

Ryota Tomioka, Ph.D.

CONTACT INFORMATION	Research Assistant Professor Toyota Technological Institute at Chicago 6045 S Kenwood Ave., Chicago, Illinois 60637, USA	<i>Phone:</i> +1 773 818 1764 <i>E-mail:</i> tomioka@ttic.edu <i>Webpage:</i> ttic.edu/tomioka [Google Scholar profile]
PERSONAL	Born September 9, 1980.	
RESEARCH INTERESTS	Statistical Learning, Convex Optimization, Tensor Decomposition My research lies in the intersection of statistics and computation. I develop mathematical models for complex phenomena in the real world, including brain-computer interface, prediction of radioactivity measurement following the recent nuclear disaster in Japan, quantitative prognosis of glaucoma, and social network analysis. Moreover, I design computational algorithms for the estimation of high dimensional parameters in such models and analyze the computational and statistical properties of such algorithms.	
EMPLOYMENT HISTORY	Research Assistant Professor Toyota Technological Institute at Chicago	October 2013 to present
	Visiting Associate Professor Section for Cognitive Systems, DTU Compute, Technical University of Denmark	July 2014 to October 2014
	Assistant Professor Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo	April 2009 to September 2013
	<ul style="list-style-type: none">Jointly managed the Information-Theoretic Machine Learning & Data Mining Group with Professor Kenji Yamanishi and Associate Professor Hisashi Kashima.	
	Postdoctoral Researcher Department of Computer Science, Graduate School of Information Science and Engineering, Tokyo Institute of Technology	April 2008 to March 2009
	<ul style="list-style-type: none">Worked under Associate Professor Masashi Sugiyama on optimization algorithms for large scale sparse estimation problems.	
EDUCATION	The University of Tokyo , Tokyo, Japan	
	Ph.D. (with President's Award), March 2008	
	<ul style="list-style-type: none">Title: <i>Supervised Learning over Matrices with Dual Spectral Regularization and its Application to Single Trial EEG Classification</i>Adviser: Professor Kazuyuki Aihara	
	Fraunhofer FIRST / Technische Universität Berlin , Berlin, Germany	
	Visiting Research Associate	November 2005 to October 2007
	<ul style="list-style-type: none">Adviser: Professor Klaus-Robert Müller	
	The University of Tokyo , Tokyo, Japan	
	M.S., March 2005	
	<ul style="list-style-type: none">Title: <i>Stochastic Dynamics of Genetic Regulatory Networks</i>Adviser: Professor Kazuyuki Aihara	
	B.Eng., March 2003	
	<ul style="list-style-type: none">Title: <i>Title: A study on stochasticity in gene-protein systems (in Japanese)</i>Adviser: Professor Hidenori Kimura	

AWARDS	<p>Best Student Paper Award in Data Mining September 2011 European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD)</p> <p>President's Award for the Ph.D. thesis. March 2008 Graduate School of Information Science and Technology, The University of Tokyo</p> <p>Best Talk Award September 2006 3rd International Brain-Computer Interface Workshop and Training Course 2006 (Graz, Austria)</p>
GRANTS	<p>Grants-in-Aid for Young Scientists April to September, 2013 Japan Society for the Promotion of Science</p> <ul style="list-style-type: none"> • Research grant of ¥3,300,000 over three years (terminated due to relocation to TTI-C, September 2013). <p>Leading Researcher Program August to September, 2011 Graduate School of Information Science and Technology</p> <ul style="list-style-type: none"> • Travel expense (about ¥1,000,000) to visit Department of Informatics and Mathematical Modeling, Technical University of Denmark for joint research on Machine Learning for Tensor Data. <p>Grants-in-Aid for Young Scientists April 2010 to March 2013 Japan Society for the Promotion of Science</p> <ul style="list-style-type: none"> • Research grant of ¥3,100,000 over three years. <p>JSPS Research Fellow April 2005 to March 2008 Japan Society for the Promotion of Science</p> <ul style="list-style-type: none"> • Scholarship and research grant of ¥10,000,000 over three years.
SELECTED INVITED TALKS	<p>Workshop on Learning Theory, Foundations of Computational Mathematics (FoCM'14) [Webpage] December 18 to 20, 2014 Universidad de la Republica in Montevideo, Uruguay Organizer: Tomaso Poggio and Lorenzo Rosasco Title: Tensor decomposition, convex optimization, and multitask learning</p> <p>Trends in Machine Learning [Webpage] March 18, 2014 Kyoto University, Kyoto, Japan Organizer: Marco Cuturi Title: Towards better computation-statistics trade-off in tensor decomposition</p> <p>Workshop on Mathematical Approaches to Large-Dimensional Data Analysis [Webpage] March 15, 2014 Institute of Statistical Mathematics, Tokyo, Japan Organizer: Kenji Fukumizu Title: Towards better computation-statistics trade-off in tensor decomposition</p> <p>Informatics Seminar [Webpage] January 26, 2012 Graduate School of Informatics, Kyoto University Invited by Marco Cuturi Title: Statistical Performance of Convex Tensor Decomposition. Lecture (1.5 hours)</p> <p>RAMP Symposium 2011 [Webpage] October 25, 2011 Kansai University Organized by Research Association of Mathematical Programming Japan Title: New Trends in Continuous Optimization in Machine Learning</p> <p>OPTEC Seminar [Webpage] September 22, 2011 Department of Electrical Engineering, KU Leuven Invited by Johan Suykens Title: Convex Tensor Decomposition with Performance Guarantee</p> <p>Machine Learning Reading Group [Webpage] March 22, 2007 Department of Engineering, University of Cambridge Invited by Zoubin Ghahramani Title: Topics in Convex Optimisation Lecture (2 hours)</p>

