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Algorithmic Game Theory

14th International Symposium, SAGT 2021
Aarhus, Denmark, September 21–24, 2021
Proceedings

⚉ Springer

Editors
Ioannis Caragiannis (ID)
Aarhus University
Aarhus, Denmark

Kristoffer Arnsfelt Hansen (ID)
Aarhus University
Aarhus, Denmark

Preface

This volume contains the papers and extended abstracts presented at the 14th International Symposium on Algorithmic Game Theory (SAGT 2021), held during September 21–24, 2021, at Aarhus University, Denmark.

The purpose of SAGT is to bring together researchers from Computer Science, Economics, Mathematics, Operations Research, Psychology, Physics, and Biology to present and discuss original research at the intersection of Algorithms and Game Theory.

This year, we received a record number of 73 submissions, which were all rigorously peer-reviewed by the Program Committee (PC). Each paper was reviewed by at least 3 PC members, and evaluated on the basis of originality, significance, and exposition. The PC eventually decided to accept 30 papers to be presented at the conference.

The works accepted for publication in this volume cover most of the major aspects of Algorithmic Game Theory, including auction theory, mechanism design, markets and matchings, computational aspects of games, resource allocation problems, and computational social choice. To accommodate the publishing traditions of different fields, authors of accepted papers could ask that only a one-page abstract of the paper appeared in the proceedings. Among the 30 accepted papers, the authors of 4 papers selected this option.

Furthermore, due to the generous support by Springer, we were able to provide a Best Paper Award. The PC decided to give the award to the paper "Descending the Stable Matching Lattice: How Many Strategic Agents are Required to Turn Pessimality to Optimality?" authored by Ndiamé Ndiaye, Sergey Norin, and Adrian Vetta.

The program also included three invited talks by distinguished researchers in Algorithmic Game Theory, namely Yiling Chen (Harvard University, USA), Elias Koutsoupias (University of Oxford, UK), and Rahul Savani (University of Liverpool, UK). In addition, SAGT 2021 featured tutorial talks given by Vasilis Gkatzelis (Drexel University, USA) and Martin Hoefer (Goethe University Frankfurt, Germany).

We would like to thank all the authors for their interest in submitting their work to SAGT 2021, as well as the PC members and the external reviewers for their great work in evaluating the submissions. We also want to thank Springer and the COST Action GAMENET (CA16228) for their generous financial support. We are grateful to the Aarhus Institute of Advanced Studies for hosting the conference. Finally, we would also like to thank Anna Kramer at Springer for helping with the proceedings, and the EasyChair conference management system for facilitating the peer-review process.

July 2021

Ioannis Caragiannis
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Invited Talks

Mechanisms for Selling Information

Yiling Chen

Harvard University, USA

Abstract. Different from traditional goods, information (private signals) can be sold in more flexible ways. A salient feature of information as goods is that it can be revealed partially. This not only means that one can sell partial information at a granularity of his choice but also suggests that partial information revelation can be used to advertise the value of the remaining information. Hence, the space of mechanisms for selling information is rich. In this talk, I will discuss designing optimal mechanisms for a revenue-driven, monopoly information holder to sell his information to information buyers in a few scenarios.

Biography: Yiling Chen is a Gordon McKay Professor of Computer Science at Harvard University. She received her Ph.D. in Information Sciences and Technology from the Pennsylvania State University. Prior to working at Harvard, she spent two years at Yahoo! Research in New York City. Her research lies in the intersection of computer science, economics and other social sciences, with a focus on social aspects of computational systems. She was a recipient of The Penn State Alumni Association Early Career Award, and was selected by IEEE Intelligent Systems as one of "AI's 10 to Watch" early in her career. Her work received best paper awards at ACM EC, AAMAS, ACM FAT* (now ACM FAccT) and ACM CSCW conferences. She has co-chaired the 2013 Conference on Web and Internet Economics (WINE'13), the 2016 ACM Conference on Economics and Computation (EC'16) and the 2018 AAAI Conference on Human Computation and Crowdsourcing (HCOMP18) and has served as an associate editor for several journals.

On the Nisan-Ronen Conjecture for Graphs

Elias Koutsoupias

University of Oxford, UK

Abstract. The Nisan-Ronen conjecture states that no truthful mechanism for makespan-minimization when allocating a set of tasks to n unrelated machines can have approximation ratio less than n. Over more than two decades since its formulation, little progress has been made in resolving it. In this talk, I will discuss recent progress towards validating the conjecture by showing a lower bound of $1 + \sqrt{n-1}$. The lower bound is based on studying an interesting class of instances that can be represented by multi-graphs in which vertices represent machines and edges represent tasks, and each task should be allocated to one of its two incident machines.

