

Zoltán Szabó
Research Associate Professor

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CONTACT INFORMATION

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RESEARCH INTEREST

- Theory: kernel methods, information theory¹, statistical machine learning.
- Applications:
 - distribution regression, hypothesis testing, structured sparsity, independent subspace analysis,
 - criminal data analysis, remote sensing, collaborative filtering, face emotion recognition and face tracking, natural language processing.

PROFESSIONAL ACTIVITIES

Area Chairing, Senior Program Committee Member

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| Advances in Neural Information Processing Systems (NIPS) | 2018 |
| International Conference on Machine Learning (ICML) | 2018 |
| International Conference on Artificial Intelligence and Statistics (AISTATS) | 2018 |
| Conference on Uncertainty in Artificial Intelligence (UAI) | 2017 |
| International Conference on Machine Learning (ICML) | 2017 |
| International Conference on Artificial Intelligence and Statistics (AISTATS) | 2017 |
| Conference on Uncertainty in Artificial Intelligence (UAI) | 2016 |

Reviewing Grant Applications

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| Swiss National Science Foundation (SNF) | 2017– |
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Program Chairing

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| Data Science Summer School (DS ³) ² | 2018 |
| – co-organizers: Emmanuel Bacry, Nozha Boujemaa, Maud Cadiz-Pena, Viviane Hoang, Aldjia Mazari, Charlotte Renaud, Erwan Scornet | |
| Data Science Summer School | 2017 |
| – co-organizers: Emmanuel Bacry, Aldjia Mazari, Éric Moulines, Erwan Scornet | |

Reviewing for Journals

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| Journal of Multivariate Analysis | 2017– |
| Annals of Statistics | 2016– |
| Machine Learning Journal | 2016– |
| Statistics and Computing | 2015– |
| IEEE Signal Processing Letters | 2015– |
| Statistical Analysis and Data Mining | 2014– |
| IET Computer Vision | 2014– |
| International Journal of Computer Vision | 2014– |
| IEEE Transactions on Information Theory | 2013– |
| Journal of Machine Learning Research | 2013– |
| IEEE Transactions on Pattern Analysis and Machine Intelligence | 2013– |
| Progress in Artificial Intelligence | 2013– |

¹ITE toolbox: <https://bitbucket.org/szzoli/ite-in-python/>.

²DS³ site: <http://www.ds3-datascience-polytechnique.fr/>.

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| Entropy | 2012– |
| IEEE Transactions on Neural Networks and Learning Systems | 2012– |
| Signal, Image and Video Processing | 2012– |
| IEEE Transactions on Signal Processing | 2009– |
| Neurocomputing | 2009– |
| IEEE Transactions on Neural Networks | 2007–2011 |
| Reviewing Books | |
| Cambridge University Press | 2018– |
| Reviewing for Conferences | |
| Conference on Learning Theory (COLT) | 2018 |
| International Conference on Learning Representations (ICLR-2018) | 2017 |
| Conference on Learning Theory (COLT) | 2017 |
| Advances in Neural Information Processing Systems (NIPS) | 2017 |
| Advances in Neural Information Processing Systems (NIPS) | 2016 |
| International Conference on Machine Learning (ICML) | 2016 |
| Advances in Neural Information Processing Systems (NIPS) | 2015 |
| Advances in Neural Information Processing Systems (NIPS) | 2014 |
| International Conference on Machine Learning (ICML) | 2012 |
| International Conference on Latent Variable Analysis and Signal Separation (LVA/ICA) | 2012 |
| International Joint Conference on Artificial Intelligence (IJCAI) | 2011 |
| International Joint Conference on Neural Networks (IJCNN) | 2011 |
| European Conference on Complex Systems (ECCS) | 2011 |
| European Signal Processing Conference (EUSIPCO) | 2011 |
| European Conference on Complex Systems (ECCS) | 2009 |
| Reviewing for Workshops | |
| NIPS: ‘Challenges in Machine Learning: Gaming and Education’ | 2016 |
| Organizing | |
| Conference (Workflow Chair) | |
| International Conference on Artificial Intelligence and Statistics (AISTATS) | 2016 |
| – co-workflow chair: Rodolphe Jenatton | |
| Workshop | |
| NIPS: ‘Learning on Distributions, Functions, Graphs and Groups’ | 2017 |
| – co-organizers: Florence d’Alché-Buc, Krikamol Muandet, Bharath K. Sriperumbudur | |
| NIPS: ‘Adaptive and Scalable Nonparametric Methods in Machine Learning’ | 2016 |
| – co-organizers: Aaditya Ramdas, Bharath K. Sriperumbudur, Han Liu, John Lafferty, Mladen Kolar, Samory Kpotufe | |
| NIPS: ‘Modern Nonparametrics 3: Automating the Learning Pipeline’ | 2014 |
| – co-organizers: Arthur Gretton, Mladen Kolar, Samory Kpotufe, Han Liu, Andrew G. Wilson, Le Song, Eric Xing | |
| Machine Learning External Seminars @ CMAP, École Polytechnique | 2017– |
| Machine Learning External Seminars @ Gatsby Unit | 2014–2016 |
| Machine Learning Journal Club | 2017– |
| – co-organizers: Elodie Vernet, Erwan Scornet, Alain Virouleau | |
| Session Chairing | |
| International Conference on Machine Learning (ICML) | 2018 |
| Paris Summit on Big Data (ParisBD) | 2017 |
| Reviewing Scientific Competitions | |

