Victoria Kostina

Assistant Professor www.caltech.edu/~vkostina
California Institute of Technology, CA 91125 vkostina@caltech.edu

Research interests

My research interests lie in information theory, theory of random processes, coding, wireless communications, and control. I am particularly interested in fundamental limits of delay-sensitive communications.

Education

Ph.D in Electrical Engineering Sep. 2008 – Sep. 2013
Princeton University, New Jersey, USA
Advisor: Sergio Verdú
Thesis: Lossy data compression: nonasymptotic fundamental limits
GPA: 3.95/4.00

Master of Applied Science in Electrical Engineering Sep. 2004 – Sep. 2006
University of Ottawa, Ontario, Canada
Advisor: Sergey Loyka
Thesis: Optimization and performance analysis of the V-BLAST algorithm
GPA: 3.95/4.00

Honors Bachelor in Applied Mathematics and Physics Sep. 2000 – Sep. 2004
Moscow Institute of Physics and Technology (MIPT), Moscow, Russia
Thesis: Dynamic Polling in Centrally-controlled Wireless Networks
Advisor: Andrey Lyakhov
GPA: 3.97/4.00

Professional Experience

Assistant Professor of Electrical Engineering Aug. 2014 –
California Institute of Technology, California, USA

Simons Institute Research Fellow Jan. 2015 – May 2015
Simons Institute, Berkeley, California, USA

Postdoctoral Research Associate Sep. 2013 – July 2014
Princeton University, New Jersey, USA
Advisor: Sergio Verdú

Assistant in Research/ Assistant in Instruction Sep. 2009 – Aug. 2013
Princeton University, New Jersey, USA

Software Engineer Nov. 2006 – Aug. 2008
Blue Castle Games, Vancouver, British Columbia, Canada

Research/Teaching Assistant Sep. 2004 – Aug. 2006
University of Ottawa, Ottawa, Ontario, Canada

Software Developer Aug. 2002 – Aug. 2004
NetCracker Technology Corp., Moscow, Russia

Research Assistant Aug. 2002 – Aug. 2004
Institute for Information Transmission Problems (IITP), Moscow, Russia

Courses taught

EE 150: Nonasymptotic information theory Fall 2014
California Institute of Technology

Delay-constrained theory of information: single-shot results, information spectrum methods. Information-theoretic limits for sources and channels with memory and/or general alphabets. Advantages of variable-length, feedback and joint source-channel coding in the nonasymptotic regime. Error exponents, source and channel dispersion. Prerequisite: EE/MA 126

EE 120: Topics in Information Theory Spring 2016
California Institute of Technology

This class introduces information measures such as entropy, information divergence, mutual information, information density from a probabilistic point of view, and discusses the relations of those quantities to problems in data compression and transmission, statistical inference, language modeling, game theory and control. Topics include information projection, data processing inequalities, sufficient statistics, hypothesis testing, single-shot approach in information theory, large deviations. Prerequisites: undergraduate calculus and probability; desirable but not required: EE126a.

EE/Ma/CS 127: Error-Correcting Codes Winter 2016
California Institute of Technology

Prerequisites: Ma 2. This course develops from first principles the theory and practical implementation of the most important techniques for combating errors in digital transmission or storage systems. Topics include algebraic block codes, e.g., Hamming, BCH, Reed-Solomon (including a self-contained introduction to the theory of finite fields); and the modern theory of sparse graph codes with iterative decoding, e.g. LDPC codes, turbo codes. The students will become acquainted with encoding and decoding algorithms, design principles and performance evaluation of codes.

Advisees

Postdocs	Arnaud Marsiglietti (CMI fellow)	Sep. 2016 –
Graduate students	Yu Su, Brennan Young	Sep. 2015 – Aug. 2016
	Peida Tian, Recep Can Yavas	Sep. 2016 –
Undergraduate students	Ayush Pandey (VURP student)	June 2016 – July 2016

