Jan Vondrák

Research interests

Discrete Optimization and Approximation Algorithms.
Recent work includes optimization of submodular functions and mechanisms for combinatorial auctions. More broadly, I am interested in approximation algorithms, algorithmic game theory and probabilistic combinatorics.

Current position

Stanford University, Stanford, CA.
Associate Professor, Department of Mathematics, since January 2016.

Previous work experience

IBM Almaden Research Center, San Jose, CA.
Theory Group, Research Staff Member 2009-15.

Princeton University, Princeton, NJ.
Postdoctoral teaching fellow, Council on Science and Technology, 2006-09.

Microsoft Research, Redmond, WA.
Postdoctoral position: Theory group, 2005-06.

Mathematical Sciences Research Institute, Berkeley, CA.
Membership: Spring 2005 program in Probability, Algorithms and Statistical Physics.

Education

Massachusetts Institute of Technology, Cambridge, MA.
Ph.D. in Applied Mathematics, 2000-05.
Thesis title: *Probabilistic Methods in Combinatorial and Stochastic Optimization.*
Advisor: Michel Goemans.

Charles University, Prague, Czech Republic.
Ph.D. in Computer Science, 1999-2000, completed 2007.
Thesis title: *Submodularity in Combinatorial Optimization.*
Advisor: Martin Loebl.

Charles University, Prague, Czech Republic.
Master's degree in Computer Science, 1995-1999.
Thesis title: *Implementation and Testing of a New Max-Cut Algorithm.*
Advisor: Martin Loebl.

Charles University, Prague, Czech Republic.
Bachelor's degree in Physics, 1992-1995.

Selected Presentations

Plenary talk: SIAM Conference on Discrete Mathematics, Minneapolis, June 2014.

Plenary talk: ACM-SIAM Symposium on Discrete Algorithms (SODA), New Orleans, January 2013.

UBC Distinguished Lecture Series: Dept. of Computer Science, UBC, Vancouver, November 2012.

Invited tutorial: Modern Aspects of Submodularity, Georgia Tech, Atlanta, March 2012.

Invited lecture: Discrete Optimization in Machine Learning workshop, Neural Information Processing Systems (NIPS), Whistler, December 2011.

Journal Publications

Impossibility results for truthful combinatorial auctions with submodular valuations
(with S. Dobzinski), J. ACM 6(1):5, 2016.

Optimal bounds on approximation of submodular and XOS functions by juntas
(with V. Feldman), SIAM J. Computing 45:3, 1129–1170, 2016.

Limitations of randomized mechanisms for combinatorial auctions
(with S. Dughmi), Games and Economic Behavior 92, 370–400, 2015.

Submodular function maximization via the multilinear relaxation and contention resolution schemes
(with C. Chekuri and R. Zenklusen), SIAM J. on Computing, 43:6, 1831–1879, 2014.

Is submodularity testable?
(with C. Seshadhri), Algorithmica 69:1, 1–25, 2014.

Symmetry and approximability of submodular maximization problems
(single author), SIAM Journal on Computing 42:1, 265–304, 2013.

Matroid matching: the power of local search
(with J. Lee and M. Sviridenko), SIAM Journal on Computing 42:1, 357–379, 2013.

On variants of the matroid secretary problem
(with S. Oveis Gharan), Algorithmica 67:4, 472–497, 2013.

Maximizing conjunctive views in deletion propagation
(with B. Kimelfeld and R. Williams), ACM Transactions on Database Systems 37:4, 2012.

Maximizing a submodular set function subject to a matroid constraint
(with C. Calinescu, C. Chekuri and M. Pál), SIAM Journal on Computing 40:6 (STOC 2008 special issue), 1740–1766, 2011.

Maximizing non-monotone submodular functions
(with U. Feige and V. Mirrokni), SIAM Journal on Computing, 40:4, 1133–1153, 2011.

Submodular maximization over multiple matroids via generalized exchange properties
(with J. Lee and M. Sviridenko), Mathematics of Operations Research 35, 795–806, 2010.

A randomized embedding algorithm for trees
(with B. Sudakov), Combinatorica 30:4, 445–470, 2010.

The Submodular Welfare Problem with demand queries
(with U. Feige), Theory of Computation 6, 247–290, 2010.

Submodularity and curvature: the optimal algorithm
(single author), Kokyuroku Bessatsu, Kyoto, Japan, 253–266, 2010.

Disjoint bases in a polymatroid
(with G. Calinescu and C. Chekuri), Random Structures and Algorithms 35:4, 418–430, 2009.

Approximating the Stochastic Knapsack Problem: The Benefit of Adaptivity
(with B. Dean and M. Goemans), Mathematics of Operations Research 33:4, 945–964, 2008.

How many random edges make a dense hypergraph non-2-colorable?
(with B. Sudakov), Random Structures and Algorithms 32, 290–306, 2008.

Shortest-path metric approximation for random subgraphs
(single author), Random Structures and Algorithms 30:1-2, 95–104, 2007.

