# Peter Richtárik: Curriculum Vitae

## 1. CONTACT DETAILS


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|---|---|
| Address: | 2221 Al-Khawarizmi Building, KAUST, Thuwal 23955-6900, Kingdom of Saudi Arabia |
| Email: | peter.richtarik@kaust.edu.sa |
| Website: | https://richtarik.org |
| Telephone: | +966 (0) 54 4700-462 |


## 2. RESEARCHER IDs


| | |
|---|---|
| orcid: | https://orcid.org/0000-0003-4380-5848 |
| Web of Science Researcher ID: | O-5797-2018 |


## 3. RESEARCH INTERESTS

big data optimization, machine learning, randomized algorithms, convex optimization, numerical analysis, randomized numerical linear algebra, first-order methods, randomized coordinate descent, stochastic gradient descent, variance reduction, iteration complexity, parallel and distributed computing, supercomputing

## 4. ACADEMIC POSITIONS

| | |
|---|---|
| 2017– | **Visiting Professor**, Moscow Institute of Physics and Technology, Russia[1] |
| 2017– | **Associate Professor**, Computer Science, KAUST, Kingdom of Saudi Arabia |
| 2016–2019 | **Associate Professor (Reader)**, Mathematics, University of Edinburgh |
| 2013 | **Invited Visiting Scientist**, Simons Institute for the Theory of Computing, UC Berkeley |
| 2009–2016 | **Assistant Professor (Lecturer)**, School of Mathematics, University of Edinburgh |
| 2007–2009 | **Postdoctoral Fellow**, Center for Operations Research and Econometrics and Department of Mathematical Engineering, Catholic University of Louvain, Belgium (host: Yu. Nesterov) |

## 5. EDUCATION

| | |
|---|---|
| 2007 | **PhD, Operations Research, Cornell University**, advisor M.J. Todd |
| 2006 | MS, Operations Research, Cornell University |
| 2001 | Mgr, Mathematics, Comenius University, Slovakia, Summa Cum Laude, ranked #1 |
| 2001 | Bc, Management, Comenius University, Slovakia, Summa Cum Laude, ranked #1 |
| 2000 | Bc, Mathematics, Comenius University, Slovakia, Summa Cum Laude, ranked #1 |

## 6. AWARDS & RECOGNITIONS

Awards explicitly addressed to my students, postdocs or coauthors for a talk, poster or paper based on joint research with me are listed in the section "8.5 My Team: Awards and Recognitions".

[1] This visiting professorship is part of my 2-year grant funded by the Russian government in the framework of the Russian Academic Excellence Project "5-to-100" that is aimed at revamping Russian higher education institutions and improving their positions and rankings in the global academic market. Within this project, I help modernizing the higher education practices at MIPT, in particular via supervising selected talented students and conducting original research and writing papers with them. Paper [68] was coauthored with three MIPT students. Two of those students decided to join my group at KAUST upon completion of their undergraduate studies at MIPT. Further papers coauthored with MIPT students include [89, 90, 93].

| | |
|---|---|
| 2018 | Best NIPS Reviewer Award[2] |
| 2018 | 2nd Most Downloaded Paper in "SIAM J. on Matrix Analysis and Applications" for paper [39] |
| 2018 | 6th Most Downloaded Paper in "SIAM J. on Matrix Analysis and Applications" for paper [44] |
| 2017 | 1st Most Read Paper in "Optimization Methods and Software" for paper [41] |
| 2017 | 1st Most Downloaded Paper in "SIAM J. on Matrix Analysis and Applications" for paper [39] |
| 2017 | 1st Most Trending Paper in "Mathematical Programming" for paper [10] |
| 2017 | Announcement of "Federated Learning" by Google (based on papers [51, 52]) |
| 2016–2017 | 2nd Most Downloaded Paper in "SIAM J. on Optimization" for paper [21] |
| 2016 | **SIAM SIGEST Outstanding Paper Award** for paper [21] |
| 2016 | **EUSA Best Research or Dissertation Supervisor Award**[3] (2nd Prize) |
| 2016– | **Turing Fellow, The Alan Turing Institute**, London |
| 2016 | **EPSRC Fellowship in Mathematical Sciences**[4] |
| 2014 | Nominated for the **Chancellor's Rising Star Award**[5], University of Edinburgh |
| 2013 | **Simons Institute Visiting Scientist Fellowship**, UC Berkeley |
| 2013 | Nominated for the **2014 Microsoft Research Faculty Fellowship**[6] |
| 2011 & 2012 | Nominated for the **Innovative Teaching Award**, University of Edinburgh |
| 2011– | **Honorary Fellow**, Heriot-Watt University |
| 2007 | **CORE Fellowship**, Université catholique de Louvain |
| 2002 | **Cornell University Graduate Fellowship** |
| 2001 | **Dean's Prize and Rector's Prize**, Comenius University |
| 1992–2001 | Winner of Numerous Mathematical Olympiads and Competitions |

# 7. GRANTS

## 7.1 MY GRANTS[7]

| | |
|---|---|
| 2018–2019 | £**216,843 (Co-I)**, Innovate UK Grant, "Renewable Energy Performance Score (REPSCORE)", Joint with: Enian (PI), Daniel Friedrich (Edinburgh, PI) |
| 2018–2021 | **$974,789 (Co-I)**, CRG2017 Grant, "Analyzing Large Scale 3D Shape Collections", Joint with: Peter Wonka (KAUST, PI), Maks Ovsjanikov (École Polytechnique, Co-I) |
| 2017–2019 | **RUB 7,960,000 (PI)**, Visiting Professor Grant, Moscow Institute of Physics and Technology |
| 2018 | **$10,000 (PI)**, KICP grant in support of KAUST Research Workshop on Optimization and Big Data, 2018 |
| 2017–2018 | **$79,281 (PI)**, KAUST Office of Sponsored Research Conference Support Grant URF/1/3347-01, "Optimization and Big Data", Joint with: Marco Canini (KAUST, PI) |
| 2016–2020 | £**70,000** EPSRC CASE[8] PhD Studentship for Filip Hanzely |
| 2016–2020 | £**45,000 (PI)**, Amazon Research Grant |
| 2016–2020 | £**823,211 (PI)**, EPSRC Early Career Fellowship in Mathematical Sciences EP/N005538/1, "Randomized Algorithms for Extreme Convex Optimization" |
| 2016–2020 | **$20,000 (PI)**, Amazon EC2 Grant (partner funding associated with the EPSRC Fellowship) |
| 2015 | £**20,000 (PI)**, Alan Turing Institute Scoping Workshop Grant, "Distributed Machine Learning and Optimization", Joint with: Artur Czumaj (Warwick, PI), Ilias Diakonikolas (Edinburgh, PI), Mark Girolami (Warwick, PI), Raphael Hauser (Oxford, PI), John Shawe-Taylor (UCL, PI) |

[2] "We are delighted to inform you that you were one of the 218 highest-scoring reviewers this year! You will therefore be given access (for a limited period of time) to one free registration to this year's conference"

[3] EUSA = Edinburgh University Students' Association. One first and one second prize are given each year across all disciplines and levels of seniority at the University of Edinburgh.

[4] In total, 5 fellowships in mathematics were awarded in the UK in this round at all levels of seniority.

[5] One of two nominated from the School of Mathematics

[6] Selected universities can nominate a single candidate. No European scientists got the award in 2014.

[7] All small grants (value below $10k) are excluded from this list. The total value of the 16 small grants excluded is £42,090.

[8] CASE = Cooperative Awards in Science and Engineering

| | |
|---|---|
| 2015 | £**12,000 (PI)**, Alan Turing Institute Scoping Workshop Grant, "Theoretical and Computational Approaches to Large Scale Inverse Problems", Joint with: Simon Arridge (UCL, PI), John Aston (Cambridge, PI), Carola-Bibiane Schönlieb (Cambridge, PI), Andrew Stuart (Warwick, PI), Jared Tanner (Oxford, PI) |
| 2014–2017 | **$180,000**, Google Europe Doctoral Fellowship for Jakub Konečný |
| 2013–2015 | £**125,849 (PI)**, EPSRC First Grant EP/K02325X/1, "Accelerated Coordinate Descent Methods for Big Data Optimization" |
| 2014–2015 | £**40,000 (PI)**, School of Mathematics Grant, "Accelerated Coordinate Descent Methods for Big Data Optimization", matching funding for my postdoc Z. Qu |
| 2013 | £**18,785 (PI)**, NAIS Travel Grant, my 2 students spending semester at Berkeley |
| 2012–2014 | £**66,300 (PI)**, NAIS Lecturer Grant, paying for a proportion of my time |
| 2012–2014 | £**10,000 (PI)**, NAIS Startup Grant |
| 2012–2013 | £**49,518 (Co-I)**, EPSRC grant EP/J020567/1, "Algorithms for Data Simplicity", Joint with: Jared Tanner (Oxford, PI) |
| 2011–2014 | £**646,264 (Co-I)**, EPSRC and RCUK grant EP/I017127/1, "Mathematics for Vast Digital Resources", Joint with: Burak Büke (Edinburgh, Co-I) and Jacek Gondzio (Edinburgh, PI) |

## 7.2 GRANTS I HELPED TO PREPARE[9]

| | |
|---|---|
| 2014– | £42 million + £5 million, "The Alan Turing Institute". I am one of a small number of people who helped to prepare Edinburgh's bid. |
| 2014–2023 | £4.5 million, EPSRC grant, "Maxwell Institute Graduate School in Mathematical Analysis and Applications", PI: Anthony Carbery (Edinburgh). I am one of the named PhD supervisors on the grant. |
| 2014–2021 | £5.03 million, EPSRC grant, "Centre for Doctoral Training in Data Science", PI: Chris Williams (Edinburgh). I am one of 45 named potential PhD advisors at U of Edinburgh. |

# 8. MY TEAM

## 8.1 MY TEAM: SUMMARY

| Primary Supervision at KAUST | | | | |
|---|---|---|---|---|
| **Interns** | **MS** | **MS/PhD** | **PhD** | **Postdocs** |
| Completed: 11 | Completed: 1 [10] | Completed: 2 | Completed: 0 | Completed: 1 |
| In Progress: 2 | In Progress: 0 | In Progress: 2 | In Progress: 4 | In Progress: 3 |

[9] Large grants which I helped to prepare but where I am not formally an investigator.

