Parameterized Complexity News

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Welcome to the *Parameterized Complexity News.* We offer congratulations to all for awards and prizes, graduates, new jobs, and wonderful research. This edition features *Programming Toolbox: Part I* by Martin Koutecký. *Part II* will follow in the Fall newsletter. Also featured is *On the Parameterized Complexity of Approximating Dominating Set* by Karthik C. S., Bundit Laekhanukit, and Pasin Manurangsi. Follow fb page @MikeFellowsFPT. Frances Rosamond (Univ Bergen) Frances.Rosamond@uib.no and Valia Mitsou (Univ Paris Diderot) vmitsou@liris.cnrs.fr, Editors.

Nerode Prize Winners Stefan Kratsch and Magnus Wahlström

CONGRATULATIONS TO Stefan Kratsch and Magnus Wahlström who have won the Nerode Prize for *Compression via Matroids: A Randomized Polynomial Kernel for Odd Cycle Transversal. ACM Trans. Algorithms 10(4): 20:1-20:15 (2014)*

The search for polynomial kernelization algorithms played a central role in the research on parameterized complexity during the last decade. By now, there are well-developed tools for both positive and negative results in this area. Kratsch and Wahlström were the first to recognize the applicability of the matroid-based machinery (developed earlier by Marx, based on classic results of Lovász) to the compression of NP-hard cut problems. Their work settled the long-standing open problem about the polynomial kernelizability of the Odd Cycle Transversal problem in a beautiful way.

The paper, and its follow-up (Representative Sets and Irrelevant Vertices: New Tools for Kernelization. FOCS 2012), have been very influential and paved the way for several other matroid-based kernelizations, such as those for Vertex Multiway Cut, Above-Guarantee Vertex Cover, and Subset Feedback Vertex Set. Moreover, experiments show that matroid-based compression is not merely a nice theoretical concept, but also gives relevant practical speedups (Stefan Fafianie, Stefan Kratsch: An Experimental Analysis of a Polynomial Compression for the Steiner Cycle Problem. SEA 2015: 367-378). For this reason, the Nerode Prize 2018 Committee unanimously decided that this foundational paper by Kratsch and Wahlström deserves to win the Nerode prize.

Figure 1: Stefan Kratsch and Magnus Wahlström

Contents of this issue:

Jarik Nešetřil awarded Donatio Universitatis Carolinae

CONGRATULATIONS to **Prof. Jaroslav (Jarik) Nešetřil**, who has received the *Donatio Universitatis Carolinae* prize "for his contribution to mathematics and for his leading role in establishing a world-renowned group in discrete mathematics at Charles University". The prize was given by the rector of the university on the occasion of the 670th anniversary of the establishment of Charles University. It comes with one million CZK support. (https://www.mff.cuni.cz/verejnost/konalo-se/2018-04-nesetril/)

Figure 2: Jarik Nešetřil

Gregory Gutin wins award for Workflows research

CONGRATULATIONS to **Gregory Gutin** who has been awarded a British pounds 210K grant for 3 years in access control in info security, where parameterized algorithmics will be used. The project is *Analyzing Security-aware Workflows.*

Gregory is looking for a good postdoc for a 3-year position with a very decent salary (37K pounds a year the 1st year and +2K each consecutive year). The start day is 1st Oct 2018. The topic is parameterized algorithmics applied to access control in info security, but not limited to it and it's a continuation of the previous parameterized algorithmics + access control grant he had.

Ronald de Haan in the Heidelberg Laureate Forum

CONGRATULATIONS to **Ronald de Haan** who was endowed with the honor of participating in the Heidelberg Laureate Forum (HLF). The HLF is a gathering of laureates of some of the most prestigious prizes in mathematics and computer science. Held in Heidelberg, Germany, from September 23-28 2018, the Heidelberg Laureate Forum brings these laureates at the apex of their careers together with 200 high-achieving graduate student and postdoctoral counterparts from around the world. The HLF gives early career researchers an opportunity for interaction that is typically not available within the normal university environment or in their home university department. Nicholas Mattei participated in 2017. Tarek Besold won this award in 2016.