Biography: Elias Koutsoupias is a professor of computer science at the University of Oxford. His research interests include algorithmic aspects of game theory, economics and networks, online algorithms, decision-making under uncertainty, distributed algorithms, design and analysis of algorithms, and computational complexity. He previously held faculty positions at the University of California, Los Angeles (UCLA) and the University of Athens. He studied at the National Technical University of Athens (BSc in electrical engineering) and the University of California, San Diego (PhD in computer science). He received the Goedel Prize of theoretical computer science for his work on the Price of Anarchy, in reference to laying the foundations of algorithmic game theory.

The Complexity of Gradient Descent

Rahul Savani

University of Liverpool, UK

Abstract. PPAD and PLS are successful classes that each capture the complexity of important game-theoretic problems: finding a mixed Nash equilibrium in a bimatrix game is PPAD-complete; and finding a pure Nash equilibrium in a congestion game is PLS-complete. Many important problems, such as solving a Simple Stochastic Game or finding a mixed Nash equilibrium of a congestion game, lie in both classes. However, it was strongly believed that their intersection does not have natural complete problems. We show that it does: any problem that lies in both classes can be reduced in polynomial time to the problem of finding a stationary point of a function. Our result has been used to show that computing a mixed equilibrium of a congestion game is also complete for the intersection of PPAD and PLS.

This is joint work with John Fearnley, Paul Goldberg, and Alexandros Hollender.

Biography: Rahul Savani is a Professor of Economics and Computation at the University of Liverpool. He has worked extensively on the computation of equilibria in game-theoretic models. The paper that he will present won a Best Paper Award at STOC'21.

Tutorial Talks

Understanding the Power and Limitations of Clock Auctions

Vasilis Gkatzelis

Drexel University, USA

Abstract. In this tutorial, we will be focusing on the class of (deferred-acceptance) clock auctions, introduced by economists Paul Milgrom and Ilya Segal. Clock auctions satisfy a sequence of impressive properties: i) they are obviously strategyproof, which implies that it is very easy for the participating bidders to identify their optimal strategy, ii) they are weakly group-strategyproof, which guarantees that even if the bidders collude, they cannot all benefit from manipulating the auction, iii) they are transparent and do not require that the bidders trust the auctioneer, and iv) they satisfy unconditional winner privacy, which means that the winners of the auction do not need to reveal their true value. This unique combination of benefits that clock auctions provide make them ideal for real-world problems, since they require very little from the participating bidders. Our presentation will first discuss these properties in detail, it will then study the extent to which clock auctions can match the state-of-the-art performance guarantees of previously known auctions (proving both positive and negative results) and will conclude with a discussion of some open problems and future directions.

Biography: Vasilis Gkatzelis is an assistant professor in computer science at Drexel University and his research focuses on problems in algorithmic game theory and approximation algorithms. He is a recipient of the NSF CAREER award. Prior to joining Drexel University, he held positions as a postdoctoral scholar at the computer science departments of UC Berkeley and Stanford University, and as a research fellow at the Simons Institute for the Theory of Computing. He received his PhD from the Courant Institute of New York University.

Algorithmic Challenges in Information Design

Martin Hoefer

Goethe University Frankfurt, Germany

Abstract. Information is a crucial resource in modern economy. Collecting and sharing information strategically is central to the business strategy of many major companies, including search engines, recommendation engines, and two-sided market platforms.

In all these domains, there is an informed "sender" (often a company or platform) who shares information in order to motivate an uninformed "receiver" (e.g., a potential customer) to take actions that are beneficial to the sender. Information design, alternatively known also as Bayesian persuasion, studies how the sender can disclose information optimally while accounting for the incentives that govern the behavior of the receiver.

Over the last decade, ideas from information design have found many applications in economics, and the area offers interesting challenges for algorithmic work. In this tutorial, we concetrate on algorithms for optimization problems arising in basic pesuasion problems. We also touch upon recent work on extensions to restricted communication, dynamic arrival, multiple senders and receivers, learning, and more. Along the way, we mention open problems and opportunities for future research.

Biography: Martin Hoefer is a professor in Computer Science at Goethe University Frankfurt. He received a PhD in Computer Science from Konstanz University in 2007. Subsequently, he was a postdoc at Stanford University and a junior professor at RWTH Aachen University. In 2012 he joined MPI Informatik as a senior researcher, and in 2016 Goethe University as full professor. His research investigates algorithms for problems at the intersection of computer science and game theory in a broad sense, with a recent focus on information design.

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