of California
Department of Computer Science
Santa Barbara, CA 93106, USA
E-mail: ibarra@cs.ucsb.edu

Bala Ravikumar
Sonoma State University
Department of Computer Science
Rohnert Park, CA 94928, USA
E-mail: ravi@cs.sonoma.edu

Library of Congress Control Number: 2008930486

CR Subject Classification (1998): F.1.1-3, F.4.2-3, F.2

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743
ISBN-10 3-540-70843-X Springer Berlin Heidelberg New York
ISBN-13 978-3-540-70843-8 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2008
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12442324 06/3180 5 4 3 2 1 0

Preface

The 13th International Conference on Implementation and Application of Automata (CIAA 2008) was held at San Francisco State University, San Francisco, July 21–24, 2008.

This volume of *Lecture Notes in Computer Science* contains the papers that were presented at CIAA 2008, as well as the abstracts of the poster papers that were displayed during the conference. The volume also includes the paper/extended abstract of the four invited talks presented by Markus Holzer, Kai Salomaa, Mihalis Yannakakis, and Hsu-Chun Yen.

The 24 regular papers were selected from 40 submissions covering various topics in the theory, implementation, and applications of automata and related structures. Each submitted paper was reviewed by at least three Program Committee members, with the assistance of external referees. The authors of the papers and posters presented in this volume come from the following countries: Australia, Belgium, Canada, China, Columbia, Czech Republic, France, Germany, Hungary, Italy, Japan, The Netherlands, Poland, Portugal, Romania, Russia, Spain, Sweden, Taiwan, United Arab Emirates, and USA.

We wish to thank all who made this conference possible: the authors for submitting papers, the Program Committee members and external referees (listed in the proceedings) for their excellent work, and the four invited speakers. Finally, we wish to express our sincere appreciation to the sponsors, local organizers, and the editors of the *Lecture Notes in Computer Science* series and Springer, in particular Alfred Hofmann, for their help in publishing this volume in a timely manner.

July 2008

Oscar H. Ibarra
Bala Ravikumar

Organization

Program Committee

John Brzozowski	University of Waterloo, Canada
Cristian Calude	The University of Auckland, New Zealand
Erzsébet Csuha-j-Varjú	Hungarian Academy of Sciences, Hungary
Jean-Marc Champarnaud	Université de Rouen, France
Volker Diekert	Universität Stuttgart, Germany
Omer Egecioglu	University of California, Santa Barbara, USA
Rusins Freivalds	University of Latvia, Latvia
Rudolf Freund	Vienna University of Technology, Austria
Dora Giammarresi	University of Rome, Italy
Jozef Gruska	Masaryk University, Czech Republic
Tero Harju	Academy of Finland, Finland
Jan Holub	Czech Technical University of Prague, Czech Republic
Juraj Hromkovic	RWTH Aachen, Germany
Oscar H. Ibarra (Co-chair)	University of California, Santa Barbara, USA
Lucian Ilie	University of Western Ontario, Canada
Masami Ito	Kyoto Sangyo University, Japan
Kazuo Iwama	Kyoto University, Japan
Juhani Karhumäki	University of Turku, Finland
Nils Klarlund	AT&T Labs-Research, USA
Jarkko Kari	University of Turku, Finland
Martin Kutrib	Universität Giessen, Germany
Sebastian Maneth	University of New South Wales, Australia
Denis Maurel	Université de Tours, France
Giancarlo Mauri	Università degli Studi di Milano - Bicocca, Italy
Mehryar Mohri	Courant Institute of Mathematical Sciences, USA
Andrei Paun	Louisiana Tech University, USA
Giovanni Pighizzini	Universita degli Studi di Milano, Italy
R. Ramanujam	Institute of Mathematical Sciences, India
Bala Ravikumar (Co-chair)	Sonoma State University, USA
Wojciech Rytter	Warsaw University, Poland
Jacques Sakarovitch	Ecole nationale supérieure des telecommunications, France
Jeffrey Shallit	University of Waterloo, Canada
Nicholas Tran	Santa Clara University, USA
Bruce Watson	University of Pretoria, Republic of South Africa
Mikhail Volkov	Ural State University, Russia
Sheng Yu	University of Western Ontario, Canada

Additional Reviewers

Cyril Allauzen
Marcella Anselmo
Abdullah Arslan
Marie-Pierre Beal
Daniela Besozzi
Hans-Joachim Boeckenhauer
Pawel Baturo
Mikolaj Bojanczyk
Cezar Campeanu
Maxime Crochemore
Jan Daciuk
Paul Gastin
Zsolt Gazdag
Jens Gloeckler
Csanad Imreh
Christos Kapoutsis
Felix Klaedtke
Andreas Klein
Tomi Krki
Manfred Kufleitner
Ratnesh Kumar
Kamal Lodaya
Gerhard Lischke
Maria Madonia
Francesco Ranzato
Kalle Saari
Kai Salomaa
Nicolae Santean
Helmut Seidl
Ayumi Shinohara
Magnus Steinby
Sara Woodworth
Hsu-Chun Yen

Organizing Committee

Omer Egecioglu	University of California, Santa Barbara, USA
Oscar H. Ibarra	University of California, Santa Barbara, USA
Bala Ravikumar	Sonoma State University (Chair), USA
Nicholas Tran	Santa Clara University, USA