Covering minimum spanning trees of random subgraphs
(with M. Goemans), Random Structures and Algorithms, 29:3, 257–276, 2006.

A Ramsey-type result for the hypercube
(with N. Alon, B. Sudakov and R. Radoičić), Journal of Graph Theory 53, 196–208, 2006.

Nearly equal distances and Szemerédi's regularity lemma

(with J. Pach and R. Radoičić), Computational Geometry 34:1, 11-19, 2006.

On the diameter of separated point sets with many nearly equal distances
(with J. Pach and R. Radoičić), European Journal of Combinatorics 27:8, 1321–1332, 2005.

Wide partitions, Latin tableaux and Rota's basis conjecture
(with T. Chow, K. Fan and M. Goemans), Advances in Applied Mathematics 31:2, 334–358, 2003.

Towards a theory of frustrated degeneracy
(with M. Loebl), Discrete Mathematics 271, 179–193, 2003.

The limit checker number of a graph
(with R. Šámal), Discrete Mathematics 235, 343–347, 2001.

Optimization via enumeration: a new algorithm for the Max-Cut problem
(with M. Loebl and A. Galluccio), J. of Math. Programming 90-2A, 273–290, 2001.

New algorithm for the Ising problem: Partition function for finite lattice graphs
(with M. Loebl and A. Galluccio), Physical Review Letters 84:26, 5924–5927, 2000.

Peer-reviewed Conference Publications

An algorithmic proof of the Lovász Local Lemma via resampling oracles
(with N. Harvey) in 56^{th} IEEE Foundations of Computer Science (FOCS 2015), 1327–1346.

Tight bounds on low-degree spectral concentration of submodular and XOS functions
(with V. Feldman) in 56^{th} IEEE Foundations of Computer Science (FOCS 2015), 923–942.

Sperner's colorings, hypergraph labeling problems and fair division
(with M. Mirzakhani) in 26^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2015), 873–886.

Optimal approximation for submodular and supermodular optimization with bounded curvature
(with M. Sviridenko and J. Ward) in 26^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2015), 1134–1148.

On multiplicative weight updates for concave and submodular function maximization
(with C. Chekuri and T.S. Jayram) in 6^{th} Innovations in Theoretical Computer Science (ITCS 2015), 201–210.

Lazier than Lazy Greedy
(with B. Mirzasoleiman, A. Badanidiyuru, A. Karbasi and A. Krause) in 29^{th} Conference on Advancement of Artificial Intelligence (AAAI 2015), 1812–1818.

Hardness of submodular cost allocation: Lattice matching and a simplex coloring conjecture
(with A. Ene) in APPROX 2014, 144–159.

Exchangeability and realizability: De Finetti theorems on graphs
(with A. Ene) in RANDOM 2014, 762-778.

Multiway Cut, pairwise realizable distributions, and descending thresholds
(with A. Sharma) in 46^{th} ACM Symposium on Theory of Computing (STOC 2014), 724–733.

Fast algorithms for maximizing submodular functions
(with A. Badanidiyuru) in 25^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2014), 1497–1514.

Optimal bounds on approximation of submodular and XOS functions by juntas
(with V. Feldman) in 54^{th} IEEE Foundations of Computer Science (FOCS 2013), 227–236; invited to a special issue in *SIAM Journal on Computing.*

Representation, approximation and learning of submodular functions using low-rank decision trees
(with V. Feldman and P. Kothari), in 26^{th} Conference on Learning Theory (COLT 2013), 711–740.

Local distribution and the symmetry gap: approximability of multiway partitioning problems

(with A. Ene and Y. Wu), in 24^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2013), 306–325.

Communication complexity of combinatorial auctions with submodular valuations
(with S. Dobzinski), in 24^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2013), 1205–1215.

Online submodular welfare maximization: greedy is optimal
(with M. Kapralov and I. Post), in 24^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2013), 1216–1225.

Multi-tuple deletion propagation: approximations and complexity
(with B. Kimelfeld and D. Woodruff), in Proceedings of the Very Large Database Endowment (PVLDB) 6:13, 1558–1569, 2013.

The computational complexity of truthfulness in combinatorial auctions
(with S. Dobzinski), in 13^{th} ACM Conference on Electronic Commerce (EC 2012), 405–422.
"Top 10% paper", invited to a special issue.

From query complexity to computational complexity
(with S. Dobzinski), in 44^{th} ACM Symposium on Theory of Computing (STOC 2012), 1107–1116.

Limitations of randomized mechanisms for combinatorial auctions
(with S. Dughmi), in 52^{nd} IEEE Foundations of Computer Science (FOCS 2011), 502–511;
invited to a special issue in *Games and Economic Behavior*.

Maximizing conjunctive views in deletion propagation
(with B. Kimelfeld and R. Williams), in 30^{th} ACM Conference on Principles of Database Systems (PODS 2011), 187–198.

On variants of the matroid secretary problem
(with S. Oveis Gharan), in 19^{th} European Symposium on Algorithms (ESA 2011), 335–346.