PUBLICATIONS

Journal Articles & Conference Papers

- [1] Zoltán Szabó and Bharath K. Sriperumbudur. Characteristic tensor product kernels. In *Conference of the International Society for Non-Parametric Statistics (ISNPS)*, Salerno, Italy, 11-15 June 2018.
- [2] Bharath K. Sriperumbudur and Zoltán Szabó. Measures of (in)dependence using positive definite kernels. In *Conference of the International Society for Non-Parametric Statistics (ISNPS)*, Salerno, Italy, 11-15 June 2018.
- [3] Zoltán Szabó and Bharath K. Sriperumbudur. Tensor product kernels: Characteristic property, universality. In *Hangzhou International Conference on Frontiers of Data Science*, Hangzhou, China, 18-20 May 2018.
- [4] Wittawat Jitkrittum, Wenkai Xu, Zoltán Szabó, Kenji Fukumizu, and Arthur Gretton. A linear-time kernel goodness-of-fit test. In I. Guyon, U. V. Luxburg, S. Bengio, H. Wallach, R. Fergus, S. Vishwanathan, and R. Garnett, editors, *Advances in Neural Information Processing Systems (NIPS)*, pages 261–270, Long Beach, CA, U.S., 4-9 December 2017. Curran Associates, Inc. (Best Paper Award = in top 3 out of 3240 submissions).
- [5] Wittawat Jitkrittum, Zoltán Szabó, and Arthur Gretton. An adaptive test of independence with analytic kernel embeddings. In Doina Precup and Yee Whye Teh, editors, *International Conference on Machine Learning (ICML)*, volume 70, pages 1742–1751, Sydney, Australia, 6-11 August 2017. PMLR. (25.46% acceptance rate).
- [6] Zoltán Szabó, Bharath K. Sriperumbudur, Barnabás Póczos, and Arthur Gretton. Learning theory for distribution regression. *Journal of Machine Learning Research*, 17(152):1–40, 2016.
- [7] Wittawat Jitkrittum, Zoltán Szabó, Kacper Chwialkowski, and Arthur Gretton. Interpretable distribution features with maximum testing power. In D. D. Lee, M. Sugiyama, U. V. Luxburg, I. Guyon, and R. Garnett, editors, *Advances in Neural Information Processing Systems (NIPS)*, pages 181–189, Barcelona, Spain, 5-10 December 2016. Curran Associates, Inc. (full oral presentation = top 1.84%).
- [8] Zoltán Szabó, Bharath K. Sriperumbudur, Barnabás Póczos, and Arthur Gretton. Minimax-optimal distribution regression. In *Conference of the International Society for Non-Parametric Statistics (ISNPS)*, Avignon, France, 11-16 June 2016.
- [9] Bharath K. Sriperumbudur and Zoltán Szabó. Optimal rates for random Fourier features. In C. Cortes, N. D. Lawrence, D. D. Lee, M. Sugiyama, and R. Garnett, editors, *Advances in Neural Information Processing Systems (NIPS)*, pages 1144–1152, Montréal, Canada, 7-12 December 2015. Curran Associates, Inc. (contributed equally; spotlight presentation – 3.65% acceptance rate).
- [10] Heiko Strathmann, Dino Sejdinovic, Samuel Livingstone, Zoltán Szabó, and Arthur Gretton. Gradient-free Hamiltonian Monte Carlo with efficient kernel exponential families. In C. Cortes, N. D. Lawrence, D. D. Lee, M. Sugiyama, and R. Garnett, editors, *Advances in Neural Information Processing Systems (NIPS)*, pages 955–963, Montréal, Canada, 7-12 December 2015. Curran Associates, Inc. (poster presentation – 17.46% acceptance rate).
- [11] Mijung Park, Wittawat Jitkrittum, Ahmad Qamar, Zoltán Szabó, Lars Buesing, and Maneesh Sahani. Bayesian manifold learning: The locally linear latent variable model. In C. Cortes, N. D. Lawrence, D. D. Lee, M. Sugiyama, and R. Garnett, editors, *Advances in Neural Information*

Processing Systems (NIPS), pages 154–162, Montréal, Canada, 7-12 December 2015. Curran Associates, Inc. (poster presentation – 17.46% acceptance rate).