[10] Visiting student Sarah Sachs from TU Münich writing her MS thesis under my supervision at KAUST.

| Primary Supervision at Moscow Institute of Physics and Technology (MIPT)[11] | | | | |
|---|---|---|---|---|
| **BS** | **MS** | **MS/PhD** | **PhD** | **Postdocs** |
| Completed: 2 | Completed: 0 | Completed: 0 | Completed: 0 | Completed: 0 |
| In Progress: 4 | In Progress: 0 | In Progress: 0 | In Progress: 0 | In Progress: 0 |

| Primary Supervision at the University of Edinburgh[12] | | | | |
|---|---|---|---|---|
| **Interns** | **MS** | **MS/PhD** | **PhD** | **Postdocs** |
| Completed: 2 | Completed: 20 | Completed: 0 | Completed: 4 | Completed: 6 |
| In Progress: 0 | In Progress: 0 | In Progress: 0 | In Progress: 1 | In Progress: 0 |

## 8.2 MY TEAM @ KAUST

| | |
|---|---|
| 09/2019– | Postdoc: Zhize Li (from Tsinghua University, China) |
| 06/2019– | Intern: Ahmed Khaled (from Cairo University, Egypt) |
| 03/2019– | Intern: Sélim Chraibi (from Grenoble, France) |
| 02/2019– | Postdoc: Adil Salim (from Télécom ParisTech, France) |
| 02/2019–03/2019 | Intern: Ľudovít Horváth (from Comenius University, Slovakia) |
| 01/2019–02/2019 | Intern: Dmitry Kamzolov (from MIPT, Russia) |
| 01/2019–02/2019 | Intern: Vladislav Elsukov (from MIPT, Russia) |
| 01/2019–02/2019 | Intern: Igor Sokolov (from MIPT, Russia) |
| 01/2019–02/2019 | Intern: Egor Shulgin (from MIPT, Russia) |
| 01/2019–02/2019 | Intern: Eduard Gorbunov (from MIPT, Russia) |
| 09/2018– | MS/PhD student: Elnur Gasanov (from MIPT, Russia) |
| 09/2018– | MS/PhD student: Dmitry Kovalev (from MIPT, Russia) |
| 03/2018–08/2018 | Visiting MS student: Sarah Sachs (from TU Münich, Germany) |
| 01/2018–02/2018 | Intern: Eduard Gorbunov (from MIPT, Russia) |
| 01/2018–02/2018 | Intern: Elnur Gasanov (from MIPT, Russia) |
| 01/2018–02/2018 | Intern: Dmitry Kovalev (from MIPT, Russia) |
| 01/2018–02/2018 | Intern: Slavomír Hanzely (from Comenius University, Slovakia) |
| 01/2018–01/2019 | Postdoc: El Houcine Bergou (from Institut National Polytechnique, Toulouse, France) |
| 10/2017–11/2017 | Intern: Nikita Doikov (from HSE Moscow, Russia) |
| 08/2017–12/2017 | PhD student: Viktor Lukáček[13] (from Comenius University, Slovakia) |
| 08/2017– | PhD student: Konstantin Mishchenko (from ENS, France) |
| 08/2017– | PhD student: Filip Hanzely (from University of Edinburgh, UK) |
| 08/2017– | MS/PhD student: Alibek Sailanbayev (awarded MS in 12/2018) |
| 08/2017– | MS/PhD student: Samuel Horváth (awarded MS in 12/2018) |
| 05/2017– | Postdoc: Aritra Dutta (from University of Central Florida, USA) |
| 05/2017–07/2017 | Intern: Atal Sahu (from IIT Kanpur, India) |
| 05/2017–07/2017 | Intern: Aashutosh Tiwari (from IIT Kanpur, India) |

## 8.3 MY TEAM @ MOSCOW INSTITUTE OF PHYSICS AND TECHNOLOGY

| | |
|---|---|
| 09/2018– | Dmitry Kamzolov |
| 09/2018– | Vladislav Elsukov |
| 09/2018– | Igor Sokolov |

[11] I hold a 2-year research grant at MIPT which requires me to form a team of talented students at MIPT and supervise them in research.

[12] I am on a 2-year leave from Edinburgh since March 2017, with a 5% appointment. This allows me to supervise my student Nicolas Loizou who decided to stay in Edinburgh when I moved to KAUST. Nicolas comes to KAUST for several extended research visits each year.

[13] Viktor Lukáček left after spending 1 semester at KAUST as he realized PhD was not the right path for him.

| | |
|---|---|
| 08/2018– | Egor Shulgin |
| 10/2017– | Eduard Gorbunov (to joint PhD program at Georgia Tech in Fall 2019) |
| 10/2017–8/2018 | Dmitry Kovalev (now: MS/PhD student in my team at KAUST) |
| 10/2017–8/2018 | Elnur Gasanov (now: MS/PhD student in my team at KAUST) |

## 8.4 MY TEAM @ UNIVERSITY OF EDINBURGH

| | |
|---|---|
| 09/2016–07/2017 | PhD student: Filip Hanzely (transferred to KAUST after 1 year in Edinburgh to follow me, with an MS degree with distinction) |
| 03/2016–07/2016 | Postdoc: Robert M. Gower |
| 10/2015– | PhD student: Nicolas Loizou |
| 10/2015–02/2017 | PhD student: Theo Pavlakou (now: Google; 2nd advisor; main advisor: Iain Murray) |
| 03/2015–03/2016 | PhD student: Robert M. Gower (now: Assistant Prof. at Télécom ParisTech) |
| 03/2015–06/2015 | Visiting PhD student: Luca Bravi (from University of Florence) |
| 10/2014–03/2015 | Postdoc: Ademir Ribeiro (now: Associate Prof. at University of Paraná) |
| 09/2014–11/2017 | PhD student: Dominik Csiba (Principal's Career Development Scholar) |
| 08/2013–07/2017 | PhD student: Jakub Konečný (now: Research Scientist, Google) |
| 12/2013–08/2015 | Postdoc: Zheng Qu (now: Assistant Prof. at University of Hong Kong) |
| 09/2012–02/2013 | Visiting PhD student: Minnan Luo (now: Assistant Prof. at Xi'an Jiaotong University) |
| 10/2012–07/2014 | Postdoc: Olivier Fercoq (now: Assistant Prof. at Télécom ParisTech) |
| 02/2012–07/2014 | Postdoc: Rachael Tappenden (now: Assistant Prof. at University of Canterbury) |
| 01/2012–06/2012 | Postdoc: Jakub Mareček (now: IBM Research, Dublin) |
| 09/2010–03/2014 | PhD student: Martin Takáč (now: Assistant Prof. at Lehigh University, USA) |
| 2010–2015 | Supervised 20 MSc Dissertations |
| 2010–2015 | Supervised 7 undergraduate students supported by research scholarships (EPSRC, Nuffield, College, ...) |

## 8.5 MY TEAM: AWARDS & RECOGNITIONS[14]

| | |
|---|---|
| 2018 (Kovalev) | Dean's Award[15], KAUST |
| 2018 (Loizou) | Research Internship at Facebook AI Research (FAIR), Montréal |
| 2018 (Mishchenko) | Research Internship at Amazon, Seattle |
| 2018 (Hanzely) | Research Internship at Microsoft Research (with Lin Xiao) |
| 2018 (Hanzely) | Research Internship at Amazon, Berlin, Scalable Machine Learning Group |
| 2018 (Horváth) | **Best DS$^3$ Poster Award**[16], Paris (1st Prize; for joint paper [81]) |
| 2018 (Doikov) | **Best Talk Award**[17], Voronovo, Russia (1st Prize; for joint paper [69]) |
| 2018 (Hanzely) | WEP Best Poster Award (3rd Place), KAUST |
| 2017 (Mishchenko) | Dean's Award, KAUST |
| 2017 (Lukáček) | Dean's Award, KAUST |
| 2017 (Hanzely) | Dean's Award, KAUST |
| 2017 (Gower) | **18th IMA Leslie Fox Prize**[18] (2nd Prize; for joint paper [39]) |
| 2016 (Csiba) | Postgraduate Essay Prize, School of Mathematics, University of Edinburgh |

[14] All travel grant awards are excluded.

