

Veniamin I. Morgenshtern

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Research Background

Mathematical signal processing, specializing in mathematics of imaging, inverse problems, mathematics of sparsity, and big data. Developed a theory of stable super-resolution of sparse sources via convex optimization, designed new algorithms for super-resolved fluorescence microscopy, proposed a new concept of super-resolution radar.

Information theory, specializing in wireless communication. Proposed a novel architecture for interference management in wireless communication networks, performed information-theoretic analysis of linear time-varying channel with implications for pulse design, studied reliable communication in the absence of channel-state information.

Education

- Postdoc, Applied Mathematics and Statistics, Stanford University, U.S.A. May 2012–present
Advisor: Prof. Emmanuel Candès
- Ph.D., Electrical Engineering, ETH Zurich, Switzerland Jul. 2010
Advisor: Prof. Helmut Bölcskei
Thesis: *Crystallization and noncoherence in wireless communication*
Co-examiners: Prof. İ. Emre Telatar and Prof. Amos Lapidoth
- Diploma in Mathematics (**with honors**), Saint-Petersburg State University, Russia Jun. 2004
Advisors: Prof. Andrey Terekhov and Prof. Helmut Bölcskei
Diploma Thesis: *Capacity scaling in large wireless networks*

Research Experience

- Postdoctoral researcher, Stanford University, U.S.A. May 2012–present
Dept. of Statistics with Prof. Emmanuel Candès
- Postdoctoral researcher, ETH Zurich, Switzerland Jul. 2010–Apr. 2012
Dept. of Information Technology and Electrical Engineering with Prof. Helmut Bölcskei
- Visiting researcher, University of Illinois at Urbana-Champaign, U.S.A. Aug. 2007–Nov. 2007
Coordinated Science Laboratory with Prof. P. R. Kumar
- Researcher, ETH Zurich, Switzerland Sep. 2004–Jun. 2010
Dept. of Information Technology and Electrical Engineering with Prof. Helmut Bölcskei
- Visiting researcher, ETH Zurich, Switzerland Jan. 2004–Jun. 2004
Dept. of Information Technology and Electrical Engineering with Prof. Helmut Bölcskei

Awards

- Second Prize in “Thomson Reuters Eikon Text Tagging Challenge”, 2015
a machine-learning competition (\$10,000)
- Fellowship for Advanced Researchers from the Swiss National Science Foundation 2012
(approx. \$130,000)
- ETH Zurich Medal for doctoral thesis (CHF 1,500) 2011
- ETH Zurich Fellowship for talented students from Eastern Europe (approx. CHF 15,000) 2004
- First Prize in Algebra at the Bernstein International Scientific Conference 1998 & 1999
- First Prize in Physics at the Saint-Petersburg Regional Olympiad 1997

Teaching and Mentoring Experience

Co-instructor, ETH Zurich (taught one-half of the course)

Harmonic Analysis: Theory and Applications in Advanced Signal Processing 2009 & 2011
Graduate course, Spring semester, taught in English, 30 students

Fundamentals of Wireless Communication 2006 & 2007
Graduate course, Spring semester, taught in English, 30 students

Teaching Assistant, ETH Zurich

Coding for Wireless Channels 2008
Graduate course, Spring semester, taught in English, 20 students

Co-supervisor and mentor of Ph.D. students, Stanford & ETH Zurich

D. A. Barmherzig, *Phase retrieval: algorithms and applications* 2014–present

R. Heckel, *Super-resolution radar* 2011–2014

Supervisor and mentor of graduate and undergraduate students, ETH Zurich

S. Christen, *Analysis of mass-spectrometry data* 2011

O. With, *Channel estimation and compensation for wireless relaying* 2011

E. Pargaetzi, *Implementation of hardware for synchronization in the relaying testbed* 2010

Publications

Book Chapters

1. V. I. Morgenshtern and H. Bölcskei, “A short course on frame theory,” in *Mathematical Foundations for Signal Processing, Communications and Networking* (T. Chen, R. Dinesh, and E. Serpedin, eds.), pp. 737–789, CRC Press, 2012 (**invited**).
2. G. Durisi, V. I. Morgenshtern, H. Bölcskei, U. G. Schuster, and S. Shamai (Shitz), “Information theory of underspread WSSUS channels,” in *Wireless Communications over Rapidly Time-Varying Channels* (F. Hlawatsch and G. Matz, eds.), pp. 65–116, Academic Press, 2011 (**invited**).

Journal Papers

1. V. I. Morgenshtern and E. J. Candès, “Super-resolution of positive sources: the discrete setup,” *SIAM J. on Imaging Sciences*, 2015. Accepted.
2. V. I. Morgenshtern, “Super-resolution of positive sources: the continuous setup,” *J. of Fourier Analysis and Appl.*, 2015. To be submitted.
3. R. Heckel, V. I. Morgenshtern, and M. Soltanolkotabi, “Super-resolution radar,” *Information and Inference: J. of the IMA*, 2015. Accepted.
4. V. I. Morgenshtern, E. Riegler, W. Yang, G. Durisi, S. Lin, and B. Sturmfels, “Capacity pre-log of noncoherent SIMO channels via Hironaka’s theorem,” *IEEE Trans. Inf. Theory*, vol. 59, pp. 4213–4229, July 2013.
5. G. Durisi, V. I. Morgenshtern, and H. Bölcskei, “On the sensitivity of continuous-time noncoherent fading channel capacity,” *IEEE Trans. Inf. Theory*, vol. 58, pp. 6372–6391, Oct. 2012.
6. V. I. Morgenshtern and H. Bölcskei, “Crystallization in large wireless networks,” *IEEE Trans. Inf. Theory*, vol. 53, no. 10, pp. 3319–3349, 2007.