- BOOK CHAPTERS
- [1] R. Tomioka, T. Suzuki, K. Hayashi, and H. Kashima. Low-rank tensor denoising and recovery via convex optimization. In . A. A. J. Suykens, M. Signoretto, editor, *Regularization, Optimization, Kernels, and Support Vector Machines*. CRC Press, 2014.
- [2] R. Tomioka, T. Suzuki, and M. Sugiyama. Augmented Lagrangian methods for learning, selecting, and combining features. In Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright, editors, *Optimization for Machine Learning*. MIT Press, 2011.
- REFEREED
JOURNAL
PUBLICATIONS
- [3] T. Takahashi, R. Tomioka, and K. Yamanishi. Discovering emerging topics in social streams via link-anomaly detection. *IEEE T. Knowl. Data. Eng.*, 26(1):120–130, 2014.
- [4] S. Nakajima, M. Sugiyama, S. Babacan, and R. Tomioka. Global analytic solution of fully-observed variational Bayesian matrix factorization. *J. Mach. Learn. Res.*, 14:1–37, 2013.
- [5] A. Narita, K. Hayashi, R. Tomioka, and H. Kashima. Tensor factorization using auxiliary information. *Data Mining and Knowledge Discovery*, 25(2):298–324, 2012.
- [6] T. Suzuki and R. Tomioka. SpicyMKL: a fast algorithm for multiple kernel learning with thousands of kernels. *Machine Learning*, 85(1–2):77–108, 2011.
- [7] R. Tomioka, T. Suzuki, and M. Sugiyama. Super-linear convergence of dual augmented Lagrangian algorithm for sparse learning. *Journal of Machine Learning Research*, 12:1537–1586, 2011.
- [8] R. Tomioka and K.-R. Müller. A regularized discriminative framework for EEG analysis with application to brain-computer interface. *Neuroimage*, 49(1):415–432, 2010.
- [9] R. Tomioka and M. Sugiyama. Dual augmented Lagrangian method for efficient sparse reconstruction. *IEEE Signal Processing Letters*, 16(12):1067–1070, 2009.
- [10] S. Haufe, R. Tomioka, T. Dickhaus, C. Sannelli, B. Blankertz, G. Nolte, and K.-R. Müller. Large-scale EEG/MEG source localization with spatial flexibility. *NeuroImage*, 54(2):851–859, 2010.
- [11] S. Haufe, R. Tomioka, G. Nolte, K.R. Müller, and M. Kawanabe. Modeling sparse connectivity between underlying brain sources for EEG/MEG. *Biomedical Engineering, IEEE Transactions on*, 57(8):1954–1963, 2010.
- [12] B. Blankertz, R. Tomioka, S. Lemm, M. Kawanabe, and K.-R. Müller. Optimizing spatial filters for robust EEG single-trial analysis. *IEEE Signal Processing Magazine*, 25(1):41–56, 2008.
- [13] R. Tomioka, H. Kimura, T. J Kobayashi, and K. Aihara. Multivariate analysis of noise in genetic regulatory networks. *Journal of Theoretical Biology*, 229(4):501–521, 2004.
- REFEREED
CONFERENCE
PUBLICATIONS
- [14] K. Wimalawarne, M. Sugiyama, and R. Tomioka. Multitask learning meets tensor factorization: task imputation via convex optimization. In Z. Ghahramani, M. Welling, C. Cortes, N. Lawrence, and K. Weinberger, editors, *Advances in Neural Information Processing Systems 27 (NIPS 2014)*, pages 2825–2833. Curran Associates, Inc., 2014.
- [15] S. Saito, R. Tomioka, and K. Yamanishi. Early detection of persistent topics in social networks. In *IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2014)*. 2014.

