Lecture Notes in Computer Science 6651

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
TU Dortmund University, Germany

Madhu Sudan
Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos
University of California, Los Angeles, CA, USA

Doug Tygar
University of California, Berkeley, CA, USA

Gerhard Weikum
Max Planck Institute for Informatics, Saarbruecken, Germany

Alexander Kulikov Nikolay Vereshchagin (Eds.)

Computer Science – Theory and Applications

6th International Computer Science Symposium in Russia, CSR 2011
St. Petersburg, Russia, June 14-18, 2011
Proceedings

Springer

Volume Editors

Alexander Kulikov
Steklov Institute of Mathematics at St. Petersburg
27 Fontanka, 191023 St. Petersburg, Russia
E-mail: kulikov@logic.pdmi.ras.ru

Nikolay Vereshchagin
Moscow State University
Department of Mathematical Logic and Theory of Algorithms
Leninskie gory 1, 119991 Moscow, Russia
E-mail: nikolay.vereshchagin@gmail.com

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-20711-2 e-ISBN 978-3-642-20712-9
DOI 10.1007/978-3-642-20712-9
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2011926308

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

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

© Springer-Verlag Berlin Heidelberg 2011
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.
The use of general descriptive names, registered names, trademarks, 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.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The 6th International Computer Science Symposium in Russia (CSR 2011) was held during June 14–18, 2011 in St. Petersburg, Russia, hosted by St. Petersburg Academic University of the Russian Academy of Sciences. It was the sixth event in the series of regular international meetings following CSR 2006 in St. Petersburg, CSR 2007 in Ekaterinburg, CSR 2008 in Moscow, CSR 2009 in Novosibirsk, and CSR 2010 in Kazan.

The opening lecture was given by Dima Grigoriev and eight other invited plenary lectures were given by Manindra Agrawal, László Babai, Andrei Bulatov, Jarkko Kari, Alexander Shen, Amir Shpilka, Madhu Sudan, and Sergey Yekhanin.

This volume contains the accepted papers and abstracts of most invited talks. The scope of the proposed topics for the symposium was quite broad and covered many areas of theoretical computer science and its applications. We received 76 papers in total, and out of these the Program Committee selected 29 papers for presentation at the symposium and for publication in the proceedings.

As usual, Yandex provided the Best Paper Awards; the recipients of these awards were selected by the Program Committee:

- Best Paper Award:
  Scott Aaronson, "The Equivalence of Sampling and Searching"
- Best Student Paper Award:
  Daniil Musatov, "Improving the Space-Bounded Version of Muchnik's Conditional Complexity Theorem via "Naive" Derandomization"

The reviewing process was organized using the EasyChair conference system, created by Andrei Voronkov. We would like to acknowledge that this system helped greatly to improve the efficiency of the committee work.

The following satellite events were co-located with CSR 2011:

- Workshop on Post-Quantum Cryptography
- Second Workshop on Program Semantics, Specification and Verification: Theory and Applications (PSSV 2011)
- Workshop on Universal Algebra and Computer Science (WUACS)

We are grateful to our sponsors:

- EMC Corporation
- Microsoft Research
- Russian Foundation for Basic Research
- Yandex (the largest Russian Internet portal providing key Web services)

We also thank the local organizers, in particular, Alexander V. Smal, Tatiana Vinogradova, and Nadya Zalesskaya.

June 2011

Alexander Kulikov
Nikolay Vereshchagin

Organization

CSR 2011 was organized by the Steklov Institute of Mathematics at St. Petersburg of the Russian Academy of Sciences and St. Petersburg Academic University of the Russian Academy of Sciences.