- [12] Wittawat Jitkrittum, Arthur Gretton, Nicolas Heess, Ali Eslami, Balaji Lakshminarayanan, Dino Sejdinovic, and Zoltán Szabó. Kernel-based just-in-time learning for passing expectation propagation messages. In *Conference on Uncertainty in Artificial Intelligence (UAI)*, pages 405–414, Amsterdam, Netherlands, 12-16 July 2015.
- [13] Zoltán Szabó, Arthur Gretton, Barnabás Póczos, and Bharath K. Sriperumbudur. Two-stage sampled learning theory on distributions. In *International Conference on Artificial Intelligence and Statistics (AISTATS)*, pages 948–957, San Diego, California, USA, 9-12 May 2015. (oral presentation – 6.11% acceptance rate).
- [14] Balázs Pintér, Gyula Vörös, Zoltán Szabó, and András Lőrincz. Wikifying novel words to mixtures of Wikipedia senses by structured sparse coding. In Ana Fred and Maria De Marsico, editors, *Pattern Recognition Applications and Methods*, volume 318 of *Advances in Intelligent and Soft Computing*, pages 241–255. Springer, 2015.
- [15] Zoltán Szabó. Information theoretical estimators toolbox. *Journal of Machine Learning Research*, 15:283–287, 2014.
- [16] László Jeni, András Lőrincz, Zoltán Szabó, Jeffrey F. Cohn, and Takeo Kanade. Spatio-temporal event classification using time-series kernel based structured sparsity. In David Fleet, Tomas Pajdla, Bernt Schiele, and Tinne Tuytelaars, editors, *European Conference on Computer Vision (ECCV)*, volume 8692 of *Lecture Notes in Computer Science*, pages 135–150, Zürich, Switzerland, 6-12 September 2014. Springer International Publishing Switzerland.
- [17] Balázs Pintér, Gyula Vörös, Zoltán Szabó, and András Lőrincz. Explaining unintelligible words by means of their context. In *International Conference on Pattern Recognition Applications and Methods (ICPRAM)*, pages 382–387, Barcelona, Spain, 15-18 February 2013.
- [18] Balázs Pintér, Gyula Vörös, Zolt Palotai, Zoltán Szabó, and András Lőrincz. Determining unintelligible words from their textual contexts. *Procedia - Social and Behavioral Sciences*, 73:101–108, 2013. (Proceedings of the 2nd International Conference on Integrated Information (IC-ININFO 2012), Budapest, Hungary, 30 August – 3 September).
- [19] Zoltán Szabó and András Lőrincz. Distributed high dimensional information theoretical image registration via random projections. *Digital Signal Processing*, 22(6):894–902, 2012.
- [20] Balázs Pintér, Gyula Vörös, Zoltán Szabó, and András Lőrincz. Automated word puzzle generation using topic models and semantic relatedness measures. *Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae, Sectio Computatorica*, 36:299–322, 2012.
- [21] László A. Jeni, András Lőrincz, Tamás Nagy, Zolt Palotai, Judit Sebők, Zoltán Szabó, and Dániel Takács. 3D shape estimation in video sequences provides high precision evaluation of facial expressions. *Image and Vision Computing*, 30(10):785–795, 2012.
- [22] Balázs Pintér, Gyula Vörös, Zoltán Szabó, and András Lőrincz. Automated word puzzle generation using topic models and semantic relatedness measures. In Zoltán Csörnyei, editor, *Joint Conference on Mathematics and Computer Science (MaCS)*, Siófok, Hungary, 9-12 February 2012.
- [23] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Collaborative filtering via group-structured dictionary learning. In Fabian Theis, Andrzej Cichocki, Arie Yeredor, and Michael Zibulevsky, editors, *International Conference on Latent Variable Analysis and Signal Separation (LVA/ICA)*, volume 7191 of *Lecture Notes in Computer Science*, pages 247–254, Tel-Aviv, Israel, 12-15 March 2012. Springer-Verlag, Berlin Heidelberg.

- [24] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Separation theorem for independent subspace analysis and its consequences. *Pattern Recognition*, 45(4):1782–1791, 2012.
- [25] Barnabás Póczos, Zoltán Szabó, and Jeff Schneider. Nonparametric divergence estimators for independent subspace analysis. In *European Signal Processing Conference (EUSIPCO) – Special Session on Dependent Component Analysis*, pages 1849–1853, Barcelona, Spain, 29 August – 2 September 2011. (ISSN: 2076-1465).
- [26] Zoltán Szabó and Barnabás Póczos. Nonparametric independent process analysis. In *European Signal Processing Conference (EUSIPCO)*, pages 1718–1722, Barcelona, Spain, 29 August – 2 September 2011. (ISSN: 2076-1465).
- [27] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Online group-structured dictionary learning. In *IEEE Computer Vision and Pattern Recognition (CVPR)*, pages 2865–2872, Colorado Springs, CO, USA, 20-25 June 2011.
- [28] Zoltán Szabó. Autoregressive independent process analysis with missing observations. In Michel Verleysen, editor, *European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN)*, pages 159–164. d-side, 28-30 April 2010. (ISBN 2-930307-10-2).
- [29] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Auto-regressive independent process analysis without combinatorial efforts. *Pattern Analysis and Applications*, 13(1):1–13, February 2010.
- [30] Zoltán Szabó and András Lőrincz. Complex independent process analysis. *Acta Cybernetica*, 19:177–190, 2009.
- [31] Zoltán Szabó and András Lőrincz. Controlled complete ARMA independent process analysis. In *International Joint Conference on Neural Networks (IJCNN)*, pages 3038–3045, 14-19 June 2009. (IEEE Catalog Number: CFP09IJS-CDR; ISBN: 978-1-4244-3553-1; ISSN: 1098-7576).
- [32] Zoltán Szabó and András Lőrincz. Fast parallel estimation of high dimensional information theoretical quantities with low dimensional random projection ensembles. In Tülay Adali, Christian Jutten, João Marcos T. Romano, and Allan Kardec Barros, editors, *International Conference on Independent Component Analysis and Signal Separation (ICA)*, volume 5441 of *Lecture Notes in Computer Science*, pages 146–153, Berlin Heidelberg, 15-18 March 2009. Springer-Verlag.
- [33] Zoltán Szabó. Complete blind subspace deconvolution. In Tülay Adali, Christian Jutten, João Marcos T. Romano, and Allan Kardec Barros, editors, *International Conference on Independent Component Analysis and Signal Separation (ICA)*, volume 5441 of *Lecture Notes in Computer Science*, pages 138–145, Berlin Heidelberg, 15-18 March 2009. Springer-Verlag.
- [34] Zoltán Szabó and András Lőrincz. Post nonlinear hidden infomax identification. In *Joint Conference of Hungarian PhD students*, pages 52–58, 2008.
- [35] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Undercomplete blind subspace deconvolution via linear prediction. In Joost N. Kok, Jacek Koronacki, Ramon Lopez de Mantaras, Stan Matwin, Dunja Mladenič, and Andrzej Skowron, editors, *European Conference on Machine Learning (ECML)*, volume 4701 of *Lecture Notes in Artificial Intelligence*, pages 740–747, Berlin Heidelberg, 17-21 September 2007. Springer-Verlag.
- [36] Zoltán Szabó, Barnabás Póczos, Gábor Szirtes, and András Lőrincz. Post nonlinear independent subspace analysis. In Joaquim Marques de Sá, Luís A. Alexandre, Włodzisław Duch, and Danilo P. Mandic, editors, *International Conference on Artificial Neural Networks (ICANN)*, volume 4668 of *Lecture Notes in Computer Science - Part I*, pages 677–686, Berlin Heidelberg, 9-13 September 2007. Springer-Verlag.