Submodular function maximization via the multilinear relaxation and contention resolution schemes
(with C. Chekuri and R. Zenklusen), in 43^{rd} ACM Symposium on Theory of Computing (STOC 2011), 783–792.

Is submodularity testable?
(with C. Seshadhri), in 2^{nd} Innovations in Computer Science (ICS 2011), 195–210.

Submodular maximization by simulated annealing
(with S. Oveis Gharan), in 22^{nd} ACM-SIAM Symposium on Discrete Algorithms (SODA 2011), 1098–1117.

Multi-budgeted matchings and matroid intersection via dependent rounding
(with C. Chekuri and R. Zenklusen), in 22^{nd} ACM-SIAM Symposium on Discrete Algorithms (SODA 2011), 1080–1097.

On principles of egocentric person search in social networks
(with S. Cohen, B. Kimelfeld and G. Koutrika), in Very Large Data Search (VLDS), 3–6, 2011.

Dependent randomized rounding via exchange properties of combinatorial structures
(with C. Chekuri and R. Zenklusen), in 51^{st} IEEE Foundations of Computer Science (FOCS 2010), 575–584;.

Matroid matching: the power of local search
(with J. Lee and M. Sviridenko), in 42^{nd} ACM Symposium on Theory of Computing (STOC 2010), 369–378.

Symmetry and approximability of submodular maximization problems
(single author), in 50^{th} IEEE Foundations of Computer Science (FOCS 2009), 651–670.

Submodular maximization over multiple matroids via generalized exchange properties

(with J. Lee and M. Sviridenko), in APPROX 2009, 244–257.

K-user fading interference channels: the ergodic very strong case
(with L. Sankar and V. Poor), in Allerton Conference on Communication, Control and Computing, 2009.

Optimal approximation for the submodular welfare problem in the value oracle model
(single author), in 40^{th} ACM Symposium on Theory of Computing (STOC 2008), 67–74; invited to a special issue in *SIAM Journal on Computing*.

Tight information-theoretic lower bounds for welfare maximization in combinatorial auctions
(with V. Mirrokni and M. Schapira), in 9^{th} ACM Conference on Electronic Commerce (EC 2008), 70–77.

Maximizing non-monotone submodular functions
(with U. Feige and V. Mirrokni), in 48^{th} IEEE Foundations of Computer Science (FOCS 2007), 461–471.

Maximizing a submodular set function subject to a matroid constraint
(with C. Calinescu, C. Chekuri and M. Pál), in 12^{th} Integer Programming and combinatorial optimization (IPCO 2007), 182–196.

Approximation algorithms for allocation problems: Improving the factor of 1 - 1/e
(with U. Feige), in 47^{th} Foundations of Computer Science (FOCS 2006), 667–676.

Stochastic covering and adaptivity
(with M. Goemans), in LATIN 2006, Theoretical informatics, LNCS 3887, 532–543.

Adaptivity and approximation for stochastic packing problems
(with B. Dean and M. Goemans), in 16^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2005), 395–404.

Approximating the stochastic knapsack problem: the benefit of adaptivity
(with B. Dean and M. Goemans), in 45^{th} IEEE Foundations of Computer Science (FOCS 2004), 208–217.

Covering minimum spanning trees of random subgraphs
(with M. Goemans), in 15^{th} ACM-SIAM Symposium on Discrete Algorithms (SODA 2004), 927–934.

Visibility representations of complete graphs
(with R. Babilon, H. Nyklová and O. Pangrác), Graph drawing 1999, LNCS 1731, Springer, 333–340.

Teaching experience

Lecturer in *Polyhedral Techniques in Combinatorial Optimization*, Stanford, Fall 2010.

Lecturer in *Calculus and Analytical Geometry*, Princeton, Fall 2008.

Lecturer (head of the course) in *Combinatorial Mathematics*, Princeton, Spring 2008.

Lecturer (head of the course) in *Calculus and Analytical Geometry*, Princeton, Spring 2007.

Recitation instructor in *Multivariable Calculus* (prof. Hartley Rogers), MIT, Fall 2004.

Recitation instructor in *Multivariable Calculus* (prof. Arthur Mattuck), MIT, Fall 2003.

Teaching assistant in *Probability Theory* (prof. Balint Virág), MIT, Fall 2002.

Teaching assistant in *Advanced Algorithms* (prof. Michel Goemans), MIT, Fall 2001.

Recitation instructor in *Discrete Mathematics*, Charles University, Prague, 1999-2000.

Recitation instructor in *Linear Algebra*, Charles University, Prague, 1998-1999.

Professional Activities

Associate Editor of the *SIAM Journal on Computing*, since January 2014.

Program committee member: SODA 2016, ESA 2014, ITCS 2014, FOCS 2012, SODA 2012, ICALP 2011, SODA 2010, APPROX 2008.

Reviewer for *Journal of ACM*, *SIAM Journal on Computing*, *SIAM Journal on Optimization*, *SIAM Journal on Discrete Mathematics*, *Math. Programming*, *Random Structures and Algorithms*, *Mathematics of Operations Research*.