Figure 3: Ronald de Haan

Sebastian Berndt, Max Bannach win ESA Track B

CONGRATULATIONS to **Sebastion Berndt** (Univ Kiel) and **Max Bannach** (Universität zu Lübeck) for their paper *Practical Access to Dynamic Programming on Tree Decompositions* which allows implementing and testing such dynamic programs easily. The paper has been awarded the **2018 ESA Best Student Paper Award (Track B)**. While the paper is not directly connected to PACE, it is certainly inspired by the challenge and by the practical success of the treewidth algorithm of Tamaki.

Jelco Bodewes, Marieke van der Wegen, and co-authors Hans Bodlaender, Gunther Cornelissen win Best Student Paper award at WG

CONGRATULATIONS to **Jelco Bodewes and Marieke van der Wegen, and co-authors Hans Bodlaender and Gunther Cornelissen**. The paper *Recognizing hyperelliptic graphs in polynomial time*, has received the Best Student Paper award at WG 2018. Marieke is a PhD student, Univ. Utrecht.

Integer Programming Toolbox

by Martin Koutecký (Technion & Charles University), `koutecky@kam.mff.cuni.cz`. See [19] for more.

As parameterized complexity grows beyond graph algorithms, a major area begging for parameterized analysis is Integer Programming (IP). Simultaneously, several recent breakthroughs in parameterized complexity [6, 31, 32, 33, 34, 37] directly follow from learning how to use existing IP algorithms, and discovering new ones.

We overview the state of the art of IP from the parameterized perspective. Consider three variants of IP:

$$\min\{\mathbf{wx} \mid A\mathbf{x} \le \mathbf{b},\ \mathbf{x} \in \mathbb{Z}^n\}, \qquad \text{(ILP)}$$
$$\min\{f(\mathbf{x}) \mid A\mathbf{x} \le \mathbf{b},\ \mathbf{x} \in \mathbb{Z}^n\}, \qquad \text{(LinIP)}$$
$$\min\{f(\mathbf{x}) \mid \mathbf{x} \in S \cap \mathbb{Z}^n, S \subseteq \mathbb{R}^n \text{ is convex}\}\ . \qquad \text{(IP)}$$

In (IP), $f\colon \mathbb{Z}^n \to \mathbb{Z}$ is the *objective function*, S is the *feasible set* (defined by *constraints* or various *oracles*), and $\mathbf{x}$ is a vector of *variables*. *Linearly-constrained IP* (LinIP) is the case when S is a polyhedron defined by $A \in \mathbb{Z}^{m\times n}$ and $\mathbf{b} \in \mathbb{Z}^m$. Letting $f(\mathbf{x}) = \mathbf{wx}$ (with $\mathbf{w} \in \mathbb{Z}^n$) gives (ILP).

We give a list of the most relevant algorithms solving IP, highlighting their fastest known runtimes (marked ⊤), typical use cases and strengths (+), limitations (−), and a list of references to the algorithms (♡) and their most illustrative applications (▷). By $\langle\cdot\rangle$ we denote the binary encoding length.

Small Dimension

The following tools rely on results from discrete geometry.

ILP in small dimension. Problem (ILP) with small n.

⊤ $n^{2.5n}\langle A, \mathbf{b}, \mathbf{w}\rangle$ [17, 29]

+ Can use large coefficients, which allows encoding logical connectives using Big-M coefficients [3]. Runs in polynomial space. Most people familiar with ILP.

− Small dimension sometimes an obstacle in modeling poly-many "types" of objects [4, Challenge #2]. Models often use $\Omega(2^k)$ variables in parameter k $\implies$ $2^{2^{\Omega(k)}}$ runtimes (ditto all small dimension techniques below). Modeling a convex objective or constraint $\implies$ many constraints [19, Model 9]. Big-M coefficients impractical.