- [16] K. Takeuchi, R. Tomioka, K. Ishiguro, A. Kimura, and H. Sawada. Non-negative multiple tensor factorization. In *Proceedings of the 13th International Conference on Data Mining (ICDM 2013)*, pages 1199–1204. IEEE, 2013.
- [17] Z. Liang, R. Tomioka, H. Murata, R. Asaoka, and K. Yamanishi. Quantitative prediction of glaucomatous visual field loss from few measurements. In *Proceedings of the 13th International Conference on Data Mining (ICDM 2013)*, pages 1121–1126. IEEE, 2013.
- [18] R. Tomioka and T. Suzuki. Convex tensor decomposition via structured Schatten norm regularization. In C. Burges, L. Bottou, M. Welling, Z. Ghahramani, and K. Weinberger, editors, *Advances in Neural Information Processing Systems 26 (NIPS 2013)*, pages 1331–1339. 2013.
- [19] K. Yoshii, R. Tomioka, D. Mochihashi, and M. Goto. Infinite Positive Semidefinite Tensor Factorization with Application to Music Signal Analysis. In *Proceedings of the 30th International Conference on Machine Learning (ICML 2013)*, pages 576–584, 2013.
- [20] S. Nakajima, R. Tomioka, M. Sugiyama, and S. Babacan. Perfect dimensionality recovery by variational Bayesian PCA. In *Advances in Neural Information Processing Systems 25 (NIPS 2012)*, pages 980–988. 2012.
- [21] F. Király and R. Tomioka. A combinatorial algebraic approach for the identifiability of low-rank matrix completion. In John Langford and Joelle Pineau, editors, *Proceedings of the 29th International Conference on Machine Learning (ICML 2012)*, pages 967–974. Omnipress, 2012.
- [22] R. Tomioka and M. Mørup. A Bayesian analysis of the radioactive releases of Fukushima. In *JMLR Workshop and Conference Proceedings 22 (AISTATS 2012)*, pages 1243–1251. MIT Press, 2012.
- [23] R. Tomioka, T. Suzuki, K. Hayashi, and H. Kashima. Statistical performance of convex tensor decomposition. In J. Shawe-Taylor, R.S. Zemel, P. Bartlett, F.C.N. Pereira, and K.Q. Weinberger, editors, *Advances in Neural Information Processing Systems 24 (NIPS 2011)*, pages 972–980. 2011.
- [24] T. Takahashi, R. Tomioka, and K. Yamanishi. Discovering emerging topics in social streams via link anomaly detection. In *Proceedings of the 11th International Conference on Data Mining (ICDM 2011)*, pages 1230–1235. IEEE, 2011.
- [25] A. Narita, K. Hayashi, R. Tomioka, and H. Kashima. Tensor factorization using auxiliary information. In *Lecture Notes in Computer Science, 2011, Volume 6912, Machine Learning and Knowledge Discovery in Databases (ECML 2011)*, pages 501–516. Springer, 2011. Best Student Paper Award in Data Mining.
- [26] S. Nakajima, M. Sugiyama, and R. Tomioka. Global analytic solution for variational Bayesian matrix factorization. In J. Lafferty, C. K. I. Williams, J. Shawe-Taylor, R. Zemel, and A. Culotta, editors, *Advances in Neural Information Processing Systems 23 (NIPS 2010)*, pages 1768–1776. 2010.
- [27] R. Tomioka, T. Suzuki, M. Sugiyama, and H. Kashima. A fast augmented Lagrangian algorithm for learning low-rank matrices. In Johannes Fürnkranz and Thorsten Joachims, editors, *Proceedings of the 27th Annual International Conference on Machine Learning (ICML 2010)*. Omnipress, 2010.
- [28] B. Blankertz, M. Kawanabe, R. Tomioka, F. Hohlefeld, V. Nikulin, and K.-R. Müller. Invariant common spatial patterns: alleviating nonstationarities in brain-computer interfacing. In *Advances in Neural Information Processing Systems 20 (NIPS 2007)*. MIT Press, Cambridge, MA, 2008.