Professional activities

Organizer	8th North American School of Information Theory *UC San Diego*	Aug. 2015
	Caltech EE Systems Seminar *Caltech*	Mar. 2017 –
	Simons Institute IT Seminar *Berkeley, CA*	Jan. 2015 – May 2015
	Communications reading group *Princeton University*	Sep. 2009 – Aug. 2012
Tutorial speaker	International Symposium on Information Theory and Its Applications (ISITA), *Monterey, CA*	Oct. 2016
	Pasadena City College Women's Engineering Day *Pasadena, CA*	Feb. 2016
	Caltech Alumni Association reception *Seattle, WA*	June 2015
	Information Technology and Systems *Sochi, Russia*	Sep. 2015
	Beyond i.i.d. in information theory workshop *Cambridge, UK / Singapore*	Jan. 2013 Jul. 2017
TPC member	2016 IEEE International Symposium on Information Theory 2018 IEEE International Symposium on Information Theory	

Reviewer

IEEE Transactions on Information Theory
IEEE Transactions on Automatic Control
IEEE Transactions on Communications
IEEE Transactions on Wireless Communications
Foundations and Trends in Communications and Information Theory
Entropy
IEEE International Symposium on Information Theory
IEEE Information Theory Workshop
IEEE Conference on Decision and Control
National Science Foundation
European Research Council

Scholarships and awards

Simons-Berkeley Research Fellowship	Jan 2015 – May 2015
Princeton Electrical Engineering Best Dissertation Award	June 2014
Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship PGS D	Sep. 2009 – Aug. 2012
Upton Fellowship in Engineering, Princeton University	Sep. 2008 – Aug. 2009
NSERC Postgraduate Scholarship PGS M	May 2005 – May 2006
University of Ottawa Excellence Scholarship	May 2005 – May 2006
University of Ottawa Admission Scholarship	Sep. 2004 – May 2005
MIPT Excellence Scholarship	Sep. 2001 – June 2004
IITP Best Bachelor's thesis award (2nd prize)	July 2004

Research grants

NSF Grant CCF-1566567: Data compression with low distortion and finite blocklength, 2016-2018.

Preprints

[1] V. Kostina and E. Tuncel, "Successive refinement of abstract sources," *ArXiv preprint*, July 2017.

[2] A. Khina, A. Khisti, V. Kostina, and B. Hassibi, "Sequential coding of Gauss–Markov sources over packet-erasure channels with feedback," *ArXiv preprint*, June 2017.

[3] A. Marsiglietti and V. Kostina, "A lower bound on the differential entropy of log-concave random vectors with applications," *ArXiv preprint*, Apr. 2017.

[4] V. Kostina and B. Hassibi, "Rate-cost tradeoffs in control. Part I: lower bounds," *ArXiv preprint*, Dec. 2016.

[5] V. Kostina and B. Hassibi, "Rate-cost tradeoffs in control. Part II: achievable scheme," *ArXiv preprint*, Dec. 2016.

Journal Publications

[1] V. Kostina, "Data compression with low distortion and finite blocklength," *IEEE Transactions on Information Theory*, vol. 63, no. 7, pp. 4268–4285, July 2017.

[2] V. Kostina, Y. Polyanskiy, and S. Verdú, "Joint source-channel coding with feedback," *IEEE Transactions on Information Theory*, vol. 63, no. 6, pp. 3502–3515, June 2017.

[3] V. Kostina and S. Verdú, "Nonasymptotic noisy lossy source coding," *IEEE Transactions on Information Theory*, vol. 62, no. 11, pp. 6111–6123, Nov. 2016.

[4] V. Kostina, Y. Polyanskiy, and S. Verdú, "Variable-length compression allowing errors," *IEEE Transactions on Information Theory*, vol. 61, no. 9, pp. 4316–4330, Aug. 2015.

[5] V. Kostina and S. Verdú, "Channels with cost constraints: strong converse and dispersion," *IEEE Transactions on Information Theory*, vol. 61, no. 5, pp. 2415–2429, May 2015.

[6] S. Loyka, V. Kostina, and F. Gagnon, "On convexity of error rates in digital communications," *IEEE Transactions on Information Theory*, vol. 59, no. 10, pp. 6501–6516, Oct. 2013.

[7] V. Kostina and S. Verdú, "Lossy joint source-channel coding in the finite blocklength regime," *IEEE Transactions on Information Theory*, vol. 59, no. 5, pp. 2545–2575, May 2013.

[8] V. Kostina and S. Verdú, "Fixed-length lossy compression in the finite blocklength regime," *IEEE Transactions on Information Theory*, vol. 58, no. 6, pp. 3309–3338, June 2012.

[9] V. Kostina and S. Loyka, "Optimum power and rate allocation for coded V-BLAST: Instantaneous optimization," *IEEE Transactions on Communications*, vol. 59, no. 10, pp. 2841–2850, Oct. 2011.