Program Committee Chair

Nikolay Vereshchagin	Moscow State University, Russia

Program Committee

Farid Ablayev	Kazan State University, Russia
Maxim Babenko	Moscow State University, Russia
Olivier Carton	Université Paris Diderot, France
Bruno Durand	Université de Provence, France
Anna Frid	Sobolev Institute of Mathematics, Russia
Valentine Kabanets	Simon Fraser University, Canada
Juhani Karhumäki	University of Turku, Finland
Michal Koucký	Institute of Mathematics, Czech Republic
Meena Mahajan	Institute of Mathematical Sciences, India
Yuri Matiyasevich	Steklov Institute of Mathematics at St. Petersburg, Russia
Pierre McKenzie	Université de Montréal, Canada
Ilya Mironov	Microsoft Research, USA
Ilan Newman	Haifa University, Israel
Alexander Razborov	University of Chicago, USA and Steklov Mathematical Institute, Russia
Miklos Santha	Université Paris-Sud, France
Nitin Saxena	Hausdorff Center for Mathematics, Germany
Valentin Shehtman	Institute for the Information Transmission Problems, Russia
Alexander Sherstov	Microsoft Research, USA
Thomas Thierauf	Aalen University, Germany
Oleg Verbitsky	Institute for Applied Problems of Mechanics and Mathematics, Ukraine
Mikhail Volkov	Ural State University, Russia
Igor Walukiewicz	Université de Bordeaux, France

Symposium Chair

Alexander Kulikov	Steklov Institute of Mathematics at St. Petersburg, Russia

CSR Steering Committee

Volker Diekert	University of Stuttgart, Germany
Anna Frid	Sobolev Institute of Mathematics, Russia
Edward A. Hirsch	Steklov Institute of Mathematics at St. Petersburg, Russia
Juhani Karhumäki	University of Turku, Finland
Mikhail Volkov	Ural State University, Russia

External Reviewers

Mikhail Abramskiy
Anil Ada
Luis Antunes
Sergei Avgustinovich
Matthias Baaz
Malte Beecken
Eli Ben-Sasson
Oren Ben-Zwi
Eugene Beschastnov
Laurent Bienvenu
Michael Blondin
Hans L. Bodlaender
Benedikt Bollig
Gerth Stølting Brodal
Peter Bro Miltersen
Harry Buhrman
Andrei Bulatov
Michaël Cadilhac
Krishnendu Chatterjee
Bruno Courcelle
Samir Datta
Holger Dell
Emilio Di Giacomo
Christoph Dürr
Henning Fernau
Jiri Fiala
Fedor Fomin
Martin Fürer
Naveen Garg
Hugo Gimbert
Nikolai Gravin
Alexey Gusakov
Vesa Halava
Magnus M. Halldorsson
Tero Harju
Johan Håstad
Danny Hermelin
Mika Hirvensalo
Emmanuel Jeandel
Artur Jez
Jarkko Kari
Marek Karpinski
Dmitry Karpov
Ralf Klasing
Ignat Kolesnichenko
Ilya Kornakov
Richard Kralovic
Andreas Krebs
Thorsten Kräling
Dietrich Kuske
Troy Lee
Jerome Leroux
Xiaowen Liu
Vadim Lozin
Johann Makowsky
Catherine Matias
Jochen Messner
George Metcalfe
Johannes Mittmann
Jerome Monnot
Pavel Nalivaiko
N.S. Narayanaswamy
Alexander Okhotin
Krzysztof Onak
Giorgio Orsi
Alexei Pastor
Wojciech Plandowski
Vladimir Podolskii
Jean-Yves Potvin
Ivan Pouzyrevsky
Pavel Pudlak
Mathieu Raffinot
Ilya Razenshteyn
Gaétan Richard
Adi Rosen
Peter Rossmanith
Andrei Rumyantsev
Wojciech Rytter
Aleksi Saarela
Pavel Salimov
Kai Salomaa
Olivier Serre
Rocco Servedio
Sergey Sevastyanov
Ilya Shapirovsky
Arseny Shur
Tatiana Starikovskaya
Tamon Stephen
Christopher Umans
Alexander Vasiliev
Fabian Wagner
Oren Weimann
Steve Wismath
Tatiana Yavorskaya

Table of Contents

The Equivalence of Sampling and Searching 1
Scott Aaronson

Towards a Complexity Theory of Randomized Search Heuristics: Ranking-Based Black-Box Complexity 15
Benjamin Doerr and Carola Winzen

