A quick summary of the field of Parameterized Complexity, 2012

Overview

Parameterized Complexity is a recent branch of computational complexity theory that provides a framework for a refined analysis of hard algorithmic problems. The big, important problems facing Planet Earth have structure with “secondary” measurements (parameters), apart from the primary measurement of overall input size, that significantly affect problem computational complexity. The central notion of fixed parameter tractability (FPT) is a generalization of polynomial-time based on confining any non-polynomial (typically exponential) complexity costs to a function only of these secondary measurements. Parameterized algorithms have strong connections to heuristics for NP-hard problems, and the multivariate approach allows more realistic modelling of real-world input distributions. The field is strongly interdisciplinary, with applications in massive parallel processing of huge datasets, bioinformatics, AI, computational social choice, ecology and other disciplines.

Online Resources

The Parameterized Complexity Wiki has a tremendous amount of information, including papers at conferences and journals and arXiv.
http://www.fpt.wikidot.com

The Parameterized Complexity Newsletter keeps the community informed about breakthrough results, awards, and other news.
http://fpt.wikidot.com/fpt-news:the-parameterized-complexity-newsletter

Monographs


Recent Special Issues and Surveys

“Exact and Parameterized Computation - Moderately Exponential and Parameterized Approximation”. Manuscripts are solicited for a special issue of the journal Theoretical Computer Science (Vangelis Th. Paschos, Lamsade, University Dauphine, Guest Editor) 2012.

“Exact and Parameterized Computation”. Special Issue of Algorithmica (Venkatesh Raman and Saket Saurabh, Guest Editors) 2011-2012.


The Computer Journal, Vol 1 and Vol 3, (Michael Fellows, Rod Downey and Michael Langston, Guest Editors). This two-volume special issue has over 17 survey papers on various areas of Parameterized Complexity, book reviews, and a preface by Mike Fellows. 2008.

“Exact and Parameterized Computation.” Special Issue of Algorithmica (Jianer Chen, Guest Editor) 2008.


Recent Milestones in Conference Proceedings

Proceedings of the 23rd SODA, 2012
- R. Chitnis, M. Hajiaghayi, D. Marx, Fixed-Parameter Tractability of Directed Multiway Cut Parameterized by the Size of the Cutset.
- H. Dell, D. Marx, Kernelization of Packing Problems.

Proceedings of the 44th STOC, 2012
- M. Grohe, D. Marx, Structure Theorem and Isomorphism Test for Graphs with Excluded Topological Subgraphs.

Proceedings of the 52nd FOCS, 2011
- M. Cygan, J. Nederlof, M. Pilipczuk, M. Pilipczuk, Johan M. M. van Rooij, J. O. Wojtaszczyk, Solving connectivity problems parameterized by treewidth in single exponential time.

Proceedings of the 43rd STOC, 2011
- N. Bousquet, J. Daligault, S. Thomassé, Multicut is FPT.
- D. Marx, I. Razgon: Fixed-parameter tractability of multicut parameterized by the size of the cutset.

Proceedings of the 21st SODA, 2010
International Conference Series

(There are four conference/workshop series. The main conference is IPEC, in its 7th year.)

1) International Symposium on Parameterized and Exact Computation (IPEC) focuses on all aspects of parameterized complexity and algorithmics. Please see http://fpt.wikidot.com/ipec for IPEC History, Steering Committee, Awards. In 2013 we will hold the 8th IPEC collocated with ALGO which also hosts ESA, WABI, WAOA, ATMOS, and ALOSENSORS, in Sophia Antipolis, France. Previous IPECs have been held in Slovenia, Germany, India, Denmark, Canada, Switzerland and Norway.

2) Workshop on Kernelization (WorKer) focuses on kernelization. The 3rd WorKer took place in 2011 at the Vienna University of Technology, Austria following successful workshops in Bergen 2009 and Leiden 2010.

3) Approximation, Parameterized and Exact Algorithms (APEX) is supported by the French National Agency for Research (ANR). APEX is co-located with STACS 2012 in Paris.

4) Workshop on Applications of Parameterized Algorithms and Complexity (APAC). APAC 2012 is collocated with ICALP in Warwick, UK.

Dagstuhl Seminars

Dagstuhl is the is the world’s premier venue for informatics.

2012 Seminar 12241, 10.06.12-15.06.12. Data Reduction and Problem Kernels. Dedicated to the occasion of the 60th birthday of Michael Fellows. Takes the place of WorKer 2012.


2005 Seminar 05301, 24.07.05 - 29.07.05. Exact Algorithms and Fixed-Parameter Tractability. R. Downey (Univ. of Wellington, NZ), M. Grohe (HU Berlin, DE), M. Hallett (McGill Univ., CA), G. Woeginger (Univ. of Twente, NL).

2003 Seminar 03311, 27.07.03 - 01.08.03. Fixed Parameter Algorithms. M. Fellows (Univ. of Newcastle, AUS), M. Hallett (McGill Univ. of Montreal, CDN), R. Niedermeier (Univ. Tübingen,), N. Nishimura (Univ. of Waterloo, CDN).