[10] V. Kostina and S. Loyka, "Optimum power and rate allocation for coded V-BLAST: Average optimization," *IEEE Transactions on Communications*, vol. 59, no. 3, pp. 877–887, Mar. 2011.

[11] S. Loyka, V. Kostina, and F. Gagnon, "Error rates of the maximum-likelihood detector for arbitrary constellations: convex/concave behavior and applications," *IEEE Transactions on Information Theory*, vol. 56, no. 4, pp. 1948–1960, Apr. 2010.

[12] V. Kostina and S. Loyka, "On optimum power allocation for the V-BLAST," *IEEE Transactions on Communications*, vol. 56, no. 6, pp. 999–1012, June 2008.

Ph.D. dissertation

[1] V. Kostina, "Lossy data compression: nonasymptotic fundamental limits," Ph.D. dissertation, Princeton University, Sep. 2013.

Conference Publications

[1] A. Khina, V. Kostina, A. Khisti, and B. Hassibi, "Sequential coding of Gauss–Markov sources with packet erasures and feedback," in *Proceedings 2017 IEEE Information Theory Workshop*, Kaohsiung, Taiwan, Nov. 2017, to appear.

[2] V. Kostina and E. Tuncel, "The rate-distortion function for successive refinement of abstract sources," in *Proceedings 2017 IEEE International Symposium on Information Theory*, Aachen, Germany, June 2017, pp. 1923–1927.

[3] A. Marsiglietti and V. Kostina, "A lower bound on the differential entropy for log-concave random variables with applications to rate-distortion theory," in *Proceedings 2017 IEEE International Symposium on Information Theory*, Aachen, Germany, June 2017, pp. 46–50.

[4] P. Noorzad, M. Effros, M. Langberg, and V. Kostina, "The birthday problem and zero-error list codes," in *Proceedings 2017 IEEE International Symposium on Information Theory*, Aachen, Germany, June 2017, pp. 1648–1652.

[5] M. Ebrahimi, F. Lahouti, and V. Kostina, "Coded random access design for constrained outage," in *Proceedings 2017 IEEE International Symposium on Information Theory*, Aachen, Germany, June 2017, pp. 2732–2736.

[6] A. Khina, G. M. Pettersson, V. Kostina, and B. Hassibi, "Multi-rate control over AWGN channels: An analog joint source-channel coding perspective," in *Proceedings 2016 IEEE Conference on Decision and Control*, Las Vegas, NV, Dec. 2016.

[7] V. Kostina, Y. Peres, M. Z. Rácz, and G. Ranade, "Rate-limited control of systems with uncertain gain," in *Proceedings 54th Annual Allerton Conference on Communication, Control and Computing*, Monticello, IL, Oct. 2016.

[8] V. Kostina and B. Hassibi, "Rate-cost tradeoffs in control," in *Proceedings 54th Annual Allerton Conference on Communication, Control and Computing*, Monticello, IL, Oct. 2016.

[9] V. Kostina, "When is Shannon's lower bound tight?" in *Proceedings 54th Annual Allerton Conference on Communication, Control and Computing*, Monticello, IL, Oct. 2016.

[10] V. Kostina, "Data compression with low distortion and finite blocklength," in *Proceedings 53rd Annual Allerton Conference on Communication, Control and Computing*, Monticello, IL, Oct. 2015.

[11] V. Kostina, Y. Polyanskiy, and S. Verdú, "Joint source-channel coding with feedback," in *Proceedings 2015 IEEE International Symposium on Information Theory*, Hong Kong, June 2015.

[12] V. Kostina, Y. Polyanskiy, and S. Verdú, "Transmitting k samples over the Gaussian channel: energy-distortion tradeoff," in *Proceedings 2015 IEEE Information Theory Workshop*, Jerusalem, Israel, Apr. 2015, pp. 1–5.

[13] V. Kostina and S. Verdú, "The output distribution of good lossy source codes," in *Proceedings 2015 Information Theory and Applications Workshop*, La Jolla, CA, Feb. 2015, pp. 308–312.

[14] V. Kostina, Y. Polyanskiy, and S. Verdú, "Variable-length compression allowing errors," in *IEEE International Symposium on Information Theory*, Honolulu, HI, July 2014.