[15] A financial add-on to the KAUST Fellowship, worth 6,000 USD annually, given to a few best incoming students by the Dean.

[16] DS$^3$ stands for Data Science Summer School, held at École Polytechnique, Paris, during June 25–29, 2018. There were 170 posters in the competition, from MS and PhD students, and postdocs. Samuel's poster, based on joint work [81], won the main prize, which also attracted a 500 EUR check.

[17] Event: "Traditional Youth School in Control, Information and Optimization", organized by Boris Polyak.

[18] "The Leslie Fox Prize is a biennial prize established in 1985 by the IMA in honour of mathematician Leslie Fox (1918-1992). The prize honours young numerical analysts worldwide (any person less than 31 years old), and applicants submit papers for review. A committee [...] awards First Prize and Second Prizes based on mathematical and algorithmic brilliance in tandem with presentational skill"

| | |
|---|---|
| 2016 (Hanzely) | **CASE PhD Studentship** (£93,333 award; 3/4 from EPSRC, 1/4 from Amazon) |
| 2016 (Loizou) | A. G. Leventis Foundation Grant for PhD studies |
| 2015 (Takáč) | **OR Society Best Doctoral Dissertation Prize** (for year 2014) |
| 2015 (Loizou) | A. G. Leventis Foundation Grant for PhD studies |
| 2015 (Loizou) | Principal's Career Development Scholarship[19] (in Data Science) |
| 2015 (Kisiala) | Best Student Prize[20], OR MSc Programme, School of Mathematics, Edinburgh |
| 2015 (Fercoq) | **17th IMA Leslie Fox Prize** (2nd Prize; for joint paper [21]) |
| 2015 (Csiba) | **Best Contribution Award** (2nd Prize; for joint paper [35]), Workshop: Optimization and Big Data, Edinburgh. Committee: Arkadi Nemirovskii (Georgia Tech) and Rodolphe Jenatton (Amazon) |
| 2015 (Konečný) | **BASP Frontiers Best Contribution Award** (1st prize in the field of signal processing; for joint paper [20]), Villars-sur-Ollon, Switzerland |
| 2014 (Konečný) | **Google European Doctoral Fellowship**[21] ($180,000 unrestricted gift funding Jakub's PhD for 3 years) |
| 2014 (Csiba) | Principal's Career Development Scholarship (in Data Science) |
| 2013 (Konečný) | Principal's Career Development Scholarship (in Data Science) |
| 2013 (Takáč) | **16th IMA Leslie Fox Prize** (2nd Prize; for joint paper [10]) |
| 2013 (Takáč) | SIAM Certificate in Recognition of Outstanding Efforts and Accomplishments, on behalf of the SIAM Chapter at the University of Edinburgh for academic year 2012–2013 |
| 2012 (Takáč) | **INFORMS Computing Society Best Student Paper Prize** (sole runner up; for joint paper [8]), Phoenix, Arizona |
| 2012 (Banks-Watson) | Best Student Prize, OR MSc Programme, School of Mathematics, Edinburgh |
| 2012 (Takáč) | **Best Talk Award**, SIAM National Student Chapter Conference, Manchester, UK |
| 2012 (Takáč) | Best Talk Award, Edinburgh Postgraduate Colloquium, University of Edinburgh |
| 2012 (Takáč) | Alice Margaret Campbell Bequest Fund Award for success in 1st year of PhD |
| 2011 (Takáč) | Certificate of Appreciation, 24th Biennial Conf. on Numerical Analysis, Glasgow, UK |
| 2011 (Takáč) | Best Poster Award, SIAM Student Chapter Conference, Edinburgh, UK |

## 8.6 MY TEAM: SELECTED INDEPENDENT ACHIEVEMENTS[22]

| | |
|---|---|
| 2018 (Mishchenko & Sailanbayev) | 80th Place, 2018 IEEEXtreme programming competition[23] |
| 2017 (Horváth) | 37th Place, Vojtech Jarník Int. Mathematical Competition, Ostrava, Czech Republic |
| 2016 (Horváth) | 36th Place, Vojtech Jarník Int. Mathematical Competition, Ostrava, Czech Republic |
| 2016 (Horváth) | 3rd Prize, Int. Mathematical Competition for University Students, Blagoevgrad, Bulgaria |
| 2016 (Sailanbayev) | Semifinal, Programming Contest ACM ICPC in NEERC region, Almaty, Kazakhstan |
| 2015 (Sailanbayev) | 2nd Prize, Int. Mathematical Competition for University Students, Blagoevgrad, Bulgaria |
| 2015 (Mishchenko) | 1st Prize, HSE Olympiad in Applied Mathematics and Informatics, Moscow, Russia |
| 2014 (Kovalev) | Honorable Mention, 15th Asian Physics Olympiad, Singapore |
| 2014 (Kovalev) | Winner, All Russian Mathematics Olympiad (Moscow Region) |
| 2014 (Kovalev) | Winner, All Russian Computer Science Olympiad (Moscow Region) |

[19] Principal's Career Development Scholarship: A highly competitive scholarship offered to 3 incoming PhD students in mathematics at the University of Edinburgh each year.

[20] For best performance in courses and MSc Dissertation, which I supervised.

[21] Google quote: "Nurturing and maintaining strong relations with the academic community is a top priority at Google. Today, we're announcing the 2014 Google PhD Fellowship recipients. These students, recognized for their incredible creativity, knowledge and skills, represent some of the most outstanding graduate researchers in computer science across the globe. We're excited to support them, and we extend our warmest congratulations."

[22] These awards are independent of my input.

[23] 4,000 teams (of size 3) from all over the world competed in a 24-hour time span against each other to solve a set of programming problems. Konstantin and Alibek scored high despite being just 2 on the team!

| | |
|---|---|
| 2014 (Kovalev) | Prizewinner, All Russian Physics Olympiad |
| 2014 (Mishchenko) | 3rd Prize, MIPT Student Mathematical Olympiad, Moscow, Russia |
| 2014 (Horváth) | 18th Place, National Mathematical Olympiad, Bratislava, Slovakia |
| 2014 (Horváth) | 1st Place, Nitra Region Mathematical Olympiad, Category A, Slovakia |
| 2014 (Sailanbayev) | 2nd Prize, Int. Mathematical Competition for University Students, Blagoevgrad, Bulgaria |
| 2014 (Loizou) | Top 1% in mathematics at National and Kapodestrian University of Athens, Greece |
| 2014 (Csiba) | Best Student Work in Applied Informatics in Czech and Slovak Republic, Annual Student Scientific Conference, Ústí nad Labem, Czech Republic |
| 2014 (Hanzely) | 2nd Prize (101st place), International Mathematical Competition for University Students, Blagoevgrad, Bulgaria |
| 2014 (Hanzely) | 9th Place, V. Jarník Int. Mathematical Competition, Ostrava, Czech Republic |
| 2014 (Lukáček) | 26th Place, Vojtech Jarník International Mathematical Competition, Ostrava, Czech Republic |
| 2013 (Kovalev) | Winner, All Russian Physics Olympiad |
| 2013 (Sailanbayev) | Silver Medal, International Mathematical Olympiad, Santa Marta, Colombia |
| 2013 (Hanzely) | Bronze Medal, International Mathematical Olympiad, Santa Marta, Colombia |
| 2013 (Sailanbayev) | 1st Place, National Mathematical Olympiad, Kazachstan |
| 2013 (Hanzely) | 1st Place, Slovak National Round of Mathematical Olympiad, Košice, Slovakia |
| 2013 (Sailanbayev) | Gold Medal, International Zhautykov Olympiad, Almaty, Kazakhstan |
| 2013 (Lukáček) | 20th Place, Vojtech Jarnik International Mathematical Competition, Ostrava, Czech Republic |
| 2012 (Kovalev) | Prizewinner, All Russian Physics Olympiad |
| 2012 (Lukáček) | 3rd Prize, Int. Mathematical Competition for University Students, Blagoevgrad, Bulgaria |
| 2012 (Mishchenko) | 1st Prize, Moscow Mathematical Olympiad, Moscow, Russia |
| 2012 (Mishchenko) | 1st Prize, PhysTech International Olympiad in Mathematics |
| 2012 (Sailanbayev) | Bronze Medal, International Mathematical Olympiad, Mar del Plata, Argentina |
| 2012 (Sailanbayev) | Silver Medal, Balkan Mathematical Olympiad, Antalya, Turkey |
| 2012 (Hanzely) | Bronze Medal, Middle European Mathematical Olympiad, Solothurn, Switzerland |
| 2012 (Csiba) | FIDE International Master in Chess |
| 2012 (Csiba) | 3rd Prize, International Mathematical Competition, Blagoevgrad, Bulgaria |
| 2012 (Konečný) | 2nd Prize, International ChaLearn Competition, One shot learning of gestures from Microsoft Kinect videos |
| 2012 (Fercoq) | Gaspard Monge Prize "for best PhD thesis defended in France 2012 in mathematics or computer science, with significant contributions to Optimization and Operations Research" |
| 2012 (Luo) | Google Anita Borg Scholarship, China |
| 2012 (Lukáček) | 2nd Place, International Correspondence Seminar in Mathematics (iKS) |
| 2011 (Lukáček) | Bronze Medal (26th Place), Middle European Mathematical Olympiad, Varaždin, Croatia |
| 2010 (Konečný) | Honourable Mention, International Mathematical Olympiad, Astana, Kazachstan |
| 2010 (Csiba) | Honourable Mention, Middle European Mathematical Olympiad, Žilina, Slovakia |
| 2008 (Konečný) | Honourable Mention, Middle European Mathematical Olympiad, Olomouc, Czech Republic |
| 2007–2009 (Takáč) | Winner, 3rd Place and Honourable Mention (twice), International Student Scientific Conference, Czech and Slovak Republic |

