Lecture Notes in Computer Science 5257

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

Masami Ito Masafumi Toyama (Eds.)

Developments in Language Theory

12th International Conference, DLT 2008
Kyoto, Japan, September 16-19, 2008
Proceedings

Springer

Volume Editors

Masami Ito
Kyoto Sangyo University
Faculty of Science, Kyoto 603-8555, Japan
E-mail: ito@cc.kyoto-su.ac.jp

Masafumi Toyama
Kyoto Sangyo University
Faculty of Computer Science and Engineering
Kyoto 603-8555, Japan
E-mail: toyama@cc.kyoto-su.ac.jp

Library of Congress Control Number: 2008934866

CR Subject Classification (1998): F.4.3, F.4.2, F.4, F.3, F.1, G.2

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

ISSN 0302-9743
ISBN-10 3-540-85779-6 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-85779-2 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: 12519972 06/3180 5 4 3 2 1 0

Preface

The 12th International Conference on Developments in Language Theory (DLT 2008) was held at Kyoto Sangyo University, Kyoto, September 16–19, 2008. This was the second time DLT took place in Kyoto. Previous DLTs were held in Turku (1993), Magdeburg (1995), Thessaloniki (1997), Aachen (1999), Vienna (2001), Kyoto (2002), Szeged (2003), Auckland (2004), Palermo (2005), Santa Barbara (2006) and Turku (2007). These will be followed by the next DLT in Stuttgart (2009).

The topics dealt with at the conference were: grammars, acceptors and transducers for words, trees and graphs; algebraic theories of automata; algorithmic, combinatorial and algebraic properties of words and languages; variable length codes; symbolic dynamics; cellular automata; polyominoes and multidimensional patterns; decidability questions; image manipulation and compression; efficient text algorithms; relationships to cryptography, concurrency, complexity theory and logic; bio-inspired computing; quantum computing.

The Program Committee selected 36 papers from 102 submitted papers. Each submitted paper was evaluated by at least three members of the Program Committee. All 36 selected papers are contained in this volume together with 6 invited papers. The editors thank the members of the Program Committee for the evaluation of the papers and the many referees who assisted the Program Committee members in this process. We are also grateful to the contributors to DLT 2008, in particular to the invited speakers for the realization of a successful conference. Moreover, we thank the Organizing Committee for its splended work, in particular Szabolcs Iván for his technical assistance. Without his assistance, it would have been impossible to perform the paper selecting process. Finally, we would like to express our gratitude to the Steering Committee for its support, in particular to Prof. Grzegorz Rozenberg for his valuable advice. This conference was dedicated to his 65th birthday.

The conference was supported by Kyoto Sangyo University and the Japanese Society for the Promotion of Science. The conference was held under the auspices of the European Association for Theoretical Computer Science. We are grateful to these institutions.

July 2008

Masami Ito
Masafumi Toyama

Organization

Steering Committee

Jean Berstel	Marne-la-Vallée, France
Cristian S. Calude	Auckland, New Zealand
Volker Diekert	Stuttgart, Germany
Juraj Hromkovic	Zurich, Switzerland
Oscar H. Ibarra	Santa Barbara, USA
Masami Ito	Kyoto, Japan
Werner Kuich	Vienna, Austria
Ghorge Paun	Bucharest, Rumania
Antonio Restivo	Palermo, Italy
Grzegorz Rozenberg, Chair	Leiden, Netherlands
Arto Salomaa	Turku, Finland
Sheng Yu	London, Canada

Program Committee

Symeon Bozapalidis	Thessaloniki, Greece
Olivier Carton	Paris, France
Alessandra Cherubini	Milan, Italy
Aldo de Luca	Naples, Italy
Zoltán Ésik	Szeged, Hungary
Volker Diekert	Stuttgart, Germany
Jozef Gruska	Brno, Czech Republic
Tero Harju	Turku, Finland
Hendrik Jan Hoogeboom	Leiden, Netherlands
Oscar H. Ibarra	Santa Barbara, USA
Masami Ito, Chair	Kyoto, Japan
Yuji Kobayashi	Funbashi, Japan
Werner Kuich	Vienna, Austria
Markus Lohrey	Leipzig, Germany
Victor Mitrana	Bucharest, Rumania
Friedrich Otto	Kassel, Germany
Jaques Sakarovitch	Paris, France
Kai Salomaa	Kingston, Canada
Pedro V. Silva	Porto, Portugal
Denis Thérien	Montreal, Canada
Sheng Yu	London, Canada
Mikhail Volkov	Ekaterinburg, Russia