[15] V. Kostina and S. Verdú, "Nonasymptotic noisy lossy source coding," in *Proceedings 2013 IEEE Information Theory Workshop*, Seville, Spain, Sep. 2013.

[16] V. Kostina and S. Verdú, "Channels with cost constraints: strong converse and dispersion," in *Proceedings 2013 IEEE International Symposium on Information Theory*, Istanbul, Turkey, July 2013.

[17] S. Loyka, V. Kostina, and F. Gagnon, "Convexity of error rates in digital communications under non-Gaussian noise," in *Proceedings 2013 IEEE International Symposium on Information Theory*, Istanbul, Turkey, July 2013.

[18] V. Kostina and S. Verdú, "To code or not to code: Revisited," in *Proceedings 2012 IEEE Information Theory Workshop*, Lausanne, Switzerland, Sep. 2012, pp. 5–9.

[19] V. Kostina and S. Verdú, "Lossy joint source-channel coding in the finite blocklength regime," in *Proceedings 2012 IEEE International Symposium on Information Theory*, Cambridge, MA, July 2012, pp. 1553–1557.

[20] V. Kostina and S. Verdú, "A new converse in rate-distortion theory," in *Proceedings 46th Annual Conference on Information Sciences and Systems*, Princeton, NJ, Mar. 2012, pp. 1–6.

[21] V. Kostina and S. Loyka, "Performance analysis of coded V-BLAST with optimum power and rate allocation," in *Proceedings 2011 IEEE International Symposium on Information Theory*, Saint Petersburg, Russia, Aug. 2011, pp. 1851–1855.

[22] V. Kostina and S. Verdú, "Fixed-length lossy compression in the finite blocklength regime: discrete memoryless sources," in *Proceedings 2011 IEEE International Symposium on Information Theory*, Saint Petersburg, Russia, Aug. 2011, pp. 41–45.

[23] V. Kostina, M. F. Duarte, S. Jafarpour, and R. Calderbank, "The value of redundant measurement in compressed sensing," in *Proceedings 2011 IEEE International Conference on*

Acoustics, Speech and Signal Processing (ICASSP), Prague, Czech Republic, May 2011, pp. 3656–3659.

[24] V. Kostina and S. Verdú, "Fixed-length lossy compression in the finite blocklength regime: Gaussian source," in *Proceedings 2011 IEEE Information Theory Workshop*, Paraty, Brazil, Oct. 2011, pp. 457–461.

[25] S. Loyka, F. Gagnon, and V. Kostina, "Error rates of capacity-achieving codes are convex," in *Proceedings 2010 IEEE International Symposium on Information Theory*, Austin, TX, June 2010, pp. 325–329.

[26] A. Lorbert, D. Eis, V. Kostina, D. M. Blei, and P. J. Ramadge, "Exploiting covariate similarity in sparse regression via the pairwise elastic net ," in *Proceedings 13th International Conference on Artificial Intelligence and Statistics*, vol. 9, Chia Laguna, Sardinia, Italy, May 2010, pp. 477–484.

[27] S. Loyka, V. Kostina, and F. Gagnon, "Bit error rate is convex at high SNR," in *Proceedings 2009 IEEE International Zurich Seminar on Communications*, ETH Zurich, Switzerland, Mar. 2010, pp. 41–44.

[28] V. Kostina and S. Loyka, "Optimum power allocation for coded V-BLAST," in *Proceedings 2009 IEEE International Conference on Communications*, Dresden, Germany, June 2009.

[29] V. Kostina and S. Loyka, "Performance analysis of V-BLAST with optimum power allocation," in *Proceedings 2007 IEEE Global Telecommunications Conference*, Washington, DC, Nov. 2007, pp. 1508–1513.

[30] S. Loyka, V. Kostina, and F. Gagnon, "Symbol error rates of maximum-likelihood detector: Convex/concave behavior and applications," in *Proceedings 2007 IEEE International Symposium on Information Theory*, Nice, France, June 2007, pp. 2501–2505.

[31] V. Kostina and S. Loyka, "Transmit power allocation for the V-BLAST algorithm," in *Proceedings 23rd Queen's Biennial Symposium on Communications*, Kingston, Canada, May 2006, pp. 165–168.

[32] V. Kostina and S. Loyka, "On optimization of the V-BLAST algorithm," in *Proceedings 2006 IEEE International Zurich Seminar on Communications*, ETH Zurich, Switzerland, Feb. 2006, pp. 110–113.