# 9. TALKS

## 9.1 TALKS: SUMMARY

I have given **more than 150 research talks**[24] at conferences, workshops and seminars worldwide (Australia, Austria, Belgium, Brazil, Canada, Chile, China, Cuba, France, Germany, Greece, Hong Kong, Hungary, India, Japan, Mongolia, Netherlands, Portugal, Russia, Saudi Arabia, Slovakia, Slovenia, Switzerland, United Kingdom, USA). Out of these, **40+ are plenary talks** at conferences and workshops, **10+ are invited PhD courses and tutorials**, **60+ are seminar talks**, and the rest are invited and contributed conference talks. I regularly give talks at the premier international optimization conferences (each taking place once in 3 years): Int. Symposium on Mathematical Programming (Rio'06, Chicago'09, Berlin'12, Pittsburgh'15, Bordeaux'18), SIAM Conf. on Optimization (Darmstadt'11, San Diego'14, Vancouver'17), Int. Conf. on Continuous Optimization (Ontario'07, Santiago'10, Lisbon'13, Tokyo'16).

## 9.2 PLENARY TALKS[25]

| | |
|---|---|
| 10/2019 | **Dagstuhl Seminar 19431 on Theory of Randomized Optimization Heuristics**, Leibnitz-Zentrum für Informatik, Germany |
| 06/2019 | **Approximation, Sampling, and Compression in High Dimensional Problems**, Isaac Newton Institute for Mathematical Sciences Program on "Approximation, Sampling and Compression in Data Science", Cambridge University, UK |
| 02/2019 | **Numerical Algorithms in Nonsmooth Optimization**, Thematic Program: "Modern Maximal Monotone Operator Theory: From Nonsmooth Optimization to Differential Inclusions", Erwin Schrödinger International Institute for Mathematics and Physics (ESI), Vienna, Austria |
| 11/2018 | **Statistics and Data Science Workshop**, KAUST, Thuwal, KSA |
| 09/2018 | **Randomized Numerical Linear Algebra and Applications**, Program: Data Science, Simons Institute, Berkeley, USA |
| 08/2018 | **DIMACS/TRIPODS Workshop: Optimization in Machine Learning**, Lehigh University, Bethlehem, USA |
| 07/2018 | **XII Brazilian Workshop on Continuous Optimization**, Foz do Iguaçu, Brazil |
| 10/2017 | **Optimization at Work**[26], Moscow Institute of Physics and Technology, Moscow, Russia |
| 09/2017 | **Workshop on Decentralized Machine Learning, Optimization and Privacy**, Lille, France |
| 07/2017 | **Workshop on Convex Optimization and Applications**, Fields Institute, Toronto, Canada (in honour of 70th birthday of Arkadi Nemirovski) |
| 04/2017 | **Visual Computing - Modeling and Reconstruction**, KAUST, Thuwal, KSA |
| 01/2017 | **2017 BASP Frontiers Workshop**, Villars-sur-Ollon, Switzerland |
| 11/2016 | **Workshop on Distributed Machine Learning**, Telecom ParisTech, Paris, France |
| 11/2016 | **SIAM Warwick Student Chapter Conference on Machine Learning and Statistics,** Coventry, UK |
| 10/2016 | **41st Woudschoten Conference,** Zeist, Netherlands. Two keynote lectures in the stream "Numerical methods for big data analytics" |
| 09/2016 | **Linear Algebra and Parallel Computing at the Heart of Scientific Computing,** a joint event of the Royal Society of Edinburgh and the French Embassy in London, Edinburgh, UK |
| 09/2016 | **"OR58": The 58th Annual Conference of the Operational Research Society,** Portsmouth, UK (closing plenary) |

[24] All my talks are listed on https://www.maths.ed.ac.uk/~prichtar/i_talks.html

[25] For the purpose of this CV, a plenary talk is any talk not given to a sub-audience; or a talk explicitly labeled as a plenary/keynote talk by the organizers of the workshop/conference. I am excluding here talks at events I organized or co-organized and declined invites to deliver a plenary talk. I am including past talks, and accepted invites to give a talk.

[26] This event was organized in my honour.

06/2016 **2016 Int. Workshop on Modern Optimization and Applications (MOA 2016),** Beijing, China

04/2016 **Einstein Center Mathematical Colloquium "Sparsity: Statistics, Optimization, and Applications"**, Berlin, Germany. "The purpose of this biannual scientific colloquium is bringing together mathematicians, scientists, and engineers to enjoy a series of talks on one topical issue of current or emerging interest to several fields within mathematics."

03/2016 **Computationally and Statistically Efficient Inference for Complex Large-scale Data**, Oberwolfach, Germany

09/2015 **Statistical and Computational Challenges in Large-Scale Data Analysis**, Alan Turing Institute Workshop, Cambridge, UK

09/2015 **LMS Inverse Day: Large-Scale and Nonlinear Inverse Problems**, Edinburgh, UK

04/2015 **Maxwell Institute Probability Day**, Edinburgh, UK

01/2015 **Optimization and Statistical Learning**, Les Houches, France

01/2015 **Theory of Big Data Science**, University College London, UK

12/2014 **Optimization Workshop, Foundations of Computational Mathematics**, Montevideo, Uruguay

11/2014 **46th Conference of Slovak Mathematicians**, Jasná, Slovakia

09/2014 **Mathematical Methods in Economics and Engineering**, Smolenice, Slovakia

07/2014 **Understanding Complex and Large Industrial Data**, Lancaster, UK

05/2014 **9th Int. Conf. on Intelligent Systems: Theories and Applications**, Rabat, Morocco

02/2014 **Stochastic Gradient Methods**, Inst. for Pure and Applied Mathematics, Los Angeles, USA

12/2013 **NIPS Workshop on Optimization in Machine Learning**, Lake Tahoe, USA. Past plenary speakers: D. Bertsekas, L. Bottou, S. Wright (2008), N. Srebro, L. Vandenberghe, A. Nemirovski (2009), M. Schmidt, Yu. Nesterov (2010), B. Recht, S. Boyd (2011), P. Parillo, F. Bach (2012)

11/2013 **International Conference on Information Technologies and Society**, Slovenia

10/2013 **Parallel and Distributed Algorithms for Inference and Optimization**, Simons Institute for the Theory of Computing, University of California, Berkeley, USA

05/2013 **Big Data Mining**, Imperial College London, UK

03/2013 **Fête Parisienne in Computation, Inference and Optimization**, IHES, Paris, France

03/2013 **Edinburgh SIAM Student Chapter Conference**, Edinburgh, UK

02/2013 **Big Data and Social Media**, Glasgow, UK

01/2013 **Optimization and Statistical Learning**, Les Houches, France

07/2012 **Optimization in Machine Learning**, ICML workshop, Edinburgh, UK

07/2011 **Optimization Workshop, Foundations of Comp. Mathematics**, Budapest, Hungary

05/2011 **Computational Complexity Challenges in Optimization**, Edinburgh, UK

## 9.3 INVITED LECTURE SERIES, TUTORIALS & SUMMER SCHOOL COURSES

08/2019 **Optimization in Machine Learning** (Summer School Lectures, 1/2 day), International Conference on Continuous Optimization (ICCOPT 2019), Berlin, Germany (co-taught with Steve Wright)

02/2019 **Randomized Optimization Methods** (PhD Course, 4.5 hours), Erwin Schrödinger International Institute for Mathematics and Physics (ESI), Vienna, Austria

06/2018 **Stochastic Reformulations in Linear Algebra and Optimization** (Summer School, 2 hours), Control, Information and Optimization, Voronovo, Moscow Region, Russia

04/2018 **Introduction to Optimization for Machine Learning** (short outreach course for selected Saudi university students who previously participated in the Saudi National Mathematical Olympiad or IMO, 4.5 hours), KAUST, Thuwal, KSA

