

## Preface

### **CiE 2017: Unveiling Dynamics and Complexity Turku, Finland, June 12–16, 2017**



The conference Computability in Europe (CiE) is organized yearly under the auspices of the Association CiE, a European association of mathematicians, logicians, computer scientists, philosophers, physicists, and others interested in new developments in computability and their underlying significance for the real world. CiE promotes the development of computability-related science, ranging from mathematics, computer science, and applications in various natural and engineering sciences, such as physics and biology, as well as related fields, such as philosophy and history of computing. CiE 2017 had as motto “Unveiling Dynamics and Complexity,” emphasizing in this way two important broad research directions within the CiE community.

CiE 2017 was the 13th conference in the series, and the first one to take place in Finland, in the city of Turku. The conference was jointly organized by the Department of Mathematics and Statistics, University of Turku, and the Department of Computer Science, Åbo Akademi University. The 12 previous CiE conferences were held in Amsterdam (The Netherlands) in 2005, Swansea (Wales) in 2006, Siena (Italy) in 2007, Athens (Greece) in 2008, Heidelberg (Germany) in 2009, Ponta Delgada (Portugal) in 2010, Sofia (Bulgaria) in 2011, Cambridge (UK) in 2012, Milan (Italy) in 2013, Budapest (Hungary) in 2014, Bucharest (Romania) in 2015, and Paris (France) in 2016. CiE 2018 will be held in Kiel, Germany. Currently, the annual CiE conference is the largest international meeting focused on computability theoretic issues. The proceedings containing the best submitted papers as well as extended abstracts of invited, tutorial, and special session speakers, for the CiE conferences are published in the Springer series *Lecture Notes in Computer Science*.

The CiE conference series is coordinated by the CiE Conference Series Steering Committee consisting of: Arnold Beckmann (Swansea), Alessandra Carbone (Paris), Natasha Jonoska (Tampa FL), Benedikt Löwe (Amsterdam), Florin Manea (Kiel, chair), Klaus Meer (Cottbus), Mariya Soskova (Sofia), Susan Stepney (York), and ex-officio members Paola Bonizzoni (Milan, president of the Association CiE) and Dag Normann (Oslo).

The Program Committee of CiE 2017 was chaired by Jarkko Kari (University of Turku) and Ion Petre (Åbo Akademi University, Turku). The committee selected the

invited and tutorial speakers and the special session organizers, and coordinated the reviewing process of all submitted contributions.

The Program Committee invited six speakers to give plenary lectures:

- Scott Aaronson (University of Texas at Austin)
- Karen Lange (Wellesley College)
- Ludovic Patey (Université Paris Diderot)
- Nicole Schweikardt (Humboldt-Universität zu Berlin)
- Alexander Shen (Université de Montpellier)
- Moshe Vardi (Rice University)

The conference also had two plenary tutorials by

- Denis R. Hirschfeldt (University of Chicago)
- Daniel M. Gusfield (University of California, Davis)

CiE 2017 had six special sessions, listed here. Speakers in these special sessions were selected by the respective special session organizers and were invited to contribute a paper to this volume. The History and Philosophy of Computing session was focused on a special topic this year: history and foundations of recursion, in memory of Rózsa Péter (1905–1977).

### Algorithmics for Biology

*Organizers:* Paola Bonizzoni and Veli Mäkinen

*Speakers:* Tobias Marschall (Max-Planck-Institut für Informatik), Fabio Vandin (University of Padova), Gregory Kucherov (University Paris-Est Marne-la-Vallée), Gianluca Della Vedova (University of Milano-Bicocca)

### Combinatorics and Algorithmics on Words

*Organizers:* Tero Harju and Dirk Nowotka

*Speakers:* Stepan Holub (Charles University in Prague), Pascal Ochem (Université de Montpellier), Svetlana Puzynina (Sobolev Institute of Mathematics and École Normale Supérieure de Lyon), Narad Rampersad (University of Winnipeg)