Organizing Committee

Masami Ito, Co-chair	Kyoto, Japan
Szabolcs Ivan	Szeged, Hungary
Yoshiyuki Kunimochi	Fukuroi, Japan
P. Leupold	Kyoto, Japan
Jianqin Liu	Kobe, Japan
Masafumi Toyama, Co-chair	Kyoto, Japan
Kayoko Tsuji	Tenri, Japan

External Referees

Anil Ada
Cyril Allauzen
Jean-Paul Allouche
Marco Almeida
Dmitry Ananichev
Marcella Anselmo
Jean Berstel
Franziska Biegler
Luc Boasson
Benedikt Bollig
Henning Bordihn
Robert Brijder
Srecko Brlek
Veronique Bruyere
Michelangelo Bucci
Thierry Cachat
Cezar Campeanu
Arturo Carpi
Giuseppa Castiglione
Arkadev Chattopadhyay
Christian Choffrut
Marek Chrobak
Alfredo Costa
Maxime Crochemore
Sinisa Crvenkovic
Elena Czeizler
Eugen Czeizler
Juergen Dassow
Alessandro De Luca
Klaus Denecke
Michael Domaratzki
Pal Domosi
Jérôme Durand-Lose
Omer Egecioglu
Laszlo Egri
Chiara Epifanio
Christiane Frougny
Yuan Gao
Zsolt Gazdag
Viliam Geffert
Silvio Ghilardi
Hugo Gimbert
Stefan Göler
Archontia Grammatikopoulou
Erich Grädel
Giovanna Guaiana
Irene Guessarian
Stefan Gulan
H. Peter Gumm
Klinkner Gwénaël
Yo-Sub Han
Johanna Högberg
Markus Holzer
Lucian Ilie
Szabolcs Ivan
Petr Jancar
Antonios Kalampakas
Juhani Karhumaki
Jarkko Kari
Efim Kinber
Daniel Kirsten
Jetty Kleijn
Walter Kosters
Mojmir Kretinsky
Manfred Kudlek
Manfred Kufleitner

Michal Kunc
Yoshiyuki Kunimochi
Petr Kurka
Dietrich Kuske
Salvatore La Torre
Klaus-Jorn Lange
Eric Laugerotte
Peter Leupold
Kamal Lodaya
Christof Loeding
Sylvain Lombardy
Florin Manea
Sebastian Maneth
Christian Mathissen
Pierre McKenzie
Alexander Meduna
Ingmar Meinecke
Mark Mercer
Wolfgang Merkle
Hartmut Messerschmidt
Naoto Miyoshi
Frantisek Mraz
Emanuele Munarini
Lorand Muzamel
Mark-Jan Nederhof
Dirk Nowotka
Hitoshi Ohsaki
Alexander Okhotin
Gennaro Parlato
Andrei Paun
Dominique Perrin
Holger Petersen
Jean-Eric Pin
Brunetto Piochi
Martin Platek
Matteo Pradella
Panagiota Pournara
George Rahonis
Bala Ravikumar
Klaus Reinhardt
Antonio Restivo
Christophe Reutenauer
Kristina Richomme
Emanuele Rodaro
Jan Rutten
Nicolae Santean
Andrea Sattler-Klein
Shinnosuke Seki
Olivier Serre
Alexander Shen
Arseny Shur
Michael Sipser
Jean-Claude Spehner
Paola Spoletini
Ludwig Staiger
Heiko Stamer
Frank Stephan
Howard Straubing
Izumi Takeuti
Carolyn Talcott
Pascal Tesson
Wolfgang Thomas
Sandor Vagvolgyi
Birgit van Dalen
Stefano Varricchio
György Vaszil
Laurent Vuillon
Pascal Weil
Thomas Worsch
Hsu-Chun Yen

Sponsoring Institutions

Kyoto Sangyo University
Japan Society for the Promotion of Science

Table of Contents

Invited Talks

Iteration Semirings 1
Zoltán Ésik

Various Aspects of Finite Quantum Automata (Extended Abstract) 21
Mika Hirvensalo

On the Hardness of Determining Small NFA's and of Proving Lower Bounds on Their Sizes 34
Juraj Hromkovič and Georg Schnitger

Selected Ideas Used for Decidability and Undecidability of Bisimilarity 56
Petr Jančar

The Frobenius Problem and Its Generalizations 72
Jeffrey Shallit

Well Quasi-orders in Formal Language Theory 84
Flavio D'Alessandro and Stefano Varricchio