- [37] Barnabás Póczos, Zoltán Szabó, Melinda Kiszlinger, and András Lőrincz. Independent process analysis without a priori dimensional information. In Mike E. Davies, Christopher J. James, Samer A. Abdallah, and Mark D. Plumbley, editors, *International Conference on Independent Component Analysis and Signal Separation (ICA)*, volume 4666 of *Lecture Notes in Computer Science*, pages 252–259, Berlin Heidelberg, 9-12 September 2007. Springer-Verlag.
- [38] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Undercomplete blind subspace deconvolution. *Journal of Machine Learning Research*, 8:1063–1095, 2007.
- [39] András Lőrincz and Zoltán Szabó. Neurally plausible, non-combinatorial iterative independent process analysis. *Neurocomputing - Letters*, 70(7-9):1569–1573, 2007.
- [40] Zoltán Szabó and András Lőrincz. Independent subspace analysis can cope with the „curse of dimensionality”. *Acta Cybernetica (+Symposium of Intelligent Systems 2006)*, 18:213–221, 2007.
- [41] Zoltán Szabó and András Lőrincz. Multilayer kerceptron. *Journal of Applied Mathematics*, 24:209–222, 2007.
- [42] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Cross-entropy optimization for independent process analysis. In Justinian Rosca, Deniz Erdogmus, José C. Príncipe, and Simon Haykin, editors, *International Conference on Independent Component Analysis and Blind Source Separation (ICA)*, volume 3889 of *Lecture Notes in Computer Science*, pages 909–916. Springer, 5-8 March 2006.
- [43] Zoltán Szabó and András Lőrincz. ϵ -sparse representations: Generalized sparse approximation and the equivalent family of SVM tasks. *Acta Cybernetica*, 17(3):605–614, 2006.
- [44] György Hévízi, Mihály Biczó, Barnabás Póczos, Zoltán Szabó, Bálint Takács, and András Lőrincz. Hidden markov model finds behavioral patterns of users working with a headmouse driven writing tool. In *International Joint Conference on Neural Networks (IJCNN)*, 26-29 July 2004. (IJCNN2004 CD-ROM Conference Proceedings, Paper No. 1268. IEEE Catalog Number: 04CH37541C, ISBN: 0-7803-8360-5).

Workshop Papers

- [1] Matthieu Lerasle, Zoltán Szabó, Éric Moulines, Guillaume Lécué, Sidonie Lefebvre, and Gaspar Massiot. MOM-based robust nonlinear anomaly detection for multispectral and hyperspectral data. In *50èmes Journées de Statistique (JdS)*, Palaiseau, France, 28 May – 1 June 2018.
- [2] Zoltán Szabó and Bharath K. Sriperumbudur. HSIC, a measure of statistical independence? In *Data Learning and Inference (DALI)*, Lanzarote, Canary Islands, Spain, 3-5 April 2018.
- [3] Wittawat Jitkrittum, Wenkai Xu, Zoltán Szabó, Kenji Fukumizu, and Arthur Gretton. A linear-time kernel goodness-of-fit test. In *Workshop on Functional Inference and Machine Intelligence*, Tokyo, Japan, 19-21 February 2018.
- [4] Wittawat Jitkrittum, Zoltán Szabó, Kenji Fukumizu, and Arthur Gretton. A fast goodness-of-fit test with analytic kernel embeddings. In *Greek Stochastics Workshop – Model Determination*, Milos, Greece, 14-17 July 2017.
- [5] Zoltán Szabó and Éric Moulines. Locally-adaptive kernel tests. In *Data Learning and Inference (DALI)*, Tenerife, Spain, 17-20 April 2017.
- [6] Wittawat Jitkrittum, Zoltán Szabó, and Arthur Gretton. The finite-set independence criterion. In *UCL Workshop on the Theory of Big Data*, London, UK, 28 June 2017.
- [7] Wittawat Jitkrittum, Zoltán Szabó, and Arthur Gretton. An adaptive test of independence with analytic kernel embeddings. In *Probabilistic Graphical Model Workshop*, Tokyo, Japan, 24 February 2017.