2001 Seminar 01311, 29.07.01 - 03.08.01. Parameterized Complexity. R. Downey (Wellington), M. Fellows (Victoria), R. Niedermeier (Tübingen), P. Rosmanith (TU München).

Other workshops

(Listed are only a few of the many schools, tutorials and small workshops.)


2011 Parameterized Complexity: Not About Graphs! August Workshop at Charles Darwin Univ, Australia. The workshop aim is to identify important problems in new directions (control theory, automata, number theory, robotics, game theory, computational physics, etc.) to investigate within the parameterized framework.


2010 Graph Decomposition: Theoretical, Algorithmic and Logical Aspects. Workshop held Oct 2010 at CIRM, Luminy, supported by French ANR projects GRAAL and AGAPE.

2010 Workshop on Parameterized Complexity, March 2010 at Univ Newcastle, Australia.

2010 Winter School at KAIST, S. Korea. Introduction to Parameterized Complexity by Sangil Oum (http://www.mathnet.or.kr/real/2010/01/OumSangil(0112).pdf)


2009 Introduction to Graph and Geometric Algorithms workshop held at IISc Bangalore.

2009 Graph Decompositions and Algorithms (GRAAL), Montpellier, France.

2009 Chinese University of Hong Kong seminars on Parameterized Complexity organized by Prof. Leizhen Cai.

2008 National Chung Cheng Univ, National Tsing Hua Univ, National Dong Hwa Univ, and Academia Sinica, Taipei, Taiwan. Workshops with Rolf Niedermeier and Peter Rossmanith.

2008 International Summer School on Fixed Parameter Algorithms, Fudan University, Shanghai, Satellite event to AAIM’08. Organized by Prof. Rudolf Fleischer.

2008 Parameterized Complexity workshop as Satellite event to International Summer School in Formal Languages and Applications, organized by Prof. Joerg Flum (Freiburg).


2008 “Approximating Solution Structure,” organized by M. Hamilton, M. Muller, and I. van Rooij and Todd Wareham, Dept of Computer Science, Memorial Univ of Newfoundland.

Awards

(These are only those reported to Frances Rosamond, newsletter Editor.)

2012 European Research Council Starting Grant, beginning January 2012. The 1.15M EUR, 5-year project will start January 2012 in Budapest, Hungary. The project is “PARAMTIGHT:
Parameterized complexity and the search for tight complexity results”. Awarded to Daniel Marx.

2011 Australian Research Council Discovery Early Career Researcher Award (DECRA) and the prestigious University of New South Wales (UNSW) Vice-Chancellor Award awarded to Serge Gaspers, Vienna Univ of Technology. Serge will move to Australia to work with Toby Walsh.

2011 Office of Naval Research (ONR) Young Investigator Award, an NSF CAREER Award, and a Google Faculty Research Award with total more than 1M dollars awarded to Mohammad Taghi Hajiaghayi, the University of Maryland.

2011 Junior Institute Universitaire de France was awarded to Cristina Bazgan, LAMSADE and University Dauphine, Paris.

2011 Spirit of Inquiry Award, DePaul Univ, Chicago in recognition for his research in theoretical computer science, especially in the area of parameterized complexity was awarded to Iyad Kanj.


2011 Czech Republic 3-year Science Research Award to Petr Hlineny (Masaryk Univ, Czech).


2011 Czech Republic 3-year Science Research Award to Petr Hlineny (Masaryk Univ, Czech)


2010 European Research Council Starting Grant of 1.4M Euros, beginning January 2010 for the project “The Parameterized Complexity of Reasoning Problems” awarded to Stefan Szeider, Vienna Univ of Technology.

2010 European Research Council Starting Grant of 2.2 million Euro for the project “Rigorous Theory of Preprocessing,” received by Fedor Fomin, University of Bergen.

2010 President of Ireland Young Researcher Award (PIYRA). The Award includes a massive grant of 700K Euros for 4 years. Igor’s project, “Parameterized Complexity of Multiway Cut,” succeeded against a prestigious interdisciplinary competition that included researchers from Biology and Medical Sciences. Awarded to Igor Razgon, University of Cork.

2010 Australian Professorial Award, five year research-only academic position to Mike Fellows (Charles Darwin University).

2010 Bergen Research Foundation award of 12.5 million NOK over 4 years including a tenure-track position at the University of Bergen was awarded to Daniel Lokshtanov. Daniel has also received a 2-year Simons Foundation Postdoc at UCSD, San Diego, CA.

2010 Microsoft Research Travel Grant 2010-2015 to Saket Saraubh, MSRI, Chennai.

2010 NSERC grant renewed as of April 2010; 15K/year for 5 years for the project, “Parameterized complexity analysis in cognitive science,” awarded to Todd Wareham. (Memorial Univ, Newfoundland,

2010 Humboldt Fellowship for Experienced Researchers. Daniel Marx will be in Berlin for 18 months, following a postdoc in Tel Aviv.

2010 Philips Prize of the Royal Mathematical Society in the Netherlands, for the best PhD research project. Award given to Matthias Mnich, whose Advisor was Gerhard Weoginger, Dept. Mathematics and Computer Science Eindhoven Univ of Technology. Mattias received a postdoc with Richard Karp, Berkeley, funded through a DAAD Fellowship.