- [29] R. Tomioka and K. Aihara. Classifying matrices with a spectral regularization. In *ICML '07: Proceedings of the 24th international conference on Machine learning*, pages 895–902. ACM Press, 2007.
- [30] R. Tomioka, K. Aihara, and K.-R. Müller. Logistic regression for single trial EEG classification. In B. Schölkopf, J. Platt, and T. Hoffman, editors, *Advances in Neural Information Processing Systems 19 (NIPS 2006)*, pages 1377–1384. MIT Press, Cambridge, MA, 2007.
- [31] R. Tomioka, G. Dornhege, G. Nolte, K. Aihara, and K.-R. Müller. Optimizing spectral filters for single trial EEG classification. In *Lecture Notes in Computer Science (DAGM 2006)*, volume 4174, pages 414–423. Springer Berlin / Heidelberg, 2006.
- [32] Z. Liang, R. Tomioka, H. Murata, R. Asaoka, and K. Yamanishi. Quantitative prediction of visual field loss due to glaucoma from few measurements. *IEEE Trans. Biomed. Eng.*, 2014. Submitted.
- [33] F. Király, L. Theran, and R. Tomioka. The algebraic combinatorial approach for low-rank matrix completion. *J. Mach. Learn. Res.*, 2014. Submitted.
- [34] S. Nakajima, R. Tomioka, M. Sugiyama, and S. D. Babacan. Condition for perfect dimensionality recovery by variational bayesian PCA. *J. Mach. Learn. Res.*, 2014. Submitted.
- [35] R. Tomioka, K. Hayashi, and H. Kashima. Estimation of low-rank tensors via convex optimization. *SIAM J. Matrix Anal. Appl.*, 2011. Submitted.
- [36] R. Tomioka and T. Suzuki. Regularization strategies and empirical Bayesian learning for MKL. *J. Mach. Learn. Res.*, 2011. Accepted with minor revision.
- [37] M. Sugiyama, T. Ide, T. Kamishima, T. Kurita, E. Maeda, et al. 統計的学習の基礎 データマイニング・推論・予測. Kyoristu Shuppan, Tokyo, 2014. Translation of T. Hastie, R. Tibshirani, and J. Friedman’s *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. I translated Chapter 18.

SUBMITTED
JOURNAL
PUBLICATIONS

BOOK
TRANSLATION

TEACHING
EXPERIENCE

(Co-)Supervised Ph.D. students at University of Chicago

- L. Zhang (February 2014–present) metric learning
- Q. Zheng (October 2014–present) tensor decomposition

Visiting Ph.D. student at TTI-C from Tokyo Institute of Technology

- K. Wimalawarne (April 2014–present) multitask learning

Co-supervised bachelor students at the University of Tokyo

- K. Tanabe (October 2012 – February 2013) non-negative matrix factorization
- Z. Liang (October 2012 – February 2013) glaucoma prediction
- S. Saito (October 2011 – February 2012) persistent topic detection on Twitter
- T. Takahashi (October 2010 – February 2011) topic discovery on Twitter

Machine Learning Summer School 2015

at Kyoto University, Japan (invited).

Ph.D. Summer Course: 02901 Advanced Topics in Machine Learning

at DTU Compute, Technical University of Denmark

- August 27, 2014: *Introduction to the analysis of learning algorithms: Does Bayesianism help?*
- August 14, 2013: *Introduction to the analysis of learning algorithms: ridge regression and lasso.*
- August 15, 2012: *Convex optimization: old tricks for new problems.*
- August 26, 2011: *Convex optimization: old tricks for new problems.*

Each was a lecture with MATLAB exercises (6 hours)

PROFESSIONAL
SERVICE

Referee Service

- Conferences: NIPS 2007, 2008, 2010–2014; ICML 2009, 2013–2015; AI & Statistics 2014–2015; ECML 2010; ACML 2009–2014.
- Journals: Journal of Machine Learning Research, Neural Networks, Neuroimage, Pattern Recognition, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Information Theory, IEEE Transactions on Neural Networks, IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, IEEE Signal Processing Magazine, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Neural Systems and Rehabilitation Engineering,

Editor Service

- Neural Networks (2013–present)

Talks.Tokyo [[Webpage](#)]

2012–2013

- Developed a web-based system for sharing seminars in and around the University of Tokyo.