08/2017 **Randomized Optimization Methods** (Summer School, 5 hours), Data Science Summer School ($DS^3$), École Polytechnique, France. Other courses: Joshua Bengio (Montreal), Deep Learning; Pradeep Ravikumar (CMU), Graphical Models; Csaba Szepesvári (Alberta/Google DeepMind), Bandits

| | |
|---|---|
| 10/2015 | **Randomized Methods for Big Data: From Linear Systems to Optimization** (Tutorial), IEEE International Conference on Data Science and Advanced Analytics, Paris, France |
| 2015 | **Randomized Algorithms for Big Data Optimization** (PhD Course, 18 hours), Graduate School in Systems, Optimization, Control and Networks – Université catholique de Louvain, Belgium |
| 09/2015 | **Optimization in Machine Learning** (PhD Course, 8 hours), Machine Learning Thematic Trimester, Toulouse, France |
| 07/2015 | **Modern Convex Optimization Methods for Large-Scale Empirical Risk Minimization** (Tutorial, 2 hours, joint with M. Schmidt), ICML 2015, Lille, France |
| 06/2014 | **Randomized Coordinate Descent Methods** (PhD Course, 6 hours), Khronos-Persyval Days "High-Dimensional Learning and Optimization", Grenoble, France |
| 06/2014 | **Coordinate Descent Methods** (Lecture, 2 hours), NATCOR PhD Course on Convex Optimization, Edinburgh, UK |
| 02/2014 | **Gradient Methods for Big Data** (Tutorial, 3 hours), Big Data: Challenges and Applications, Imperial College London, UK |

## 9.4 TALKS @ RESEARCH SEMINARS

| | |
|---|---|
| 2018 | Bratislava, KAUST (2), Warwick, Edinburgh (2) |
| 2017 | Imperial College London, KAUST, Plymouth, Cardiff |
| 2016 | Cambridge, Edinburgh (3), Stanford (2), KAUST, The Alan Turing Institute, LSE, Southampton, Skoltech, Yandex |
| 2015 | Louvain, Oxford, IST Austria, UC Davis, UC Berkeley, Edinburgh |
| 2014 | Moscow, Paris, Hong Kong, Edinburgh (3) |
| 2013 | UC Berkeley, Google, SAS Inc, Louvain, Edinburgh |
| 2012 | Wisconsin, Cambridge, Glasgow, Cardiff, Bratislava |
| 2011 | Edinburgh, Oxford, London, Heriot-Watt, Louvain |
| 2010 | Birmingham, Nottingham, Southampton |
| 2009 | ETH Zürich, Linz, Louvain, Edinburgh (2) |
| 2008 | Liége, Bratislava |
| 2007 | Cornell (2), Louvain (2) |

## 10. TEACHING[27]

| | |
|---|---|
| KAUST | **CS394D, Contemporary Topics in Machine Learning*** (Spring 2018, 2019) |
| | **CS390FF, Selected Topics in Data Science*** (Fall 2017, 2018) |
| Edinburgh | **Modern Optimization Methods for Big Data Problems*** (Spring 2016, 2017) |
| | **Optimization Methods in Finance*** (Spring 2011, 2012, 2013, 2014, 2015) |
| | **Game Theory*** (Fall 2010, 2011, 2012) |
| | Computing and Numerics (Spring 2013) |
| | Dynamic & Integer Programming (Fall 2010) |
| | Mathematics for Chemical Engineers (Fall 2010) |
| Louvain | **Nonlinear Optimization** (Spring 2009), with Yu. Nesterov |
| Cornell | Optimization II/Nonlinear Optimization (Spring 2006) |
| | **Engineering Probability and Statistics*** (Summer 2005) |
| | Engineering Probability and Statistics (Summer 2003, Fall 2003) |
| | Optimization II (Spring 2004) |
| | Application of Game Theory and OR to IT (Spring 2005) |
| | Topics in Linear Optimization (Spring 2005) |
| | Combinatorial Optimization (PhD course taught by David Williamson, Fall 2006) |

[27] I have proposed and developed from scratch courses marked with an asterisk. I was the instructor for all courses marked in bold. I was a TA (teaching assistant / tutor) for all other courses.

| | |
|---|---|
| Comenius | Complex Analysis (Fall 1998) |

## 11. CONFERENCE, STREAM, WORKSHOP & SEMINAR ORGANIZATION[28]

| | |
|---|---|
| 05/2020 | **SIAM Conference on Optimization**, The Hong Kong Polytechnic University, Hong Kong (member of the organizing committee) |
| 06/2019 | **Sparse Approximation and Sampling**, The Alan Turing Institute, London |
| 04/2019 | **A Short Course on Deep Learning and the Latest AI Algorithms**, KAUST, Saudi Arabia. A 2-day course delivered by Xavier Bresson, NTU, Singapore |
| 07/2018 | **International Symposium on Mathematical Programming**, Bordeaux, France. Scientific Committee Member for stream 4a: "Machine Learning, Big Data, Cloud Computing, and Huge-Scale Optimization" (with A. d'Aspremont, O. Beaumont and S. Sra) |
| 02/2018 | **Optimization and Big Data 2018**, KAUST (co-organizer with M. Canini) |
| 2017– | **All Hands Meetings on Big Data Optimization**, KAUST. This is a weekly group research seminar. |
| 09/2016 | **IMA Numerical Linear Algebra and Optimization**, Birmingham, UK (co-organizing 2 mini-symposia) |
| 12/2015 | **Mathematical Perspectives on Big Data**, a joint meeting of the London and Edinburgh mathematical societies, celebrating 150th anniversary of the former, Edinburgh |
| 12/2015 | **Theoretical and Computational Approaches to Large-Scale Inverse Problems**, Edinburgh (Alan Turing Institute Scoping Workshop) |
| 11/2015 | **Distributed Machine Learning and Optimization**, Edinburgh (Alan Turing Institute Scoping Workshop) |
| 05/2015 | **Optimization and Big Data 2015**, Edinburgh (founder and co-organizer; with Z. Qu) |
| 01/2015 | **International BASP Frontiers Workshop 2015**, Villars-sur-Ollon, Switzerland |
| 12/2014 | **Workshop: Numerical Algorithms and Intelligent Software**, Edinburgh |
| 09/2014 | 2 minisymposia at 4th IMA Conf. on Numerical Lin. Alg. and Optimisation, Birmingham |
| 05/2014 | **Coordinate Descent Methods Symposium** at the SIAM Conference on Optimization, San Diego (24 speakers) |
| 2014–2017 | **All Hands Meetings on Big Data Optimization**, University of Edinburgh. This is a weekly interdisciplinary research seminar attended by faculty, postdocs and PhD students from the Schools of Mathematics, Engineering and Informatics and Heriot-Watt University |
| 07/2013 | **Cluster Co-Chair** for "Convex and Nonsmooth Optimization" at the International Conference on Continuous Optimization (ICCOPT), Lisbon, Portugal (with F. Glineur). We organized 23 invited sessions in the cluster (=70 speakers). ICCOPT is the premiere conference in continuous optimization, taking place once in 3 years. Our cluster was twice as large as the second largest cluster. |
| 05/2013 | **Optimization and Big Data 2013**, Edinburgh, 64 participants (founder and organizer) |
| 05/2012 | **Optimization and Big Data 2012**, Edinburgh, 62 participants (founder and organizer) |
| 07/2011 | 2 minisymposia at 3rd IMA Conf. on Numerical Lin. Alg. and Optimisation, Birmingham |
| 07/2011 | 2 minisymposia at 24th Biennial Conf. on Numerical Analysis, Glasgow |

## 12. COMMISSIONS OF TRUST

## 12.1 EXTERNAL ACTIVITIES

| | |
|---|---|
| 2019– | **Handling Editor**, Journal of Nonsmooth Analysis and Optimization |
| 2019 | **Senior Program Committee Member**, 28th International Joint Conference on Artificial Intelligence (IJCAI 2019) |
| 2019 | **Area Chair**, International Conference on Machine Learning (ICML 2019) |

[28] I am excluding organized conference sessions.