Contributed Papers

On the Non-deterministic Communication Complexity of Regular Languages 96
Anil Ada

General Algorithms for Testing the Ambiguity of Finite Automata 108
Cyril Allauzen, Mehryar Mohri, and Ashish Rastogi

Emptiness of Multi-pushdown Automata Is 2ETIME-Complete 121
Mohamed Faouzi Atig, Benedikt Bollig, and Peter Habermehl

The Average State Complexity of the Star of a Finite Set of Words Is Linear 134
Frédérique Bassino, Laura Giambruno, and Cyril Nicaud

On the Computational Capacity of Parallel Communicating Finite Automata 146
Henning Bordihn, Martin Kutrib, and Andreas Malcher

On a Generalization of Standard Episturmian Morphisms 158
Michelangelo Bucci, Aldo de Luca, and Alessandro De Luca

Universal Recursively Enumerable Sets of Strings 170
Cristian S. Calude, André Nies, Ludwig Staiger, and Frank Stephan

Algorithmically Independent Sequences 183
Cristian S. Calude and Marius Zimand

Relationally Periodic Sequences and Subword Complexity 196
Julien Cassaigne, Tomi Kärki, and Luca Q. Zamboni

Bounds on Powers in Strings 206
Maxime Crochemore, Szilárd Zsolt Fazekas, Costas Iliopoulos, and Inuka Jayasekera

When Is Reachability Intrinsically Decidable? 216
Barbara F. Csima and Bakhadyr Khoussainov

Some New Modes of Competence-Based Derivations in CD Grammar Systems 228
Erzsébet Csuhaj-Varjú, Jürgen Dassow, and György Vaszil

The Synchronization Problem for Strongly Transitive Automata 240
Arturo Carpi and Flavio D'Alessandro

On the Decidability of the Equivalence for k-Valued Transducers (Extended Abstract) 252
Rodrigo de Souza

Decidable Properties of 2D Cellular Automata 264
Alberto Dennunzio and Enrico Formenti

Fixed Point and Aperiodic Tilings 276
Bruno Durand, Andrei Romashchenko, and Alexander Shen

Extended Multi Bottom-Up Tree Transducers 289
Joost Engelfriet, Eric Lilin, and Andreas Maletti

Derivation Tree Analysis for Accelerated Fixed-Point Computation 301
Javier Esparza, Stefan Kiefer, and Michael Luttenberger

Tree Automata with Global Constraints 314
Emmanuel Filiot, Jean-Marc Talbot, and Sophie Tison

Bad News on Decision Problems for Patterns 327
Dominik D. Freydenberger and Daniel Reidenbach

Finding the Growth Rate of a Regular of Context-Free Language in Polynomial Time 339
Paweł Gawrychowski, Dalia Krieger, Narad Rampersad, and Jeffrey Shallit

More Concise Representation of Regular Languages by Automata and Regular Expressions 359
Viliam Geffert, Carlo Mereghetti, and Beatrice Palano

A Taxonomy of Deterministic Forgetting Automata 371
Jens Glöckler

Provably Shorter Regular Expressions from Deterministic Finite Automata (Extended Abstract) 383
Hermann Gruber and Markus Holzer

Large Simple Binary Equality Words 396
Jana Hadravová and Štěpán Holub

On the Relation between Periodicity and Unbordered Factors of Finite Words 408
Štěpán Holub and Dirk Nowotka

Duplication in DNA Sequences 419
Masami Ito, Lila Kari, Zachary Kincaid, and Shinnosuke Seki

On the State Complexity of Complements, Stars, and Reversals of Regular Languages 431
Galina Jirásková

On the State Complexity of Operations on Two-Way Finite Automata 443
Galina Jirásková and Alexander Okhotin

On the Size Complexity of Rotating and Sweeping Automata 455
Christos Kapoutsis, Richard Královič, and Tobias Mömke

An Analysis and a Reproof of Hmelevskii's Theorem (Extended Abstract) 467
Juhani Karhumäki and Aleksi Saarela

Hierarchies of Piecewise Testable Languages 479
Ondřej Klíma and Libor Polák

Construction of Tree Automata from Regular Expressions 491
Dietrich Kuske and Ingmar Meinecke

Balance Properties and Distribution of Squares in Circular Words 504
Roberto Mantaci, Sabrina Mantaci, and Antonio Restivo

MSO Logic for Unambiguous Shared-Memory Systems 516
Rémi Morin

Complexity of Topological Properties of Regular ω-Languages 529
Victor L. Selivanov and Klaus W. Wagner

Author Index 543