♡ [17, 29, 36]

▷ Closest String (first use of ILP in FPT) [39], graph layout problems [15], OPT+1 approximation for Bin Packing (MILP with column generation) [28], graph coloring [16], opinion diffusion (modeling tricks) [14]

Convex IP in small dimension. Problem (IP) with f a convex function; several representations of S.

⊤ $n^{\frac{4}{3}n}\langle B\rangle$, where S is contained in a ball of radius B [10]

+ Strictly stronger than ILP. Implicit representation of S by an oracle $\implies$ better dependence on instance size.

− Exponential space. Algorithms usually impractical. Proving convexity can be difficult.

♡ [20, Theorem 6.7.10] (separation), [30] (semialgebraic sets), [21, 25] (polynomials), [9] randomized / [10] deterministic (separation), [40] reduction to Mixed ILP subproblems (first-order oracle).

▷ Scheduling [24, 31, 38], bribery [5], graph problems [19, Model 8]

Indefinite quadratic IP in small dimension. (LinIP) with $f(\mathbf{x}) = \mathbf{x}^\intercal Q\mathbf{x}$ indefinite (non-convex) quadratic.

⊤ $g(n, \|A\|_\infty, \|Q\|_\infty)\langle\mathbf{b}\rangle$ [42]

+ Currently the only tractable indefinite objective.

− Limiting parameterization.

♡ [37, 42] ▷ graph problems [37], [19, Model 10]

Parametric ILP in small dimension. Let $Q = \{\mathbf{b} \in \mathbb{R}^m \mid B\mathbf{b} \le \mathbf{d}\}$. Decide $\forall \mathbf{b} \in Q \cap \mathbb{Z}^m\ \exists \mathbf{x} \in \mathbb{Z}^n :\ A\mathbf{x} \le \mathbf{b}$.

⊤ $g(n, m)\mathrm{poly}(\|A, B, \mathbf{d}\|_\infty)$ [12]

+ Models one quantifier alternation. Useful in expressing game-like constraints ("∀ moves ∃ a counter-move"). Unary big-M coefficients model logic [34, Theorem 4.5].

− Input has to be given in unary (vs. Lenstra).

♡ [12], [8, Cor 1] ▷ Access control [8], bribery [34]

Variable Dimension

From now on we consider the *standard form* of (LinIP):

$$\min\{f(\mathbf{x}) \mid A\mathbf{x} = \mathbf{b},\ \mathbf{l} \le \mathbf{x} \le \mathbf{u},\ \mathbf{x} \in \mathbb{Z}^n\}, \qquad \text{(SLinIP)}$$

where $\mathbf{l}, \mathbf{u} \in \mathbb{Z}^n$. Let $f_{\max} = \max_{\mathbf{x}:\mathbf{l}\le\mathbf{x}\le\mathbf{u}} |f(\mathbf{x})|$, and $L = \langle f_{\max}, \mathbf{b}, \mathbf{l}, \mathbf{u}\rangle$. The *primal graph* $G_P(A)$ of A has a vertex for each column, and two columns are connected if they share a row which is non-zero in both. The *dual graph* $G_D(A)$ is $G_P(A^\intercal)$. The primal and dual treedepth and treewidth of A, denoted $\mathrm{td}_P(A)$, $\mathrm{td}_D(A)$, $\mathrm{tw}_P(A)$ and $\mathrm{tw}_D(A)$, are the treedepth and treewidth of $G_P(A)$ and $G_D(A)$, respectively. In contrast with the above, the following algorithms rely on algebraic arguments and dynamic programming.

ILP with few rows. Problem (SLinIP) with small m and a linear objective $\mathbf{wx}$ for $\mathbf{w} \in \mathbb{Z}^n$.

⊤ $\mathcal{O}((m\|A\|_\infty)^{2m})\langle\mathbf{b}\rangle$ if $\mathbf{l} \equiv \mathbf{0}$ and $\mathbf{u} \equiv +\infty$, and $n \cdot (m\|A\|_\infty)^{\mathcal{O}(m^2)}\langle\mathbf{b}, \mathbf{l}, \mathbf{u}\rangle$ in general [27]

+ Useful for configuration IPs with small coefficients, leading to exponential speed-ups. Best runtime in the case without upper bounds. Linear dependence on n.