| | |
|---|---|
| 2018 | Invite to join the External Advisory Board[29], Imam Abdulrahman Bin Faisal University, Dammam, KSA |
| 2018– | **Associate Editor**, Optimization Methods and Software |
| 2018– | Reviewer, Carnegie Trust, UK |
| 2017 | Reviewer, ERC (European Research Council) Consolidator Grants |
| 2016 | Habilitation Examiner for Nicolas Couellan, Institut de Mathématiques de Toulouse, Université Paul Sabatier, France (other examiners: Jean-Baptiste Hiriart-Urruty (Toulouse)) |
| 2016 | External PhD Examiner for Igor Colin, Télécom ParisTech, France (other examiners: Alexandre D'Aspremont (ENS) and Mikael Johansson (KTH)) |
| 2016 | **Guest Editor**, Journal of Computational Mathematics (co-editors: Xiaojun Chen, Yuhong Dai, and Yinyu Ye) |
| 2016 | Reviewer, EPSRC Programme Grant Scheme |
| 2016 | External PhD Examiner for Hamid Reza Feyzmahdavian, Automatic Control Dept, KTH Royal Institute of Technology, Sweden |
| 2015 | External DPhil Examiner for Sheng Fang, Mathematical Institute, University of Oxford, UK (internal examiner: Jared Tanner) |
| 2015 | Lead, Alan Turing Institute PhD Programme in Data Science (responsible, on behalf of the University of Edinburgh, for the development of the PhD programme, starting in 2017) |
| 2015 | Evaluator & Reviewer, EU Horizon 2020 grants totaling 36.2 million EUR |
| 2015 | Reviewer for Leverhulme Trust (2×) |
| 2015 | Reviewer for Isaac Newton Trust |
| 2014– | **Associate Editor**, Optimization (Frontiers in Applied Mathematics and Statistics) |
| 2014–2017 | Steering Committee (representing School of Mathematics), Centre for Doctoral Training in Data Science, University of Edinburgh (£5.03m grant from EPSRC) |
| 2013– | Member, EPSRC Peer Review College |
| 2013 | Evaluator & Reviewer, EU FP7 grants totaling 42.5 million EUR. |
| 2013 | **Chief Editor (declined invite)**, Statistics, Optimization and Computing (SOIC) |
| 2012–2014 | Steering Committee (representing University of Edinburgh), Numerical Algorithms and Intelligent Software (£5m grant from EPSRC) |
| 2011– | Reviewer, EPSRC |
| 2011–2016 | Faculty Advisor, SIAM Edinburgh Student Chapter |

## 12.2 JOURNAL REVIEWING

Mathematical Programming, SIAM Journal on Optimization, SIAM Review, Foundations of Computational Mathematics, Journal of Machine Learning Research, Machine Learning, IEEE Signal Processing, Symposium on Theory of Computing, Computational Optimization and Applications, Optimization Methods and Software, SIAM Journal on Computing, European Journal of Operational Research, Central European Journal of Operational Research, Journal of Global Optimization.

## 12.3 CONFERENCE REVIEWING (PROGRAM COMMITTEE MEMBERSHIP)

| | |
|---|---|
| 2019 | **NeurIPS**, Vancouver, Canada |
| 2019 | **AISTATS**, Naha, Okinawa, Japan |
| 2018 | **NIPS**, Montreal, Canada |
| 2018 | **ICML**, Stockholm, Sweden |
| 2018 | **ICLR**, Vancouver, Canada |
| 2017 | **NIPS**, Long Beach, USA |
| 2017 | **AAAI**, New Orleans, USA |

[29] I accepted the invite; formal appointment decision is pending.

| | |
|---|---|
| 2016 | **Symposium on Distributed Information Processing, Optimization, and Resource Management over Networks**, IEEE Global Conference on Signal and Information Processing, Greater Washington, D.C., USA |
| 2016 | **NIPS**, Barcelona, Spain |
| 2016 | **ICML**, New York, USA |
| 2016 | **International Conference on Internet of Things and Big Data**, Rome, Italy |
| 2015 | **AISTATS**, San Diego, California |
| 2015 | **13th EUROPT Workshop on Advances in Continuous Optimization**, Edinburgh |
| 2015 | **ICML**, Lille, France |

## 12.4 SERVICE @ KAUST

| | |
|---|---|
| 2019– | PhD Proposal Examiner for Adel Bibi, Computer Science |
| 2019– | Member, Research Strategic Plan Working Group (representing CEMSE) |
| 2018– | Chair, Artificial Intelligence Committee |
| 2018– | Co-Founder, The Machine Learning Hub (with M. Canini, B. Ghanem and P. Kalnis) |
| 2018– | Faculty Search Committee, Machine Learning |
| 2018– | CS Program Curriculum Committee |
| 2017 | PhD Proposal Examiner for Khalil Elkhalil, Electrical Engineering |
| 2017–2019 | Elected Member of the Academic Council |
| 2017–2018 | Faculty Search Committee, Statistics and Computer Science Position |
| 2017 | Directed Research Project Evaluation Panel |

## 12.5 SERVICE @ EDINBURGH

| | |
|---|---|
| 2016 | Recruitment Panel, Chancellor's Fellowships in "Mathematics of Data Science" and "Industrial Mathematics" |
| 2016 | Internal PhD Examiner for Zhanxing Zhu, School of Informatics, University of Edinburgh (external examiner: Manfred Opper (TU Berlin)) |
| 2015 | PhD Admissions, Data Science |
| 2015 | Recruitment Panel, Lectureship in "Mathematics of Data Science" |
| 2014–2015 | Part of a small team assisting with a bid for The Alan Turing Institute (successful) and subsequently with organizational planning |
| 2013–2016 | PhD Admissions, OR & Optimization |
| 2009–2015 | Director of Studies and Personal Tutor |
| 2009–2015 | MSc Projects Coordinator, OR and Optimization Programme |

## 13. PROFESSIONAL AFFILIATIONS

Society for Industrial and Applied Mathematics (SIAM)
Mathematical Optimization Society (MOS)
Edinburgh Mathematical Society (EMS)
Isaac Newton Institute for Mathematical Sciences (INIMS)
Institute for Operations Research and Management Science (INFORMS)
Foundations of Computational Mathematics (FoCM)
Slovak Mathematical Society (SMS)

# 14. INDUSTRY INVOLVEMENT

## 14.1 INDUSTRY INVOLVEMENT: SUMMARY

| company | paper(s) | comment |
|---|---|---|
| Intel | [93] | + ongoing collaboration |
| Microsoft Research | [79] | + ongoing collaboration |
| IBM Research | [22, 78] | + ongoing collaboration |
| Samsung | | contacted me with a grant/consulting offer to lead their Federated Learning efforts |
| Facebook | [83] | + ongoing collaboration through my student Nicolas Loizou who is interning at FAIR in Montréal at the moment |
| Amazon | [49] | + ongoing collaboration through my students Hanzely and Mishchenko who are interning at Amazon Berlin and Seattle, respectively |
| Google | [51, 52] | |
| Baidu | [29] | |
| Western General Hospital | [11] | |

In the past I have had research discussions with SAS, Twitter, Arup, British Geological Survey, Confbuzz and Scottish Financial Risk Academy.

## 14.2 INDUSTRY INVOLVEMENT: FEDERATED LEARNING (with Google)

Standard machine learning approaches require centralizing the training data on one machine or in a datacenter. For models trained from user interaction with mobile devices, a new approach was just released by Google, a result of collaboration between Google, Jakub Konečný and myself. The new approach is called "Federated Learning"; it is described in my papers [51, 52] and two additional papers by Google.
Federated Learning enables mobile phones to collaboratively learn a shared prediction model while keeping all the training data on device, decoupling the ability to do machine learning from the need to store the data in the cloud. This goes beyond the use of local models that make predictions on mobile devices by bringing model training to the device as well. **The technology is now in use by around 1 billion Android devices.**
The CEO of Google, Sundar Pichai, said:

> "... we continue to set the pace in machine learning and AI research. We introduced a new technique for training deep neural networks on mobile devices called Federated Learning. This technique enables people to run a shared machine learning model, while keeping the underlying data stored locally on mobile phones."

The new technology is described in a Google Research Blog, dated April 2017, to a lay audience. Selected media coverage: Forbes, The Verge, Quartz, TechRepublic, ZDNet, Computer Business Review, Motherboard Vice, Infoworld, Venturebeat, Engadget, Tech Narratives, GadgetHacks, BGR, AndroidAuthority, AndroidHeadlines, Tom's Guide, Digital Trends, The Exponential View, 9to5google.

# 15. PUBLICATIONS

## 15.1 CONFERENCE ABBREVIATIONS

| | |
|---|---|
| NIPS | Annual Conference on Neural Information Processing Systems<br>(one of the two primary conferences of high impact in machine learning and artificial intelligence research) |
| ICML | International Conference on Machine Learning<br>(one of the two primary conferences of high impact in machine learning and artificial intelligence research) |
| ECML PKDD | European Conf. on Machine Learning and Principles & Practice of Knowledge Discovery in Databases |

| | |
|---|---|
| ALT | International Conference on Algorithmic Learning Theory |
| AAAI | Conference on Artificial Intelligence |
| AISTATS | International Conference on Artificial Intelligence and Statistics |
| CVPR | Computer Vision and pattern Recognition |
| ICCV | IEEE International Conference on Computer Vision |
| MLSP | IEEE International Workshop on Machine Learning for Signal Processing |
| PROMS | Springer Proceedings in Mathematics & Statistics |
| ICASSP | International Conference on Acoustics, Speech, and Signal Processing (world's largest and most comprehensive technical conference focused on signal processing and its applications) |
| GlobalSIP | IEEE Global Conference on Signal and Information Processing |
| Allerton | Annual Allerton Conference on Communication, Control, and Computing |
| SPARS | Proceedings of Signal Processing with Adaptive Sparse Structured Representations |
| WACV | IEEE Winter Conference on Applications in Computer Vision |
| SPIE | Proceedings of the Society of Photo-Optical Instrumentation Engineers |
| OR | Operations Research Proceedings |
| SIGCOMM | ACM's Special Interest Group on Data Communications, specializing in the field of communication and computer networks |

