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Preface

This volume contains the papers presented at FAW-AAIM 2012: the 6th International Frontiers of Algorithmics Workshop (FAW 2012) and the 8th International Conference on Algorithmic Aspects of Information and Management (AAIM 2012), jointly held during May 14–16, 2012, at Peking University, Beijing, China.

The joint conference provides a focused forum on current trends of research on algorithms, discrete structures, operation research, combinatorial optimization and their applications, and brings together international experts at the research frontiers in these areas to exchange ideas and to present significant new results.

There were 81 submissions to this edition of the conference, of which 33 papers were accepted. All papers were rigorously reviewed by the Program Committee members and/or external referees; almost all papers received at least three detailed reviews. The papers were evaluated on the basis of their significance, novelty, soundness and relevance to the conference.

We were pleased to deliver the best paper award to Kazuhide Nishikawa, Takao Nishizeki and Xiao Zhou for their paper "Algorithms for Bandwidth Consecutive Multicolorings of Graphs" and the best student paper award to Bryan He for his paper "Optimal Binary Representation of Mosaic Floorplans and Baxter Permutations."

Besides the regular talks, the program also included two invited talks by Tao Jiang (University of California - Riverside, USA) and Joseph S.B. Mitchell (State University of New York at Stony Brook, USA).

We are very grateful to all the people who made this meeting possible: the authors for submitting their papers, the Program Committee members and external reviewers for their excellent work, and the two invited speakers. In particular, we would like to thank Peking University for hosting the conference and providing organizational support.

We also acknowledge EasyChair, a powerful and flexible system for managing all stages of the paper handling process, from the submission stage to the preparation of the final version of the proceedings.

May 2012

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Computational Geometry Approaches to Some Algorithmic Problems in Air Traffic Management

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Abstract. The next generation of air transportation system will have to use technology to be able to cope with the ever increasing demand for flights. Several challenging optimization problems arise in trying to maximize efficiency while maintaining safe operation in air traffic management (ATM). Constraints and issues unique to air transportation arise in the ATM domain, including weather hazards, turbulence, no-fly zones, and three-dimensional routing. The challenge is substantially compounded when the constraints vary in time and are not known with certainty, as is the case with weather hazards. Human oversight is provided by air traffic controllers, who are responsible for safe operation within a portion of airspace known as a sector.

In this talk we discuss algorithmic methods that can be used in modeling and solving air traffic management problems, including routing of traffic flows, airspace configuration into load-balanced sectors, and capacity estimation in the face of dynamic and uncertain constraints and demands. We highlight several open problems.

Keywords: computational geometry, geometric flow, air traffic management, load balancing, sectorization.

Acknowledgments. This research has been supported by grants from the National Science Foundation (CCF-0729019, CCF-1018388), NASA Ames, and Metron Aviation. The talk is based on collaborative work with many, including Anthony D. Andre, Dominick Andrisani, Estie Arkin, Amitabh Basu, Jit-Tat Chen, Nathan Downs, Moein Ganji, Robert Hoffman, Joondong Kim, Victor Klimenko, Irina Kostitsyna, Shubh Krishna, Jimmy Krozel, Changkil Lee, Tenny Lindholm, Anne Pääkkö, Steve Penny, Valentin Polishchuk, Joseph Prete, Girishkumar Sabhnani, Robert Sharman, Philip J. Smith, Amy L. Spencer, Shang Yang, Arash Yousefi, Jingyu Zou.

Combinatorial Methods for Inferring Isoforms from Short Sequence Reads

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Abstract. Due to alternative splicing, a gene may be transcribed into several different mRNA transcripts (called *isoforms*) in eukaryotic species. How to detect isoforms on a genomic scale and measure their abundance levels in a cell is a central problem in transcriptomics and has broad applications in biology and medicine. Traditional experimental methods for this purpose are time consuming and cost ineffective. Although deep sequencing technologies such as RNA-Seq provide a possible effective method to address this problem, the inference of isoforms from tens of millions of short sequence reads produced by RNA-Seq has remained computationally challenging. In this talk, I will first briefly survey the state-of-the-art methods for inferring isoforms from RNA-Seq short reads including Cufflinks, Scripture and IsoInfer, and then describe the algorithmic framework behind IsoInfer in more detail. The design of IsoInfer exhibits an interesting combination of combinatorial optimization techniques (*e.g.*, convex quadratic programming) and statistical concepts (*e.g.*, maximum likelihood estimation and p-values). Finally, I will introduce our recent improvement of IsoInfer, called IsoLasso. The new method incorporates the well-known LASSO regression method into the quadratic program of IsoInfer and is likely to deliver isoform solutions with both good accuracy and sparsity. Our extensive experiments on both simulated and real RNA-Seq data demonstrate that this addition could help IsoLasso to filter out lowly expressed isoforms (which are often noisy) and achieve higher sensitivity and precision simultaneously than the existing transcriptome assembly tools.

This is a joint work with Wei Li (UC Riverside) and Jianxing Feng (Tongji University).

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