− Limited modeling power. Requires small coefficients.

♡ [13, 27, 41] ▷ Scheduling [27]

$$A_{\text{nfold}} = \begin{pmatrix} A_1 & A_1 & \cdots & A_1 \\ A_2 & 0 & \cdots & 0 \\ 0 & A_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & A_2 \end{pmatrix} \qquad A_{\text{stoch}} = \begin{pmatrix} B_1 & B_2 & 0 & \cdots & 0 \\ B_1 & 0 & B_2 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ B_1 & 0 & 0 & \cdots & B_2 \end{pmatrix}$$

n-fold IP, tree-fold IP, and dual treedepth. *n-fold IP* is problem (SLinIP) in dimension nt, with $A = A_{\text{nfold}}$ for some two blocks $A_1 \in \mathbb{Z}^{r\times t}$ and $A_2 \in \mathbb{Z}^{s\times t}$, $\mathbf{l}, \mathbf{u} \in \mathbb{Z}^{nt}$, $\mathbf{b} \in \mathbb{Z}^{r+ns}$, and with f a separable convex function, i.e., $f(\mathbf{x}) = \sum_{i=1}^n \sum_{j=1}^t f_j^i(x_j^i)$ with each $f_j^i : \mathbb{Z} \to \mathbb{Z}$ convex. *Tree-fold IP* is a generalization of n-fold IP where the block A_2 is itself replaced by an n-fold matrix, and so on, recursively, τ times. Further generalized by bounded dual treedepth $\mathrm{td}_D(A)$.

⊤ $(\|A\|_\infty rs)^{\mathcal{O}(r^2 s + rs^2)}(nt)^2 \log(nt)\langle L\rangle$ n-fold IP [1, 11]; $(\|A\|_\infty + 1)^{2^{\mathrm{td}_D(A)}}(nt)^2 \log(nt)\langle L\rangle$ for (SLinIP) [35].

+ Variable dimension useful in modeling many "types" of objects [33, 34]. Exponential speed-ups (not only configuration IPs). "Rigid" format not problematic (blocks can be different if $\|A\|_\infty$ and dimensions are small).

− Requires small coefficients. ♡ [1, 6, 11, 22, 32, 35]

▷ Parameterized scheduling [6, 31], scheduling EPTAS [26], bribery and string problems [32, 33], Sum Coloring [19, Model 11]

2-stage and multi-stage stochastic IP, and primal treedepth. 2-stage stochastic IP is problem (SLinIP) with $A = A_{\mathrm{stoch}}$ and f a separable convex function; multi-stage stochastic IP is problem (SLinIP) with a multi-stage stochastic matrix, which is the transpose of a tree-fold matrix; multi-stage stochastic IP is in turn generalized by IP with small primal treedepth $\mathrm{td}_P(A)$.

⊤ $g(\mathrm{td}_P(A), \|A\|_\infty)n^2 \log n\langle L\rangle$, g computable [35]

+ Similar to Parametric ILP in fixed dimension, but quantification $\forall \mathbf{b} \in Q \cap \mathbb{Z}^n$ over an explicit poly-sized but possibly non-convex set of right hand sides.

− Not clear how to use. Requires small coefficients. Parameter dependence g possibly non-elementary; no upper bounds on g known, only computability.

♡ [2, 23, 35] ▷ N/A

Small treewidth and Graver norms. Let $g_\infty(A) = \max_{\mathbf{g}\in\mathcal{G}(A)} \|\mathbf{g}\|_\infty$ and $g_1(A) = \max_{\mathbf{g}\in\mathcal{G}(A)} \|\mathbf{g}\|_1$ be maximum norms of elements of the *Graver basis* $\mathcal{G}(A)$.

⊤ $\min\{g_\infty(A)^{\mathcal{O}(\mathrm{tw}_P(A))}, g_1(A)^{\mathcal{O}(\mathrm{tw}_D(A))}\}n^2 \log n\langle L\rangle$ [35]

+ Captures IPs beyond the classes defined above.