## 15.2 PUBLICATION SUMMARY

In total, I have written 97 papers, of which 65 are published or accepted, most in leading journals and conferences in optimization, machine learning, numerical linear algebra, signal processing and statistics:

- 28 peer-reviewed journal papers:
  - Optimization Methods and Software (6)
  - Journal of Machine Learning Research (4)
  - SIAM Journal on Optimization (3)
  - SIAM Journal on Matrix Analysis and Applications (2)
  - Mathematical Programming (2)
  - Journal of Optimization Theory and Applications (2)
  - Frontiers in Applied Mathematics and Statistics (2)
  - SIAM Review (1)
  - IEEE Selected Topics in Signal Processing (1)
  - Journal of the American Statistical Association (1)
  - Linear Algebra and its Applications (1)
  - European Journal of Operations Research (1)
  - Journal of Computational Mathematics (1)
  - Optimization Letters (1)
- 37 peer-reviewed conference papers:
  - ICML (11)
  - NIPS (4)
  - NIPS Workshops (5)
  - PROMS (3)
  - SPARS (2)
  - AAAI (1)
  - AISTATS (1)
  - ALT (1)
  - ECML PKDD (1)
  - WACV (1)
  - ICCV Workshops (1)
  - ICASSP (1)
  - MLSP (1)
  - GlobalSIP (1)
  - Allerton (1)

– SPIE (1)
– OR (1)

## 15.3 CITATION METRICS[30]

According to Google Scholar, my works attracted more than 4,000 citations, my `h-index` is 30, and my `i10-index` (number of papers with at least 10 citations) is 51. My 10 most cited papers are:

| Paper | Journal / Conference | Citations (Google Scholar) |
|---|---|---|
| [8] | Mathematical Programming (MAPR) | 517 |
| [4] | Journal of Machine Learning Research (JMLR) | 440 |
| [10] | Mathematical Programming (MAPR) | 356 |
| [21] | SIAM Journal on Optimization (SIOPT) | 236 |
| [20] | Frontiers in Applied Mathematics and Statistics (Front Appl Math Stat) | 161 |
| [13] | International Conference on Machine Learning (ICML) | 146 |
| [37] | IEEE Journal of Selected Topics in Signal Processing (JSTSP) | 144 |
| [52] | Neural Information Processing Systems (NIPS) | 143 |
| [18] | Journal of Machine Learning Research (JMLR) | 138 |
| [29] | Neural Information Processing Systems (NIPS) | 103 |

## 15.4 LIST OF PUBLICATIONS, PREPRINTS & TECHNICAL REPORTS

The papers are listed in reverse chronological order in terms of their appearance online. The `arXiv` identifier is mentioned for papers which are not yet published. Coauthors marked with $(p)$, $(d)$, $(m)$ and $(i)$ were my $(p)$ostdocs, $(d)$octoral students, $(m)$aster students and $(i)$ interns at the time of writing, respectively.

(97) J. Xiong, P. Richtárik and W. Heidrich
**Stochastic convolutional sparse coding**
Submitted to: *CVPR 2019*

(96) A. Sapio, M. Canini, C.-Y. Ho, J. Nelson, P. Kalnis, C. Kim, A. Krishnamurthy, M. Moshref, D. Ports and P. Richtárik
**Scaling distributed machine learning with in-network aggregation**
`arXiv:arXiv:1903.06701`

(95) S. Horváth$^{(d)}$, D. Kovalev$^{(d)}$, K. Mishchenko$^{(d)}$, P. Richtárik and S. Stich
**Stochastic distributed learning with gradient quantization and variance reduction**

(94) E. Bergou$^{(p)}$, M. Canini, A. Dutta$^{(p)}$, P. Richtárik and Y. Xiao$^{(i)}$
**Direct nonlinear acceleration**

(93) E. Bergou$^{(p)}$, E. Gorbunov$^{(i)}$and P. Richtárik
**Stochastic three points method for unconstrained smooth minimization**
`arXiv:1902.03591`

(92) E. Bergou$^{(p)}$, A. Bibi, B. Ghanem, O. Sener and P. Richtárik
**A stochastic derivative-free optimization method with importance sampling**
`arXiv:1902.01272`

(91) K. Mishchenko$^{(d)}$, F. Hanzely$^{(d)}$and P. Richtárik
**99% of parallel optimization is inevitably a waste of time**

[30]These citations metric were extracted via Google Scholar in April 2019.

arXiv:1901.09437

(90) K. Mishchenko[(d)], E. Gorbunov[(i)], M. Takáč and P. Richtárik
**Distributed learning with compressed gradient differences**
arXiv:1901.09269

(89) R. M. Gower, N. Loizou[(d)], X. Qian[(p)], A. Sailanbayev[(d)], E. Shulgin[(i)]and P. Richtárik
**SGD: general analysis and improved rates**
*ICML 2019*

(88) D. Kovalev[(d)], S. Horváth[(d)]and P. Richtárik
**Don't jump through hoops and remove those loops: SVRG and Katyusha are better without the outer loop**
arXiv:1901.08689

(87) X. Qian[(p)], Z. Qu and P. Richtárik
**SAGA with arbitrary sampling**
*ICML 2019*

(86) L. M. Nguyen, P. H. Nguyen, P. Richtárik, K. Scheinberg and M. Takáč and M. van Dijk
**New convergence aspects of stochastic gradient algorithms**
arXiv:1811.12403

(85) F. Hanzely[(d)], J, Konečný[(d)], N. Loizou[(d)], P. Richtárik and D. Grishchenko[(i)]
**A privacy preserving randomized gossip algorithm via controlled noise insertion**[31]
*NIPS Privacy Preserving Machine Learning Workshop, 2018*

(84) K. Mishchenko[(d)]and P. Richtárik
**A stochastic penalty model for convex and nonconvex optimization with big constraints**
arXiv:1810.13387

(83) N. Loizou[(d)], M. Rabbat and P. Richtárik
**Provably accelerated randomized gossip algorithms**
*ICASSP 2019*

(82) F. Hanzely[(d)]and P. Richtárik
**Accelerated coordinate descent with arbitrary sampling and best rates for minibatches**
*AISTATS 2019*

(81) S. Horváth[(d)]and P. Richtárik
**Nonconvex variance reduced optimization with arbitrary sampling**
*ICML 2019*
Horváth: Best DS[3] (Data Science Summer School) Poster Award[32], 2018

(80) F. Hanzely[(d)], K. Mishchenko[(d)]and P. Richtárik
**SEGA: Variance reduction via gradient sketching**
*NIPS 2018 (Advances in Neural Information Processing Systems 31)*

[31]Short version of [58]

[32]The first prize out of 170 competing posters presented by MS students, PhD students and postdocs. SH is an MS student. Cash award 500 EUR.

(79) F. Hanzely[(d)], P. Richtárik and L. Xiao
**Accelerated Bregman proximal gradient methods for relatively smooth convex optimization**
arXiv:1808.03045

(78) J. Mareček, P. Richtárik and M. Takáč
**Matrix completion under interval uncertainty: highlights**
*ECML-PKDD 2018*

(77) N. Loizou[(d)] and P. Richtárik
**Accelerated gossip via stochastic heavy ball method**
*Allerton 2018 (The 56th Annual Allerton Conf. on Communication, Control, and Computing, 2018)*

(76) A. Bibi, A. Sailanbayev[(d)], B. Ghanem, R. M. Gower and P. Richtárik
**Improving SAGA via a probabilistic interpolation with gradient descent**
arXiv:1806.05633

(75) A. Dutta[(p)], F. Hanzely[(d)] and P. Richtárik
**A nonconvex projection method for robust PCA**
To appear in: *AAAI 2019*

(74) R. M. Gower, P. Richtárik and F. Bach
**Stochastic quasi-gradient methods: variance reduction via Jacobian sketching**
arXiv:1805.02632

(73) A. Dutta[(p)], X. Li and P. Richtárik
**Weighted low-rank approximation of matrices and background modeling**
arXiv:1804.06252

(72) F. Hanzely[(d)] and P. Richtárik
**Fastest rates for stochastic mirror descent methods**
arXiv:1803.07374

(71) L. M. Nguyen, P. H. Nguyen, M. van Dijk, P. Richtárik, K. Scheinberg and M. Takáč
**SGD and Hogwild! convergence without the bounded gradients assumption**
*ICML 2018 (Proceedings of the 35th Int. Conf. on Machine Learning, PMLR 80:3750-3758, 2018)*

(70) R. M. Gower, F. Hanzely[(d)], P. Richtárik and S. Stich
**Accelerated stochastic matrix inversion: general theory and speeding up BFGS rules for faster second-order optimization**
*NIPS 2018 (Advances in Neural Information Processing Systems 31)*

(69) N. Doikov[(i)] and P. Richtárik
**Randomized block cubic Newton method**
*ICML 2018 (Proceedings of the 35th Int. Conf. on Machine Learning, PMLR 80:1290-1298, 2018)*
Doikov: Best Talk Award at "Traditional Youth School in Control, Information and Optimization", Voronovo, Russia, 2018