Journal Papers in Preparation

1. V. I. Morgenshtern, M. D. Lew, A. Backer, C. A. Sing-Long, S. J. Sahl, E. J. Candès, and W. E. Moerner, “Algorithms for super-resolution microscopy: the basics,” 2015. In preparation.

Conference Papers

1. G. Koliander, E. Riegler, G. Durisi, V. I. Morgenshtern, and F. Hlawatsch, “A lower bound on the noncoherent capacity pre-log for the MIMO channel with temporally correlated fading,” in *Proc. Allerton Conf. Commun., Contr., and Comput.*, (Monticello, IL), pp. 1198–1205, Oct. 2012.
2. W. Yang, G. Durisi, V. I. Morgenshtern, and E. Riegler, “Capacity pre-log of SIMO correlated block-fading channels,” in *Proc. International Symposium on Wireless Communication Systems*, (Aachen, Germany), pp. 869–873, Nov. 2011.
3. E. Riegler, V. I. Morgenshtern, G. Durisi, S. Lin, B. Sturmfels, and H. Bölcskei, “Noncoherent SIMO pre-log via resolution of singularities,” in *Proc. IEEE Int. Symp. Inf. Theory (ISIT)*, (St. Petersburg, Russia), pp. 2020–2024, Aug. 2011.
4. V. I. Morgenshtern, G. Durisi, and H. Bölcskei, “The SIMO pre-log can be larger than the SISO pre-log,” in *Proc. IEEE Int. Symp. Inf. Theory (ISIT)*, (Austin, TX, U.S.A.), pp. 320–324, June 2010.
5. G. Durisi, V. I. Morgenshtern, and H. Bölcskei, “On the sensitivity of noncoherent capacity to the channel model,” in *Proc. IEEE Int. Symp. Inf. Theory (ISIT)*, (Seoul, Korea), pp. 2174–2178, June 2009.
6. V. I. Morgenshtern and H. Bölcskei, “Random matrix analysis of large relay network,” in *Proc. Allerton Conf. Commun., Contr., Comput.*, (Monticello, IL), pp. 106–112, Sept. 2006 (**invited paper**).
7. V. I. Morgenshtern and H. Bölcskei, “Capacity of large amplify and forward relay networks,” in *IEEE Commun. Theory Workshop*, May 2006 (**invited paper**).
8. V. I. Morgenshtern, H. Bölcskei, and R. U. Nabar, “Distributed orthogonalization in large interference relay networks,” in *Proc. IEEE Int. Symp. Inf. Theory (ISIT)*, (Adelaide, Australia), pp. 1211–1215, Sept. 2005.
9. V. I. Morgenshtern and H. Bölcskei, “On the value of cooperation in interference relay networks,” in *Proc. Allerton Conf. Commun., Contr., Comput.*, (Monticello, IL), Sept. 2005 (**invited paper**).
10. V. I. Morgenshtern, “Characterization of Birkhoff’s semigroup,” in *Proc. Bernstein Int. Scientific Conf.*, (Saint-Petersburg, Russia), p. 18, Feb. 1999.
11. V. I. Morgenshtern, “Archimedean semigroups in fields,” in *Proc. Bernstein Int. Scientific Conf.*, (Saint-Petersburg, Russia), p. 33, Feb. 1998.

Theses

1. V. I. Morgenshtern, *Crystallization and noncoherence in wireless communication*. PhD thesis, ETH Zurich, Switzerland, July 2010 (**ETH Zurich Medal for doctoral dissertation**).
2. V. I. Morgenshtern, “Capacity scaling in large wireless networks,” Master’s thesis, St. Petersburg State University, Russia, June 2004.

Unrefereed Paper Published Online

1. R. U. Nabar, H. Bölcskei, and V. I. Morgenshtern, “On the robustness of distributed orthogonalization in dense wireless networks,” Mar. 2005.

Talks

Stanford Information Theory Forum	2015
Berkeley Networking Communications and DSP Seminar	2015
Stanford Workshop in Biostatistics	2015
University of California San Diego Mathematics Seminar	2015
University of California Irvine Mathematics Seminar	2015
University of California Irvine EE Seminar	2015
Information Theory and Applications Workshop (San Diego, California U.S.A.)	2015
University of Illinois CSL Seminar	2007
Allerton Conference on Communications, Control, and Computing (Allerton, Illinois USA)	2006
Allerton Conference on Communications, Control, and Computing (Allerton, Illinois USA)	2005
International Conference on Information Theory (Adelaide, Australia USA)	2005

Professional Service

Journal reviewing: *Journal of Fourier Analysis and Applications*, *IEEE Transactions on Information Theory*, *IEEE Transactions on Signal Processing*, *IEEE Transactions on Wireless Communications*, *IEEE Proceedings Communications*, *IEEE Journal on Selected Areas in Communications*.

Conference reviewing: *IEEE International Symposium on Information Theory (ISIT)*, *International Zurich Seminar on Communications (IZS)*, *IEEE Global Communications Conference (GLOBECOM)*, *International Symposium on Wireless Communication Systems (ISWCS)*, *IEEE International Conference on Communications (ICC)*, *IEEE International ITG Workshop on Smart Antennas (WSA)*, *International Wireless Communications and Mobile Computing Conference (IWCMC)*.

Industry Employment

Team Leader, Technical Writer's team, Relativity Technologies Corp., U.S.A. & Russia	2002–2003
Software Developer, real-time control software for rockets, "Karat" design office, Russia	2001–2002

Outside Interest

Backcountry skiing and snowboarding, rock climbing, alpinism, surfing, kitesurfing.

Languages

Russian (native), English (fluent), German (good knowledge).

References

Prof. Helmut Bölcskei
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Prof. Shlomo Shamai (Shitz)
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