− Bounding $g_1(A)$ and $g_\infty(A)$ is often hard or impossible.

♡ [35] ▷ Sum Coloring [19, Model 14]

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On the Parameterized Complexity of Approximating Dominating Set

by Karthik C. S., *Weizmann Institute of Science, Israel,* Bundit Laekhanukit, *Shanghai University of Finance and Economics, China, and* Pasin Manurangsi, *University of California, Berkeley, USA.*

We study the parameterized complexity of approximating the k-Dominating Set (DomSet) problem where the input is an integer k and a graph G on n vertices, and the goal is to find a dominating set of size at most $F(k)\cdot k$ whenever the graph G has a dominating set of size k. When such an algorithm runs in FPT time (parameterized by k), it is said to be an *$F(k)$-FPT-approximation algorithm* for k-DomSet. Whether such an algorithm exists for any computable function F at all (e.g., $F(k) = 2^{2^k}$) has been a long-standing open question. In this work, we prove the non-existence of such an algorithm under $\mathsf{W}[1] \neq \mathsf{FPT}$. We further provide tighter running time lower bounds under stronger hypotheses: for any computable functions F, T and $\varepsilon > 0$, no $F(k)$-approximation algorithm can run in time $T(k) \cdot n^{o(k)}$ under ETH and $T(k) \cdot n^{k-\varepsilon}$ under SETH.

Previously, only constant ratio FPT-approximation algorithms were ruled out under $\mathsf{W}[1] \neq \mathsf{FPT}$ and $(\log^{1/4-\varepsilon} k)$-FPT-approximation algorithms were ruled out under ETH [4]. Furthermore, the non-existence of an $F(k)$-FPT-approximation algorithm for any computable function F was known only under Gap-ETH [3].

Proof Overview. In [3], Chalermsook et al. provide an approximation-preserving reduction (using a gadget from [5]) from a parameterized variant of the Label Cover problem, called MaxCover, to k-DomSet. Thus, it suffices for us to prove the hardness of approximating MaxCover.

Our main contribution is in establishing a connection between communication complexity and inapproximability of MaxCover, generalizing the ideas from a recent breakthrough work of Abboud et al. [1]. In particular, we show that to prove hardness of approximation of MaxCover, it suffices to devise a specific protocol for a communication problem that depends on which hypothesis we rely on. Each of these communication problems turns out to be either a well studied problem or a variant of one; this allows us to apply known techniques to solve them.

Due to space constraints, we do not attempt to formally define MaxCover and the connections here; rather, we describe the communication problem that corresponds to the k-Clique problem, and the protocol we use in proving our W[1]-hardness result.

The communication problem for k-Clique is a multiparty problem where there are $\binom{k}{2}$ players, each associated with a two-element subset $\{i, j\}$ of $[k]$. The players cannot communicate with each other. Rather, there is a referee that they can send messages to. Each player $\{i, j\}$ is given two vertices $u_i^{\{i,j\}}$ and $u_j^{\{i,j\}}$ that form an edge in G (the input graph of k-Clique). The vertices $u_i^{\{i,j\}}$ and $u_j^{\{i,j\}}$ are allegedly the i^{th} and j^{th} vertices of a clique, respectively. The goal is to determine whether there is an actual k-clique in G such that, for every $\{i, j\} \subseteq [k]$, $u_i^{\{i,j\}}$ and $u_j^{\{i,j\}}$ are the i^{th} and j^{th} vertices of the clique.

The communication protocol that we are looking for is a one-round protocol with public randomness and by the end of which the referee is the one who outputs the answer. Specifically, the protocol proceeds as follows. First, the players and the referee jointly toss some random coins. Then each player sends a message to the referee. Finally, the referee decides based on the messages received and the randomness, either to accept or reject. We are interested in constructing protocols that have perfect completeness and soundness s, i.e., (1) when there is a desired clique, the referee always accepts and (2) when there is no such clique, the referee accepts with probability at most s. The blow-up in size in the reduction to MaxCover depends on the amount of randomness and the message length of each player and the gap of MaxCover arrives from the gap

$1/s$ of the accepting probabilities in the completeness and soundness cases of the protocol. The parameters of the protocol are chosen carefully in order to make the reduction work, but we will not go into the details here.