### Computability in Analysis, Algebra, and Geometry

*Organizers:* Julia Knight and Andrey Morozov

*Speakers:* Saugata Basu (Purdue University), Margarita Korovina (University of Aarhus), Alexander Melnikov (University of California, Berkeley), Russell Miller (Queens College, City University of New York)

### Cryptography and Information Theory

*Organizers:* Delaram Kahrobaei and Helger Lipmaa

*Speakers:* Jean-Charles Faugère (Université Pierre et Marie Curie), Elham Kashefi (University of Edinburgh, Université Pierre et Marie Curie), Aggelos Kiayias (University of Edinburgh), Ivan Visconti (Università degli Studi di Salerno)

## Formal Languages and Automata Theory

*Organizers:* Juhani Karhumäki and Alexander Okhotin

*Speakers:* Kai Salomaa (Queen's University at Kingston), Matrin Kutrib (Justus-Liebig-Universität Gießen), Thomas Colcombet (Université Paris Diderot), Artur Jez (University of Wrocław)

## History and Philosophy of Computing

*Organizers:* Liesbeth De Mol and Giuseppe Primiero

*Speakers:* Juliette Kennedy (University of Helsinki), Jan von Plato (University of Helsinki), Giovanni Sommaruga (Université de Fribourg), Hector Zenil (University of Oxford and Karolinska Institute)

The members of the Program Committee of CiE 2017 selected for publication in this volume and for presentation at the conference 25 of the 52 non-invited submitted papers. Each paper received at least three reviews by the Program Committee and their subreviewers. In addition to the accepted contributed papers, this volume contains 12 invited full papers. The production of the volume would have been impossible without the diligent work of our expert referees, both Program Committee members or subreviewers. We would like to thank all of them for their excellent work.

Springer generously funded this year a Best Student Paper Award, awarded to a paper authored solely by students. The winner of this award was the paper "*Towards Computable Analysis on the Generalized Real Line*," by Lorenzo Galeotti and Hugo Nobrega. All authors who contributed to this conference were encouraged to submit significantly extended versions of their papers, with additional unpublished research content, to *Computability. The Journal of the Association CiE*.

The Steering Committee of the conference series CiE is concerned about the representation of female researchers in the field of computability. In order to increase female participation, the series started the Women in Computability (WiC) program in 2007. In 2016, after the new constitution of the Association CiE allowed for the possibility of creating special interest groups, the Special Interest Group Women in Computability was established. Also since 2016, the WiC program has been sponsored by ACM's Women in Computing. This program includes a workshop, the annual WiC diner, the mentorship program, and a grant program for young female researchers. In 2017, the Women in Computability Workshop, coordinated by Liesbeth De Mol, invited the following speakers: Juliette Kennedy (University of Helsinki, Finland), Karen Lange (Wellesley College, USA), Ursula Martin (University of Oxford, UK)

The symposium Magic in Science was co-located with CiE 2017. It took place immediately after the conference and celebrated the 75th birthday of Grzegorz Rozenberg (University of Leiden, The Netherlands and University of Colorado at Boulder, USA), one of the world leaders in research on theoretical computer science and natural computing.

The organizers of CiE 2017 would like to acknowledge and thank the following entities for their financial support (in alphabetical order): the Academy of Finland, the Association for Symbolic Logic (ASL), the City of Turku, the European Association for Theoretical Computer Science (EATCS), Federation of Finnish Learned Societies, Finnish Academy of Science and Letters, Springer, Turku Centre for Computer

Science, Turku Complex Systems Institute, Turku University Foundation, University of Turku, Åbo Akademi University, Åbo Akademi University Foundation. We would also like to acknowledge the support of our non-financial sponsor, the Association Computability in Europe (CiE).

March 2017

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Unveiling Dynamics and Complexity

13th Conference on Computability in Europe, CiE 2017,

Turku, Finland, June 12-16, 2017, Proceedings

Kari, J.; Manea, F.; Petre, I. (Eds.)

2017, XIII, 401 p. 57 illus., Softcover

ISBN: 978-3-319-58740-0