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Nikhil Bansal · Irene Finocchi (Eds.)

Algorithms – ESA 2015

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Preface

This volume contains the extended abstracts selected for presentation at ESA 2015, the 23rd European Symposium on Algorithms, held in Patras, Greece, September 14–16, 2015, as part of ALGO 2015. The ESA symposia are devoted to fostering and disseminating the results of high-quality research on algorithms and data structures. ESA seeks original algorithmic contributions for problems with relevant theoretical and/or practical applications and aims at bringing together researchers in the computer science and operations research communities. Ever since 2002, it has had two tracks, the Design and Analysis Track (Track A), intended for papers on the design and mathematical analysis of algorithms, and the Engineering and Applications Track (Track B), for submissions dealing with real-world applications, engineering, and experimental analysis of algorithms. Information on past symposia, including locations and LNCS volume numbers, is maintained at <http://esa-symposium.org>.

In response to the call for papers, ESA 2015 attracted a record number of 320 submissions, 261 for Track A and 59 for Track B. Paper selection was based on originality, technical quality, and relevance. Considerable effort was devoted to the evaluation of the submissions, with at least three reviews per paper. With the help of more than 980 expert reviews and more than 514 external reviewers, the two committees selected 86 papers for inclusion in the scientific program of ESA 2015, 71 in Track A and 15 in Track B, yielding an acceptance rate of about 26%. In addition to the accepted contributions, the symposium featured two invited lectures by Rasmus Pagh (IT University of Copenhagen, Denmark) and Paul Spirakis (University of Liverpool, UK and CTI & University of Patras, Greece). Abstracts of the invited lectures are also included in this volume.

The European Association for Theoretical Computer Science (EATCS) sponsored a best paper award and a best student paper award. A submission was eligible for the best student paper award if all authors were doctoral, master, or bachelor students at the time of submission. This award was shared by two papers: one by Sascha Witt for his contribution on “Trip-Based Public Transit Routing” and the other by Meirav Zehavi for her contribution entitled “Mixing Color Coding-Related Techniques.” The best paper award went to Christina Boucher, Christine Lo, and Daniel Lokshtanov for their paper entitled “Consensus Patterns (Probably) Has No EPTAS.” Our warmest congratulations to all of them for these achievements!

We wish to thank all the authors who submitted papers for consideration, the invited speakers, the members of the Program Committees for their hard work, and all the external reviewers who assisted the Program Committees in

the evaluation process. Special thanks go to Giuseppe Italiano for answering our many questions along the way, and to Christos Zaroliagis, who helped with the local organization of the conference.

July 2015

Nikhil Bansal
Irene Finocchi

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Invited Lectures

Correlated Locality-Sensitive Hashing^{*}

Rasmus Pagh

IT University of Copenhagen, Denmark

After an introduction to the area, we consider a new construction of locality-sensitive hash functions for Hamming space that is *covering* in the sense that it is guaranteed to produce a collision for every pair of vectors within a given radius r . The construction is *efficient* in the sense that the expected number of hash collisions between vectors at distance cr , for a given $c > 1$, comes close to that of the best possible data independent LSH without the covering guarantee, namely, the seminal LSH construction of Indyk and Motwani (FOCS '98). The efficiency of the new construction essentially *matches* their bound if $\log(n)/(cr)$ is integer, where n is the number of points in the data set, and differs from it by at most a factor $\ln(4) < 1.4$ in the exponent for larger values of cr . As a consequence, LSH-based similarity search in Hamming space can avoid the problem of false negatives at little or no cost in efficiency.

^{*} The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement no. 614331.

On the Discrete Dynamics of Probabilistic (Finite) Population Protocols

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Population Protocols are a recent model of computation that captures the way in which complex behavior of systems can emerge from the underlying local interactions of agents. Agents are usually anonymous and the local interaction rules are scalable (independent of the size, n , of the population). Such protocols can model the antagonism between members of several “species” and relate to evolutionary games.

In the recent past the speaker was involved in joint research studying the discrete dynamics of cases of such protocols for finite populations. Such dynamics are, usually, probabilistic in nature, either due to the protocol itself or due to the stochastic nature of scheduling local interactions. Examples are (a) the generalized Moran process (where the protocol is evolutionary because a fitness parameter is crucially involved) (b) the Discrete Lotka-Volterra Population Protocols (and associated Cyclic Games) and (c) the Majority protocols for random interactions.

Such protocols are usually discrete time transient Markov Chains. However the detailed states description of such chains is exponential in size and the state equations do not facilitate a rigorous approach. Instead, ideas related to filtering, stochastic domination and Potentials (leading to Martingales) help in understanding the dynamics of the protocols.

In the talk we discuss such rigorous approaches and their techniques. We examine the question of fast (in time polynomial in the population size) convergence (to an absorbing state). We also discuss the question of most probable eventual state of the protocols (and the computation of the probability of such states). Several aspects of such discrete dynamics are wide open and it seems that the algorithmic thought can contribute to the understanding of this emerging subfield of science.

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