- [8] Heiko Strathmann, Dino Sejdinovic, Samuel Livingstone, Ingmar Schuster, Maria Lomeli Garcia, Zoltán Szabó, Christophe Andrieu, and Arthur Gretton. Kernel techniques for adaptive Monte Carlo methods. In *Greek Stochastics Workshop on Big Data and Big Models*, Tinos, Greece, 10-13 July 2016.
- [9] Wittawat Jitkrittum, Zoltán Szabó, Kacper Chwialkowski, and Arthur Gretton. Distinguishing distributions with interpretable features. In *International Conference on Machine Learning (ICML): Data-Efficient Machine Learning workshop*, New York, 24 June 2016.
- [10] Bharath K. Sriperumbudur and Zoltán Szabó. Optimal uniform and L^p rates for random Fourier features. In *Theory of Big Data Workshop*, London, UK, 6-8 January 2016. (contributed equally).
- [11] Wittawat Jitkrittum, Arthur Gretton, Nicolas Heess, Ali Eslami, Balaji Lakshminarayanan, Dino Sejdinovic, and Zoltán Szabó. Just-in-time kernel regression for expectation propagation. In *International Conference on Machine Learning (ICML) – Large-Scale Kernel Learning: Challenges and New Opportunities workshop*, Lille, France, 10-11 July 2015.
- [12] Zoltán Szabó, Bharath K. Sriperumbudur, Barnabás Póczos, and Arthur Gretton. Distribution regression - make it simple and consistent. In *Data, Learning and Inference workshop (DALI)*, La Palma (Canaries, Spain), 10-12 April 2015.
- [13] Wittawat Jitkrittum, Arthur Gretton, Nicolas Heess, Ali Eslami, Balaji Lakshminarayanan, Dino Sejdinovic, and Zoltán Szabó. Kernel-based just-in-time learning for passing expectation propagation messages. In *Data, Learning and Inference workshop (DALI)*, La Palma (Canaries, Spain), 10-12 April 2015.
- [14] Zoltán Szabó, Arthur Gretton, Barnabás Póczos, and Bharath K. Sriperumbudur. Consistent vector-valued distribution regression. In *UCL Workshop on the Theory of Big Data*, London, UK, 7-9 January 2015.
- [15] Zoltán Szabó, Arthur Gretton, Barnabás Póczos, and Bharath K. Sriperumbudur. Simple consistent distribution regression on compact metric domains. In *UCL-Duke Workshop on Sensing and Analysis of High-Dimensional Data (SAHD)*, London, UK, 4-5 September 2014.
- [16] Zoltán Szabó, Arthur Gretton, Barnabás Póczos, and Bharath K. Sriperumbudur. Learning on distributions. In *Kernel methods for big data workshop*, Lille, France, 2 April 2014.
- [17] Zoltán Szabó. Information theoretical estimators toolbox. In *Advances in Neural Information Processing Systems (NIPS) – Workshop on Machine Learning Open Source Software 2013: Towards Open Workflows*, Harrahs and Harveys, Lake Tahoe, Nevada, United States, 10 December 2013.
- [18] András Lőrincz, László A. Jeni, Zoltán Szabó, Jeffrey Cohn, and Takeo Kanade. Emotional expression classification using time-series kernels. In *IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW): IEEE International Workshop on Analysis and Modeling of Faces and Gestures (AMFG)*, pages 889–895, Portland, Oregon, 23-28 June 2013.
- [19] Balázs Pintér, Gyula Vörös, Zoltán Szabó, and András Lőrincz. Automated word puzzle generation via topic dictionaries. In *International Conference on Machine Learning (ICML) – Sparsity, Dictionaries and Projections in Machine Learning and Signal Processing workshop*, Edinburgh, Scotland, 30 June 2012.
- [20] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Online dictionary learning with group structure inducing norms. In *International Conference on Machine Learning (ICML) – Structured Sparsity: Learning and Inference workshop*, Bellevue, Washington, USA, 2 July 2011.
- [21] Zoltán Szabó and András Lőrincz. Towards independent subspace analysis in controlled dynamical systems. In *ICA Research Network International Workshop (ICARN)*, pages 9–12, 25-26 September 2008.

- [22] Zoltán Szabó and András Lőrincz. Real and complex independent subspace analysis by generalized variance. In *ICA Research Network International Workshop (ICARN)*, pages 85–88, 18-19 September 2006.

Symposium Papers

- [1] Bharath K. Sriperumbudur and Zoltán Szabó. Optimal uniform and L^p rates for random Fourier features. Quinquennial Review Symposium, 23 September 2015. (contributed equally).
- [2] Mijung Park, Wittawat Jitkrittum, Ahmad Qamar, Zoltán Szabó, Lars Buesing, and Maneesh Sahani. Bayesian manifold learning: Locally linear latent variable model (LL-LVM). Quinquennial Review Symposium, 23 September 2015.
- [3] Zoltán Szabó. Independent subspace analysis in case of missing observations. In *Symposium of Intelligent Systems*, 20 November 2009.

Technical Reports

- [1] Romain Brault, Alex Lambert, Zoltán Szabó, Maxime Sangnier, and Florence d’Alché Buc. Infinite-task learning with vector-valued RKHSs. Technical report, 2018. (<https://arxiv.org/abs/1805.08809>).
- [2] Matthieu Lerasle, Zoltán Szabó, Guillaume Lecué, Gaspar Massiot, and Éric Moulines. MONK – outlier-robust mean embedding estimation by median-of-means. Technical report, 2018. (<http://arxiv.org/abs/1802.04784>).
- [3] Zoltán Szabó and Bharath K. Sriperumbudur. Characteristic and universal tensor product kernels. Technical report, 2017. (<http://arxiv.org/abs/1708.08157>).
- [4] András Lőrincz, Viktor Gyenes, Zsolt Palotai, Balázs Pintér, Zoltán Szabó, and Gyula Vörös. Innovation engine for blogspaces (EOARD - US Air Force Research Laboratories). Technical report, Eötvös Loránd University, Budapest, 2011. (<http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA550367>).
- [5] Zoltán Szabó. Towards nonstationary, nonparametric independent process analysis with unknown source component dimensions. Technical report, Eötvös Loránd University, Budapest, 2010. (<http://arxiv.org/abs/1008.1393>).
- [6] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Separation theorem for \mathbb{K} -independent subspace analysis with sufficient conditions. Technical report, Eötvös Loránd University, Budapest, 2006. (<http://arxiv.org/abs/math.ST/0608100>).
- [7] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Separation theorem for independent subspace analysis with sufficient conditions. Technical report, Eötvös Loránd University, Budapest, 2006. (<http://arxiv.org/abs/math.ST/0603535>).
- [8] Zoltán Szabó, Barnabás Póczos, and András Lőrincz. Separation theorem for independent subspace analysis. Technical report, Eötvös Loránd University, Budapest, 2005. (http://www.gatsby.ucl.ac.uk/~szabo/publications/szabo05separation_TR.pdf).
- [9] Zoltán Szabó and András Lőrincz. L_1 regularization is better than L_2 for learning and predicting chaotic systems. Technical report, Eötvös Loránd University, Budapest, 2004. (<http://arxiv.org/abs/cs/0410015>).