Learning Read-Constant Polynomials of Constant Degree Modulo Composites 29
Arkadev Chattopadhyay, Ricard Gavaldà, Kristoffer Arnsfelt Hansen, and Denis Thérien

On the Arithmetic Complexity of Euler Function (Invited Talk) 43
Manindra Agrawal

Pseudo-random Graphs and Bit Probe Schemes with One-Sided Error 50
Andrei Romashchenko

Improving the Space-Bounded Version of Muchnik's Conditional Complexity Theorem via "Naive" Derandomization 64
Daniil Musatov

The Complexity of Solving Reachability Games Using Value and Strategy Iteration 77
Kristoffer Arnsfelt Hansen, Rasmus Ibsen-Jensen, and Peter Bro Miltersen

Faster Polynomial Multiplication via Discrete Fourier Transforms 91
Alexey Pospelov

Kolmogorov Complexity as a Language (Invited Talk) 105
Alexander Shen

Almost k-Wise Independent Sets Establish Hitting Sets for Width-3 1-Branching Programs 120
Jiří Šíma and Stanislav Žák

The Complexity of Inversion of Explicit Goldreich's Function by DPLL Algorithms 134
Dmitry Itsykson and Dmitry Sokolov

Gate Elimination for Linear Functions and New Feebly Secure Constructions 148
Alex Davydow and Sergey I. Nikolenko

Finite Groups and Complexity Theory: From Leningrad to Saint Petersburg via Las Vegas (Invited Talk) 162
László Babai

On Maltsev Digraphs 181
Catarina Carvalho, László Egri, Marcel Jackson, and Todd Niven

Join-Reachability Problems in Directed Graphs 195
Loukas Georgiadis, Stavros D. Nikolopoulos, and Leonidas Palios

Graphs of Bounded Treewidth Can Be Canonized in AC^1 209
Fabian Wagner

Snakes and Cellular Automata: Reductions and Inseparability Results (Invited Talk) 223
Jarkko Kari

Computing the Clique-Width of Large Path Powers in Linear Time via a New Characterisation of Clique-Width 233
Pinar Heggernes, Daniel Meister, and Udi Rotics

An Extended Tree-Width Notion for Directed Graphs Related to the Computation of Permanents 247
Klaus Meer

Computing Vertex-Surjective Homomorphisms to Partially Reflexive Trees 261
Petr A. Golovach, Daniël Paulusma, and Jian Song

Compressed Membership in Automata with Compressed Labels 275
Markus Lohrey and Christian Mathissen

Locally Decodable Codes (Invited Talk) 289
Sergey Yekhanin

Precedence Automata and Languages 291
Violetta Lonati, Dino Mandrioli, and Matteo Pradella

Orbits of Linear Maps and Regular Languages 305
Sergey Tarasov and Mikhail Vyalyi

Shared-Memory Systems and Charts 317
Rémi Morin

On the CSP Dichotomy Conjecture (Invited Talk) 331
Andrei A. Bulatov

$LR(0)$ Conjunctive Grammars and Deterministic Synchronized Alternating Pushdown Automata 345
Tamar Aizikowitz and Michael Kaminski

Two-Way Automata versus Logarithmic Space 359
Christos A. Kapoutsis

A Polynomial-Time Algorithm for Finding a Minimal Conflicting Set Containing a Given Row 373
Guillaume Blin, Romeo Rizzi, and Stéphane Vialette

Two Combinatorial Criteria for BWT Images 385
Konstantin M. Likhomanov and Arseny M. Shur

Recent Results on Polynomial Identity Testing (Invited Talk) 397
Amir Shpilka

Towards Approximate Matching in Compressed Strings: Local Subsequence Recognition 401
Alexander Tiskin

The Optimal Strategy for the Average Long-Lived Consensus 415
Eric Rémila

Improved Online Scheduling in Maximizing Throughput of Equal Length Jobs 429
Thang Nguyen Kim

Recognizing Sparse Perfect Elimination Bipartite Graphs 443
Matthijs Bomhoff

A Multiple-Conclusion Calculus for First-Order Gödel Logic 456
Arnon Avron and Ori Lahav

Author Index 471