Proceedings Committee

Oscar H. Ibarra University of California, Santa Barbara, USA
Bala Ravikumar Sonoma State University, Rohnert Park, USA

Publicity Committee

Andrei Paun Louisiana Tech University, USA

Steering Committee

Jean-Marc Champarnaud Université de Rouen, France
Oscar H. Ibarra University of California, Santa Barbara, USA
Denis Maurel Université de Tours, France
Derick Wood Hong Kong Univ. of Science and Technology,
 Hong Kong
Sheng Yu (Chair) University of Western Ontario, Canada

Sponsoring Organizations

Citrix Systems Inc., Fort Lauderdale, USA
ELC Technologies, Santa Barbara, USA
Google Inc., Mountain View, USA
Sonoma State University, Rohnert Park, USA
University of California, Santa Barbara, USA

Table of Contents

Invited Lectures

Nondeterministic Finite Automata—Recent Results on the Descriptional and Computational Complexity	1
<i>Markus Holzer and Martin Kutrib</i>	
Language Decompositions, Primality, and Trajectory-Based Operations	17
<i>Kai Salomaa</i>	
Automata, Probability, and Recursion	23
<i>Mihalis Yannakakis</i>	
Concurrency, Synchronization, and Conflicts in Petri Nets	33
<i>Hsu-Chun Yen</i>	

Technical Contributions

Automated Compositional Reasoning of Intuitionistically Closed Regular Properties	36
<i>Yih-Kuen Tsay and Bow-Yaw Wang</i>	
Antimirov and Mosses's Rewrite System Revisited	46
<i>Marco Almeida, Nelma Moreira, and Rogério Reis</i>	
Antichain-Based Universality and Inclusion Testing over Nondeterministic Finite Tree Automata	57
<i>Ahmed Bouajjani, Peter Habermehl, Lukáš Holík, Tayssir Touili, and Tomáš Vojnar</i>	
Testing Whether a Binary and Prolongeable Regular Language L Is Geometrical or Not on the Minimal Deterministic Automaton of $\text{Pref}(L)$	68
<i>J.-M. Champarnaud, J.-Ph. Dubernard, and H. Jeanne</i>	
Hopcroft's Minimization Technique: Queues or Stacks?	78
<i>Andrei Păun, Mihaela Păun, and Alfonso Rodríguez-Patón</i>	
Learning Regular Languages Using Nondeterministic Finite Automata	92
<i>Pedro García, Manuel Vázquez de Parga, Gloria I. Álvarez, and José Ruiz</i>	

Multi-Return Macro Tree Transducers	102
<i>Kazuhiro Inaba, Haruo Hosoya, and Sebastian Maneth</i>	
Computing Convex Hulls by Automata Iteration	112
<i>François Cantin, Axel Legay, and Pierre Wolper</i>	
A Translation from the HTML DTD into a Regular Hedge Grammar	122
<i>Takuya Nishiyama and Yasuhiko Minamide</i>	
Tree-Series-to-Tree-Series Transformations	132
<i>Andreas Maletti</i>	
Automata-Theoretic Analysis of Bit-Split Languages for Packet Scanning	141
<i>Ryan Dixon, Ömer Egecioglu, and Timothy Sherwood</i>	
Pattern Matching in DCA Coded Text	151
<i>Jan Lahoda, Bořivoj Melichar, and Jan Ždárek</i>	
Five Determinisation Algorithms	161
<i>Rob van Glabbeek and Bas Ploeger</i>	
Persistent Computations of Turing Machines	171
<i>Harald Hempel and Madlen Kimmritz</i>	
On Complexity of Two Dimensional Languages Generated by Transducers	181
<i>Egor Dolzhenko and Nataša Jonoska</i>	
Games for Temporal Logics on Trees	191
<i>Z. Ésik and Sz. Iván</i>	
A Run-Time Efficient Implementation of Compressed Pattern Matching Automata	201
<i>Tetsuya Matsumoto, Kazuhito Hagiya, and Masayuki Takeda</i>	
Composed Bisimulation for Tree Automata	212
<i>Parosh A. Abdulla, Ahmed Bouajjani, Lukáš Holík, Lisa Kaati, and Tomáš Vojnar</i>	
Hyper-Minimization in $O(n^2)$	223
<i>Andrew Badr</i>	
Deterministic Pushdown Automata and Unary Languages	232
<i>Giovanni Pighizzini</i>	
Finite Eilenberg Machines	242
<i>Benoît Razet</i>	
The Number of Runs in Sturmian Words	252
<i>Paweł Bąturo, Marcin Piątkowski, and Wojciech Rytter</i>	

3-Way Composition of Weighted Finite-State Transducers	262
<i>Cyril Allauzen and Mehryar Mohri</i>	
Progressive Solutions to FSM Equations	274
<i>Khaled El-Fakih and Nina Yevtushenko</i>	
Combination of Context-Free Grammars and Tree Automata for Unranked and Ranked Trees	283
<i>Akio Fujiyoshi</i>	
Approximate Periods with Levenshtein Distance	286
<i>Martin Šimůnek and Bořivoj Melichar</i>	
Author Index	289