Theses

- [1] Zoltán Szabó. *Group-Structured and Independent Subspace Based Dictionary Learning*. PhD thesis, Eötvös Loránd University, Budapest, 2012.

- [2] Zoltán Szabó. *Separation Principles in Independent Process Analysis*. PhD thesis, Eötvös Loránd University, Budapest, 2009.
- [3] Zoltán Szabó. Retina based sampling in face component recognition. Master's thesis, Eötvös Loránd University, Budapest, 2003.

INVITED TALKS & POSTERS

- [1] HSIC, a measure of independence? Laboratory for Information and Inference Systems (LIONS), EPFL, presentation (40 minutes), 28 February 2018.
- [2] HSIC, an independence measure? Machine Learning & Computational Biology Lab, Department of Biosystems Science and Engineering (D-BSSE), ETH Zürich, presentation (1 hour), 26 February 2018.
- [3] Linear-time divergence measures with applications in hypothesis testing. Tao Seminar, INRIA Saclay, presentation (45 minutes), 13 February 2018.
- [4] Characterizing independence with tensor product kernels. Department of Statistics, Pennsylvania State University, presentation (1 hour), 13 December 2017.
- [5] Tensor product kernels: Independence and beyond. Google Brain, Mountain View, presentation (1 hour), 1 December 2017.
- [6] Tensor product kernels: Characteristic property and beyond. Advanced Methods Group, Cubist Systematic Strategies, New York, presentation (90 minutes), 28 November 2017.
- [7] Independence with tensor product kernels. Yahoo Research, New York, presentation (1 hour), 28 November 2017.
- [8] Tensor product kernels: Characteristic property and universality. Research Seminar, Sfs, ETH Zürich, presentation (45 minutes), 3 November 2017.
- [9] Characteristic tensor kernels. CREST Statistics Seminar, ENSAE, presentation (75 minutes), 9 October 2017.
- [10] Data-efficient independence testing with analytic kernel embeddings. PASADENA Seminar, Télécom ParisTech, presentation (1 hour), 17 May 2017.
- [11] Distribution regression: A simple technique with minimax-optimal guarantee. Parisian Statistics Seminar, Henri Poincaré Institute, presentation (1 hour), 27 March 2017.
- [12] A linear-time adaptive nonparametric two-sample test. Signal Processing and Machine Learning Seminar, Marseilles, presentation (1 hour), 24 March 2017.
- [13] Minimax-optimal distribution regression. Probability and Statistics Seminar, Orsay, presentation (1 hour), 16 March 2017.
- [14] T-testing: A linear-time adaptive nonparametric technique. Machine Learning Seminar, Télécom ParisTech, presentation (1 hour), 2 February 2017.
- [15] Distribution regression. New Directions for Learning with Kernels and Gaussian Processes Dagstuhl Seminar, presentation (30 minutes), 1 December 2016.
- [16] Adaptive linear-time nonparametric t-test. Facebook AI Research, Paris, France, presentation, 21 November 2016.
- [17] Distinguishing distributions with maximum testing power. Realeyes, Budapest, Hungary, presentation (1 hour), 24 August 2016.

- [18] Optimal regression on sets. eResearch Domain launch event, London, UK, poster, 29 June 2016.
- [19] Hypothesis testing with kernels. International Workshop on Pattern Recognition in Neuroimaging (PRNI), Trento, Italy, presentation (1 hour), 22-24 June 2016.
- [20] Kernel-based learning on probability distributions. University of California, San Diego, presentation (30 minutes), 25 April 2016.
- [21] Distribution regression with minimax-optimal guarantee. MASCOT-NUM, presentation (45 minutes), 25 March 2016.
- [22] Performance guarantees for kernel-based learning on probability distributions. Special Symposium on Intelligent Systems, MPI, Tübingen, presentation (20 minutes), 16 March 2016.
- [23] Optimal rates for the random Fourier feature technique. École Polytechnique, presentation (2 hours), 14 March 2016.
- [24] Learning theory for vector-valued distribution regression. CMStatistics 2015, presentation (35 minutes), 12 December 2015.
- [25] Optimal uniform and L^p rates for random Fourier features. Pennsylvania State University, presentation (1 hour), 4 December 2015.
- [26] Optimal rates for the random Fourier feature method. Statistical ML Reading Group, Carnegie Mellon University, presentation (1 hour), 1 December 2015.
- [27] Distribution regression: Computational and statistical tradeoffs. ML Lunch Seminar, Carnegie Mellon University, presentation (50 minutes), 30 November 2015.
- [28] Distribution regression: Computational and statistical tradeoffs. Princeton University, presentation (1 hour), 26 November 2015.
- [29] Optimal rates for random Fourier feature approximations. University of Alberta, presentation (1 hour), 24 November 2015.
- [30] Optimal rates for random Fourier feature kernel approximations. AMPLab, UC Berkeley, presentation (1 hour), 20 November 2015.
- [31] Performance guarantees for random Fourier features - limitations and merits. Neil Lawrence's lab, University of Sheffield, presentation (1 hour), 25 June 2015.
- [32] Regression on probability measures: A simple and consistent algorithm. Centre for Research in Statistical Methodology Seminars, Department of Statistics, University of Warwick, presentation (1 hour), 29 May 2015.
- [33] Vector-valued distribution regression - keep it simple and consistent. Computational Statistics and Machine Learning reading group, Department of Statistics, University of Oxford, presentation (50 minutes), 1 May 2015.
- [34] A simple and consistent technique for vector-valued distribution regression. Artificial Intelligence and Natural Computation seminars, University of Birmingham, presentation (50 minutes), 26 January 2015.
- [35] Consistent vector-valued regression on probability measures. Bernhard Schölkopf's Lab, MPI for Intelligent Systems, Tübingen, presentation (1 hour), 15 January 2015.
- [36] Vector-valued distribution regression: A simple and consistent approach. Statistical Science Seminars, UCL, presentation (1 hour), 9 October 2014.