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**Stochastic spectral and conjugate descent methods**
*NIPS 2018 (Advances in Neural Information Processing Systems 31)*

(67) R. Harman, L. Filová and P. Richtárik
**A randomized exchange algorithm for computing optimal approximate designs of experiments**
*Journal of the American Statistical Association, 2018*

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(65) N. Loizou$^{(d)}$and P. Richtárik
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*WACV 2019*

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*NIPS Workshop on Optimization for Machine Learning, 2017*

(62) D. Csiba$^{(d)}$and P. Richtárik
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(61) A. A. Ribeiro$^{(p)}$and P. Richtárik
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*Linear Algebra and its Applications 556, 342-372, 2018*

(60) M. J. Ehrhardt, P. Markiewicz, A. Chambolle, P. Richtárik, J. Schott and C. B. Schönlieb
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*Proceedings of SPIE, Wavelets and Sparsity XVII, Volume 10394, pages 103941O-1 to 103941O-11, 2017*

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*IEEE International Conference on Computer Vision (ICCV) Workshops, 2017*

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**Parallel stochastic Newton method**
*Journal of Computational Mathematics 36(3):405–427, 2018*

(54) R. M. Gower[(d)] and P. Richtárik
**Linearly convergent randomized iterative methods for computing the pseudoinverse**
Submitted to: *Linear Algebra and its Applications*[33]
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**Randomized distributed mean estimation: accuracy vs communication**
*Frontiers in Applied Mathematics and Statistics 4:62, 2018*

(52) J. Konečný[(d)], H. B. McMahan, F. Yu, P. Richtárik, A.T. Suresh and D. Bacon
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*NIPS Private Multi-Party Machine Learning Workshop, 2016*
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(51) J. Konečný[(d)], H. B. McMahan, D. Ramage and P. Richtárik
**Federated optimization: distributed machine learning for on-device intelligence**
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(50) N. Loizou[(d)] and P. Richtárik
**A new perspective on randomized gossip algorithms**
*GlobalSIP 2016 (The 4th IEEE Global Conference on Signal and Information Processing, 440–444, 2016)*

(49) S. J. Reddi, J. Konečný[(d)], P. Richtárik, B. Póczos and A. Smola
**AIDE: Fast and communication efficient distributed optimization**
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(48) D. Csiba[(d)] and P. Richtárik
**Coordinate descent face-off: primal or dual?**
*ALT 2018 (Proceedings of Algorithmic Learning Theory, PMLR 83:246–267, 2018)*

(47) O. Fercoq[(p)] and P. Richtárik
**Optimization in high dimensions via accelerated, parallel and proximal coordinate descent**[34]
*SIAM Review 58(4), 2016*
SIAM SIGEST Outstanding Paper Award, 2017

(46) R. M. Gower[(d)], D. Goldfarb and P. Richtárik
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*ICML 2016 (Proceedings of The 33rd Int. Conf. on Machine Learning, PMLR 48:1869–1878, 2016)*

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**Importance sampling for minibatches**

[33] We did not yet receive any reviews as of September 2018; the paper is in review since December 2016.
[34] A (refreshed) reprint of [21] originally published in SIAM Journal on Optimization

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*IEEE Journal of Selected Topics in Signal Processing 10(2):242–255, 2016*
Konečný: BASP Frontiers Best Contribution Award, 2015

(36) R. Tappenden[(p)], M. Takáč[(d)] and P. Richtárik
**On the complexity of parallel coordinate descent**
*Optimization Methods and Software 33(2), 372-395, 2018*

(35) D. Csiba[(d)], Z. Qu[(p)] and P. Richtárik
**Stochastic dual coordinate ascent with adaptive probabilities**
*ICML 2015 (Proceedings of the 32nd Int. Conf. on Machine Learning, PMLR 37:674-683, 2015)*
Csiba: Best Contribution Award (2nd Prize), Optimization and Big Data 2015
Implemented in Tensor Flow

[35] We did not receive any reviews after 2.5 years since submission. The paper was recently accepted after a change in JMLR leadership.

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**Adding vs. averaging in distributed primal-dual optimization**
*ICML 2015 (Proceedings of the 32nd Int. Conf. on Machine Learning, PMLR 37:1973-1982, 2015)*
Smith: MLconf Industry Impact Student Research Award, 2015
CoCoA+ is now the default linear optimizer in Tensor Flow

(33) Z. Qu$^{(p)}$, P. Richtárik, M. Takáč$^{(d)}$and O. Fercoq$^{(p)}$
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*ICML 2016 (Proceedings of The 33rd Int. Conf. on Machine Learning, PMLR 48:1823-1832, 2016)*

(32) Z. Qu$^{(p)}$and P. Richtárik
**Coordinate descent with arbitrary sampling II: expected separable overapproximation**
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*PROMS 2015 (In: Al-Baali M., Grandinetti L., Purnama A. (eds) Numerical Analysis and Optimization. Springer Proceedings in Math. & Statistics, vol 134. Springer, Cham, 261–288, 2015)*

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[36] A short version of the journal paper [37]
[37] A short version of the journal paper [30]

(23) D. Forgan and P. Richtárik
**On optimal solutions to planetesimal growth models**
*Technical Report ERGO 14-002, 2014*

(22) J. Mareček[(p)], P. Richtárik and M. Takáč[(d)]
**Matrix completion under interval uncertainty**
*European Journal of Operational Research 256(1):35–43, 2017*

(21) O. Fercoq[(p)] and P. Richtárik
**Accelerated, parallel and proximal coordinate descent**
*SIAM Journal on Optimization 25(4):1997–2023, 2015*
Fercoq: 17th Leslie Fox Prize (2nd Prize), Institute for Mathematics and its Applications, 2015
2nd Most Downloaded Paper from the SIOPT Website, 2016 & 2017

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**Semi-stochastic gradient descent**
*Frontiers in Applied Mathematics and Statistics 3:9, 2017*

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*Optimization Letters 10(6):1233–1243, 2016*

(18) P. Richtárik and M. Takáč[(d)]
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*Journal of Machine Learning Research 17 (75):1–25, 2016*

(17) O. Fercoq[(p)] and P. Richtárik
**Smooth minimization of nonsmooth functions with parallel coordinate descent methods**
To appear in: *PROMS 2017 (Modelling and Optimization: Theory and Applications, Springer Proceedings in Math. and Statistics)*

(16) R. Tappenden[(p)], P. Richtárik and B. Büke
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*Optimization Methods and Software 30(3):643–668, 2015*

(15) R. Tappenden[(p)], P. Richtárik and J. Gondzio
**Inexact coordinate descent: complexity and preconditioning**
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Submitted to: *Journal of Machine Learning Research (under revision*[38]*)*
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(11) W. Hulme$^{(m)}$, P. Richtárik, L. McGuire and A. Green
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(10) P. Richtárik and M. Takáč$^{(d)}$
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*Mathematical Programming 156(1):433–484, 2016*
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(9) P. Richtárik and M. Takáč$^{(d)}$
**Efficient serial and parallel coordinate descent methods for huge-scale truss topology design**
*In: Klatte D., Lüthi HJ., Schmedders K. (eds) Operations Research Proceedings 2011 (Gesellschaft für Operations Research e.V.). Springer, Berlin, Heidelberg, 2012*

(8) P. Richtárik and M. Takáč$^{(d)}$
**Iteration complexity of randomized block-coordinate descent methods for minimizing a composite function**
*Mathematical Programming 144(2):1–38, 2014*
Takáč: Best Student Paper Award (sole runner-up), INFORMS Computing Society, 2012

(7) P. Richtárik and M. Takáč$^{(d)}$
**Efficiency of randomized coordinate descent methods on minimization problems with a composite objective function**
*SPARS 2011 (Signal Processing with Adaptive Sparse Structured Representations)*

(6) P. Richtárik
**Finding sparse approximations to extreme eigenvectors: generalized power method for sparse PCA and extensions**
*SPARS 2011 (Signal Processing with Adaptive Sparse Structured Representations)*

(5) P. Richtárik
**Approximate level method for nonsmooth convex optimization**
*Journal of Optimization Theory and Applications 152(2):334–350, 2012*

(4) M. Journée, Yu. Nesterov, P. Richtárik and R. Sepulchre
**Generalized power method for sparse principal component analysis**
*Journal of Machine Learning Research 11:517–553, 2010*

(3) P. Richtárik
**Improved algorithms for convex minimization in relative scale**
*SIAM Journal on Optimization 21(3):1141–1167, 2011*

(2) P. Richtárik
**Simultaneously solving seven optimization problems in relative scale**
*Technical Report, Optimization Online, 2008*

[38] Due to mishandling, this paper was not assigned an Associate Editor for a few years. A new Associate Editor was recently found. We have now obtained reviews and are revising the manuscript.

(1) P. Richtárik
**Some algorithms for large-scale linear and convex minimization in relative scale**
*PhD thesis, School of ORIE, Cornell University, 2007*

## 15.5 PATENTS

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**Method and system for classifying images**
*Patent# WO/2015/011470*