2009 Agence Nationale de la Recherche, Programme Blanc Grant for the AGAPE Project, “Research in Fixed-Parameter and Exact Algorithmics”. The budget is approx 700k Euros for a period of 4 years. Project Leader Fred Havet (Nice), and Local Leaders D.Kratsch (Metz), I. Todinca (Orleans), and S. Thomasse and C. Paul (Montpellier).

2009 NSF CAREER award for her project titled, “CAREER: A Complete System for Protein Identification with Computational Approaches” The project uses parameterized complexity and tree decomposition. Awarded to Chunmei Liu, Howard University, Washington, DC.

Research team leaders active in Parameterized Complexity

Africa
Univ. of Johannesburg, South Africa. Anders Yeo
Tanzania. Egbert Mujuni

Australia
Univ. Newcastle. Pablo Moscato (Comp Bio)
Griffith Univ. Vladimir Estivill-Castro (Algorithms, Game Theory)
University of New South Wales. Toby Walsh (Artificial Intelligence)

Austria
Vienna Univ of Technology. Stefan Szeider, Reinhard Pichler (AI, SAT)

Brazil
Federal University of Rio de Janeiro. Jayme Szwarcfiter (Graphs)

Canada
Carleton. Frank Dehne (Parallel Algorithms)
Dalhousie University. Norbert Zeh
McGill Univ. Michael Hallett (Biology)
Memorial Univ. of Newfoundland. Todd Wareham (Computational Biology, Brain Science)

New Brunswick. Patricia Evans (Computational Biology)
University of Victoria, BC. Sue Whitesides (Geometry), Ulrike Stege
Waterloo. Naomi Nishimura, Prabhakar Ragde

Czech Republic
Masaryk University. Petr Hlineny
Charles University, Prague. Daniel Kral

Chile
Universidad de Chile. Juan Andres Montoya

China
Central South Univ., Changsha. Jianxin Wang, Zhibiao Yang
Shanghai Jiaotong Univ., Shanghai. Yijia Chen
City Univ. of Hong Kong. Leizhen Cai

Denmark
Copenhagen. Thore Husfeldt

Finland
Helsinki. Mikko Koivisto

France
CIRM Luminy. Christophe Paul
LAMSADe and Univ. Dauphine. Vangelis Paschos, Cristina Bazgan
Lyon. Stephane Thomasse
Metz. Dieter Kratsch

Germany
RWTH Aachen. Peter Rossmanith, Arie Koster
Humboldt-Universität zu Berlin. Martin Grohe
Technische Universität Berlin. Stefan
Kreutzer, Rolf Niedermeier
Düsseldorf. Jorg Rothe, Felix Brandt
Freiburg. Jorg Flum
Karlsruhe. Detlef Seese
Christian Albrechts Univ., Keil. Klaus Jansen
Luebeck. Rudiger Reischuk
Max Planck Research Institute, Saarbrücken.
Kurt Mehlhorn
Univ. Saarlands, Saarbrücken. Jiong Guo
Trier. Henning Fernau
Greece
Athens. Dimitrios M. Thilikos
Hungary
Budapest. Daniel Marx
India
Institute for Mathematical Sciences, Chennai.
Venkatesh Raman, Saket Saurabh
Ireland
Cork. Barry O’Sullivan
Israel
Haifa Technion. Hadas Shachnai (Approximation)
Tel Aviv. Noga Alon (Combinatorics), Benny
Chor, Ron Shamir (Computational Biology)
Italy
Marcus Cesati
Japan
Tokyo. Ken-Ichi Kawarabayashi, Yusuke
Kobayashi, Osamu Watanabe
Lebanon
Lebanese American Univ. Faisal Abu-Khasam
Netherlands
Utrecht. Hans Bodlaender
Eindhoven. Gerhard Woeginger
Nijmegen. Iris van Rooij
New Zealand
Auckland. Arkady Slinko
Massey. Catherine McCardin
Wellington. Rodney Downey
Norway
Bergen. Fedor Fomin, Pinar Heggernes, Jan
Arue Telle
Poland
Univ. Warsaw. Marek Cygan
South Korea
Sangil Oum
Sweden
Lund. Thore Husfeldt
Peter Damaschke
UK
Oxford. Georg Gottlob
Durham. Paul Bonsma, Danial Paulusma
Leicester. Igor Razgon
Royal Holloway. Gregory Gutin
United States
Buffalo. Kenneth W. Regan
Central Florida. Ron Dutton
Univ. of Chicago. Marcus Schafer
DePaul Univ. Iyad Kanj
Univ. Georgia. Liming Cai
Univ. of Maryland. MohammadTaghi Haji-
aghayi
MIT. Erik D. Demaine
Univ. Ohio. David Juedes
Univ Oregon. Andrzej Proskurowski
Puerto Rico. Yiannis Koutis
Stanford. Ryan Williams
Univ. Tennessee and Oak Ridge National Labs.
Michael Langston
Texas A&M. Jianer Chen