- [37] Distribution regression - the set kernel heuristic is consistent. CSML Lunch Talk Series, UCL, presentation (1 hour), 2 May 2014.
- [38] Consistent distribution regression via mean embedding. University of Hertfordshire, presentation (1 hour), 5 March 2014.
- [39] Dictionary learning: Independence, structured sparsity and beyond. Gatsby Unit, UCL, presentation (45 minutes), 23 April 2013.
- [40] Dictionary optimization problems and their applications. Eötvös Loránd University, Day of Science, presentation (40 minutes), 22 November 2012.
- [41] Recommender systems, applications in education. Child's Play with Adult's Mind, Conference, Budapest University of Technology and Economics, presentation, 22 March 2012.
- [42] Collaborative filtering via group-structured dictionary learning. Eötvös Loránd University, Innovation Day, poster, 23 February 2012.
- [43] Beyond independent subspace analysis. INRIA, SIERRA project-team, presentation (90 minutes), 17 January 2012.
- [44] Hedging with Lasso. Morgan Stanley, presentation, 9 September 2011.
- [45] Interpreting natural language: applications of group-structured dictionary learning. Eötvös Loránd University, Faculty of Informatics, Neumann's Day, poster, 12 May 2011.
- [46] Interpreting words: an application of (structured) sparse coding. Eötvös Loránd University, Faculty of Informatics, Neumann's Day, poster, 12 May 2011.
- [47] Online group-structured dictionary learning. Eötvös Loránd University, Faculty of Informatics, Neumann's Day, poster, 12 May 2011.
- [48] Structured sparsity and non-convex sparsity-inducing methods. Morgan Stanley, presentation, 9 May 2011.
- [49] Online group-structured dictionary learning. Eötvös Loránd University, TÁMOP Research Seminar, presentation, 28 January 2011.
- [50] Online group-structured dictionary learning. Machine Learning at Budapest, presentation, 22 November 2010.
- [51] Online structured dictionary learning and its applications. Eötvös Loránd University, Problem Solving Seminar for Applied Mathematicians, presentation, 5 November 2010.
- [52] Nonparametric regression, Lasso. Eötvös Loránd University, Problem Solving Seminar for Applied Mathematicians, presentation, 12 November 2009.
- [53] Analysis and prediction of time series with missing data. Morgan Stanley, Speaker Series Event, presentation, 9 October 2009.
- [54] Analysis and prediction of time series with missing data. Morgan Stanley - BME Financial Innovation Centre Kick-off & Workshop, presentation, 15 June 2009.
- [55] Independent subspace analysis; tensor-SVD, tensorfaces; blind subspace deconvolution. Eötvös Loránd University, Problem Solving Seminar for Applied Mathematicians, presentation, 19 October 2007.
- [56] Exploration of behavioral patterns and its applications in human-computer interaction. Info Savaria (Szombathely), presentation, 14-16 April 2005.

- [57] Recognition of behavioral patterns and its potentials of human-computer interaction. Info ÉRA (Békéscsaba), presentation, 14-16 April 2004.
- [58] Adaptive human-computer interaction via face and gaze tracking. Eötvös Loránd University, Faculty of Informatics, Neumann's Day, presentation, 6 November 2003.

LECTURING (G–GRADUATE, U–UNDERGRADUTE)

École Polytechnique (France)

- Structured Data: Learning, Prediction, Dependency, Testing Spring, 2018
 – g; ca. 70 students
 – with Prof. Florence d'Alché-Buc, Prof. Slim Essid, Prof. Arthur Tenenhaus, Alexandre Garcia (Datalab)
- Advanced Machine Learning (MSc Big Data For Business - X/HEC) Spring, 2018
 – g; ca. 60 students
 – with Prof. Stéphane Canu, Prof. Erwan Le Pennec, Anne Auger
- Structured Data: Learning, Prediction, Dependency, Testing Spring, 2017
 – g; ca. 95 students
 – with Prof. Florence d'Alché-Buc, Prof. Slim Essid, Prof. Arthur Tenenhaus
- Functional Data Analysis Fall, 2016
 – g; special course

INRIA (France)

- Kernel Methods, Divergence and Independence Measures, Hypothesis Testing July 16-20, 2018
 – Summer School on Data Science for Document Analysis and Understanding (g)
- Manifold Learning and Classification for EEG Analysis July 27, 2017
 – Summer School on Mathematical and Computational Methods for Life Sciences (3-hour long course; g)

Carnegie Mellon University (US)

- Kernel-based Dependency Measures and Hypothesis Testing (g) Nov. 27, 2017
 – Guest Lecture @ Machine Learning Department

University College London (UK)

- Advanced Topics in Machine Learning - Theory of RKHS Spring, 2015–2016
 – g; ca. 60 students
 – with Prof. Arthur Gretton, Kacper Chwialkowski
- Adaptive Modelling, Introduction to Kernel Methods Spring, 2015–2016
 – g; ca. 20 students
 – with Prof. Arthur Gretton, Heiko Strathmann, Wittawat Jitkrittum

Eötvös Loránd University (Hungary)