The communication protocol we use for this problem is quite simple. First, observe that the referee only needs to check whether each alleged vertex of the clique sent to different players are the same; namely, he only needs to verify that, for every $i \in [k]$, we have $u_i^{\{i,1\}} = u_i^{\{i,2\}} = \cdots = u_i^{\{i,i-1\}} = u_i^{\{i,i+1\}} = \cdots = u_i^{\{i,k\}}$. In other words, he only needs to check equalities for each of the k unknowns. The equality problem is extensively studied in communication complexity and in our case, the protocol can be easily obtained using error-correcting codes. Specifically, every Player $\{i,j\}$ encodes each of his input vertices (i.e., $u_i^{\{i,j\}}$ and $u_j^{\{i,j\}}$) using an error-correcting code of relative distance δ. The players and the referee jointly at random pick a coordinate of the encoding, and each player sends only that coordinate of each encoded vertex to the referee. The referee then checks whether, for every $i \in [k]$, the received messages of the encoding of $u_i^{\{i,1\}}, u_i^{\{i,2\}}, \ldots, u_i^{\{i,k\}}$ restricted to the fixed random coordinate are equal. It is easy to verify that this protocol has perfect completeness and soundness $1 - \delta$. By choosing an appropriate code, this protocol gives us the W[1]-hardness of approximating k-DomSet.

Concluding Remarks. We remark that recently Lin [6] gave a different and elegant proof of results similar to ours that does not involve the viewpoint of communication complexity and MaxCover.

Despite all these recent developments, there are still many interesting open questions left. We conclude this short article with two such questions. First, it remains open whether k-DomSet is W[2]-hard to approximate; this would give a rare completeness result in FPT inapproximability. Another related question is whether it is W[1]-hard to approximate k-Clique (even to within say 1.01 factor). Note that inapproximability of k-Clique is currently only known under Gap-ETH [2, 3].

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July: Parameterized Complexity for Practical Computing–Wellington, New Zealand

The URL is https://www.cmsc.nz/ftp-workshop/. One-day workshop on 24 July. This FPT workshop immediately follows the 4th Creative Mathematical Sciences Communication (CMSC 2018) conference which will be held 21-23 July in Wellington. Come for both. Keynote speaker Mike Fellows will talk about **Future Directions of the Field** related to his recently awarded Toppforsk award. Discussions will also include how parameterized complexity interfaces with operations research, machine learning, artificial intelligence and other fields. For workshop details contact organizers Catherine McCartin (c.m.mccartin@massey.ac.nz) and Peter Shaw (peter.shaw.cs@gmail.com), both at Massey Univ. or Frances Rosamond (frances.rosamond@uib.no)

July: 4th Creative Mathematical Sciences Communication Conference

The 4th Creative Mathematical Sciences Communication (CMSC 2018) conference will be held 21-23 July in Wellington, NZ (website is http://www.cmsc.nz). Stay for the FPT workshop immediately following.

Join scientists, researchers, musicians, and artists in developing new ways of communicating mathematical and computational thinking. Welcome are contributions in art forms such as dance, music, theatre, and the myriad of ways to communicate science to the public. The conference will feature keynote talks by leading researchers and communicators in the mathematical sciences, sharing their experience, new initiatives, and ideas. The conference will be held in Wellington, New Zealand, at a premier art institute, The Learning Connexion (TLC) on 21–23 July 2018. Organizers: Frances Rosamond, Univ Bergen (Frances.Rosamond@uib.no) and Jonathan Milne, The Learning Connexion (jonathanmilnetlc@gmail.com).

IPEC 2018, 22-24 August in Helsinki

The 13th International Symposium on Parameterized and Exact Computation (IPEC 2018) covers research in all aspects of parameterized and exact algorithms and complexity.

IPEC 2018 will be part of ALGO 2018, which also hosts ESA 2018 and a number of more specialized conferences and workshops. IPEC 2018 will take place 22-24 August 2018, in Helsinki, Finland.

Accepted papers will be published in the symposium proceedings in the Leibniz International Proceedings in Informatics (LIPIcs) series, based at Schloss Dagstuhl. Authors of accepted papers are expected to present their work at the symposium, and to incorporate the comments from the program committee. A journal special issue is planned for selected papers presented at IPEC 2018.

A paper accepted to the conference is eligible for the Best Student Paper Award if either all its authors are students, or if there is one non-student co-author that confirms that a clear majority of conceptual work on the paper was done by the student co-author(s). It is expected that a student gives a presentation at the conference.

SPECIAL EVENTS

NERODE PRIZE: An invited talk will be given by the 2018 EATCS-IPEC Nerode Prize winner.

TUTORIAL: Radu Curticapean will give an invited tutorial on *Counting Problems in Parameterized Complexity.*

PACE: There will be a session presenting the results of the *3rd Parameterized Algorithms and Computational Experiments Challenge* (PACE 2018).

August: PACE Award Ceremony is part of IPEC2018

The PACE Award ceremony will be held at IPEC 2018 in Helsinki. https://pacechallenge.wordpress.com/pace-2018/. Especial thanks to the sponsors. Prizes and travel awards of 4000 Euros have been provided for participants through the generous sponsorship of NETWORKS (http://thenetworkcenter.nl/), an NWO Gravitation project of the Univ of Amsterdam, Eindhoven Univ of Technology, Leiden Univ, and the Center for Mathematics and Computer Science (CWI).

September: PC + OR in Bergen

A two-day: **Operations Research + Parameterized Complexity Workshop** on 17 and 18 September, 2018. The convergence of topics seems abundant with unexplored, interesting theoretical challenges, and targeted practical impact.

Mike's Norwegian Toppforsk Award will pay for buses from the university to the workshop venue on the morning of the 17th and return evening of the 18th, accommodation for all participants for the one night, and meals. The workshop is limited to 50 participants. This workshop is inspired by the DNZ support for researchers from the University of Kiel who will spend the entire week in Bergen (including the OR + PC Workshop). An Erasmus proposal (still under review) may bring additional members from this ancient Hanseatic League, now modern sister city of Bergen. For more information contact Frances Rosamond or Mike Fellows.

Feb 2019: WALCOM

13th International Conference and Workshops on Algorithms and Computation (WALCOM 2019). Feb 27 - March 2, 2019 - IIT Guwahati, India. SCOPE includes Parameterized Algorithms, Parameterized Complexity. http://www.iitg.ac.in/walcom2019/

Sofja Kovalevskaja Award for Young Research Talent

APPLICATION DEADLINE: 31 JULY 2018. The Alexander von Humboldt Foundation promotes outstanding talent and best conditions for research. Award winners receive up to €1.65 million each, enabling them to spend five years establishing and heading their own research groups at a research institution in Germany.

Junior academics of all disciplines from abroad with outstanding qualifications, who completed their doctorates within the last six years, are eligible to apply for the Sofja Kovalevskaja Award. Applications may also be submitted on completion of doctoral studies. Six awards are scheduled to be granted. Visit www.humboldt-foundation.de/skp_en for further information and a link to the online application package. If you have any questions about the Sofja Kovalevskaja Award or would like individual guidance, please contact info@avh.de.

New book on Kernelization coming soon

The book, *Kernelization: Theory of Parameterized Preprocessing* by Fedor Fomin, Daniel Lokshtanov, Saket Saurabh, and Meirav Zehavi, published by Cambridge University Press, has December expected online publication date.

FPT Wiki JOBS and RECENT PAPERS pages

JOBS: A Professor looking for a post-doc recently reported to us that 8 of his applicants had heard about the open position by reading the Jobs Page on the FPT wiki http://fpt.wikidot.com/jobs:positions-available-and-people-looking. Post your job announcement on the wiki.

RECENT PAPERS: Big Thank You to Bart Jansen who posts the Recent Papers in conferences and online. This is a tremendous resource. If you know of papers not posted, please post yourself or inform Bart.

Moving Around – Congratulations to all

Dr. Haris Aziz has taken up a Scientia Fellowship at UNSW Sydney, Australia, a research-intensive tenure-track position. Haris remains affiliated with his former employer, Data61, CSIRO, as well.

Dr. Nick Brettell has accepted a postdoctoral researcher position at Eindhoven University of Technology, in the Department of Mathematics and Computer Science, from July.

Dr. Radu Curticapean has joined the IT University of Copenhagen and also the new research center *Basic Algorithms Research Copenhagen* (BARC) as a postdoctoral researcher.

Dr. Martin Koutecký has accepted an assistant professor position in the Computer Science Institute of Charles University, Prague, starting in 2019.

Dr. Ioannis Koutis is now Associate Professor Department of Computer Science Ying-Wu College of Computing at the New Jersey Institute of Technology.

Alexsander Andrade de Melo PhD student of Ueverton Sousa, has received a scholarship from the Brazilian government for study with Michael Fellows, Univ Bergen from September 2018 to February 2019.

Dr. Sebastian Ordyniak has accepted a lecturer position at the University of Sheffield working in the Algorithms group. Dr. Ordyniak will be hiring a fully funded 3 year PhD student working on the development of Parameterized Algorithms for Problems in Artificial Intelligence and Logic. For informal inquiries send an email to sordyniak@gmail.com.

Dr. Abdallah Saffidine has accepted a Lecturer position at UNSW Sydney, Australia, starting from November 2018.

Dr. Remi Watrigant is now assistant professor at University of Lyon, doing research in the MC2 team of the LIP laboratory.

CONGRATULATIONS Habilitation and PhDs

Congratulations to **Ignasi Sau Valles**, who successfully defended his Habilitation at LIRMM Université de Montpellier on Parameterized Complexity on Monday 25 June. Reports were from Mike Fellows, Fedor Fomin, Rolf Niedermeier. Examiners were Dimitrios Thilikos, Jean-Claude Bermond, Marc Noy and Gilles Trombetton.

Katrin Casel, Title: *Lower-Bounded Clustering - Models, Complexity and (Parameterised) Approximation*, Abteilung Informatikwissenschaften, Fachbereich IV, Universität Trier, Germany.
Advisor: Professor Henning Fernau (Universität Trier)
Second Referee: Professor Ljiljana Brankovic (University of Newcastle, AU) as a Mercator Fellow.
Congratulations, Dr. Casel. Dr. Casel has joined the research group of Tobias Friedrich at the Hasso Plattner Institute, University of Potsdam.

Eduard Eiben, Title: *Exploiting new types of structure for fixed-parameter tractability*, TU Wien, Vienna, Austria. Eduard was part of a doctoral program "Logical Methods in Computer Science (LogiCS)". A copy is accessible online through the university library: http://katalog.ub.tuwien.ac.at/AC15020516
Advisor: Professor Stefan Szeider (TU Wien, Vienna)
Advisor: Professor Georg Gottlob (University of Oxford)
Advisor Unofficial: Dr. Robert Ganian.
Congratulations, Dr. Eiben. Dr. Eiben is a post-doc with Daniel Lokshtanov at the University of Bergen.

Abhisekh Sankaran, Title: *A Generalization of the Łoś-Tarski Preservation Theorem*, The Department of Computer Sciences and Engineering, Indian Institute of Technology Bombay.
Advisor: Professor Supratik Chakraborty
Advisor: Professor Bharat Adsul.
Congratulations, Dr. Sankaran. Dr. Sankaran has accepted a post-doctoral position with Professor Anuj Dawar at the University of Cambridge.

Figure 4: Jarik Nešetřil being awarded the Donatio Universitatis Carolinae prize by the rector of Charles University