- Reinforcement Learning Spring, 2009–2013
 – g; ca. 45 students in each semester
 – with Prof. András Lőrincz
- Artificial Neural Networks Fall, 2008–2012
 – g; ca. 45 students in each semester
 – with Prof. András Lőrincz
- Image Processing, Speech Recognition, Applications of Artificial Intelligence 2007–2008
 – g; ca. 25 students in each semester
- Introduction to Mathematics 2006–2007
 – u; ca. 25 students in each semester
- Symbolic Programming 2004–2006

– u; ca. 25 students in each semester

STUDENT SUPERVISION

Supervision

- Linda Chamakh (Ph.D.) Apr., 2018–
– CMAP, École Polytechnique & BNP Paribas, France
– Co-supervised with Prof. Emmanuel Gobet, Jean-Philippe Lemor
– Topic: Uncertainty Quantification, Robustness of Systematic Strategies
- Gaspar Massiot (PostDoc) Oct., 2017–
– French Aerospace Lab ONERA, France
– Co-supervised with Prof. Éric Moulines, Sidonie Lefebvre
– Topic: Kernel Methods in Hyperspectral Imaging
- Romain Brault (PostDoc) Oct., 2017–
– CMAP, École Polytechnique & LTCI, Télécom ParisTech, France
– Co-supervised with Prof. Florence d’Alché-Buc, Prof. Arthur Tenenhaus
– Topic: Prediction of Functional Outputs by Kernels
- Alex Lambert (Ph.D.) Oct., 2017–
– CMAP, École Polytechnique & LTCI, Télécom ParisTech, France
– Co-supervised with Prof. Florence d’Alché-Buc
– Topic: Statistical Learning of Vector-Valued Functions with Operator
Random Fourier Features
- Zoltán Milacski (M.Sc.) 2012–2013
– School of Computer Science, Eötvös Loránd University (ELU), Hungary
– Co-supervised with Prof. András Lőrincz of the national student competitor (2nd prize)
– Topic: Recurrent Reinforcement Learning in High-Frequency Algorithmic Trading
- Gabriella Merész (M.Sc.) 2012
– Department of Applied Mathematics, ELU, Hungary
– Topic: Prediction of Financial Time Series via ARMA-GARCH Methods

Mentoring

- Meyer Scetbon (M.Sc. intern) Apr., 2018–
– INRIA, France
– Co-supervised with Gaël Varoquaux
– Topic: Fast Kernel-based Hypothesis Testing
- Roulier Lorraine, Flore Martin (M.Sc.) Jan. – Mar., 2018
– Sciences for Environmental Challenges, École Polytechnique, France
– Topic: Low-Dimensional Embedding of Environmental Variables
- Moussab Djerrab (Ph.D.) Oct., 2017–
– LTCI, Télécom ParisTech, France
– Topic: Structured Prediction with Surrogate Losses
- Wittawat Jitkrittum (Ph.D.) 2013–2016
– Gatsby Unit, University College London, UK
– Topic: Kernel Techniques, Statistics
- Máté Csákvári, Zoltán Tóser (M.Sc.) 2012–2013
– School of Computer Science, ELU, Hungary
– Topic: Information Theory, Dictionary Learning
- László Jeni (PostDoc) 2011–2013
– Robotics Institute, Carnegie Mellon University, US
– Topic: Extensions of Constrained Local Models, Facial Expression Recognition
- Balázs Pintér, Gyula Vörös (Ph.D.) 2011–2013
– School of Computer Science, ELU, Hungary
– Topic: Structured-Sparse Coding and Dictionary Learning in Natural

Language Processing

- András Sárkány (M.Sc.) 2011–2013
– School of Computer Science, ELU, Hungary
– Topic: Hedging via Sparse Coding
- Gergő Hammer (M.Sc.) 2011 Autumn – 2012 Spring
– Department of Applied Mathematics, ELU, Hungary
– Topic: Self-Similar Structures for Financial Prediction
- Mária Mészáros, Dávid Retek (M.Sc.) 2009 Autumn – 2010 Spring
– Department of Applied Mathematics, ELU, Hungary
– Topic: Online Structured Dictionary Learning and Its Applications
- Kitti Korbács, Nóra Villányi, Gabriella Merész (M.Sc.) 2007 Autumn – 2008 Spring
– Department of Applied Mathematics, ELU, Hungary
– Topic: Tensor Textures
- Kata Péter, Anikó Márton (M.Sc.) 2007 Autumn – 2008 Spring
– Department of Applied Mathematics, ELU, Hungary
– Topic: Temporal Independent Subspace Analysis of Facial Features

Thesis Committee

- Zhu Li (M.Sc., Wolfson College) Summer, 2018
– University of Oxford, Department of Statistics, UK
– Thesis title: On Kernel Approximation and Distribution Regression
– (External Examiner for Thesis defense)
- Romain Brault (Ph.D.) July 3, 2017
– Télécom ParisTech, France
– Thesis title: Large-scale Operator-Valued Kernel Regression
– (Committee member for Thesis defense)
- Gábor Matuz (M.Sc.) 2010
– Budapest University of Technology and Economics, Hungary
– Thesis title: Adaptive Algorithms in Multiagent Environments
– (External Examiner for Thesis defense)
- Kornél Kovács (Ph.D.) 2008
– University of Szeged, Hungary
– Thesis title: Various Kernel Methods with Applications
– (External Examiner for Thesis defense)

Internship Committee

- X-HEC (M.Sc.) Sept. 10, 2018
– École Polytechnique, France
- Statistical Models in Biology and Physics (M.Sc.) Mar. 22, 2018
– École Polytechnique, France
- Data Science (M.Sc.) Sept. 27, 2017
– École Polytechnique (morning) & Télécom ParisTech (afternoon), France
- Data Science (M.Sc.) Sept. 4-5, 2017
– École Polytechnique, France

Referent Professor

- Camille Jandot's internship (M.Sc.) Apr.–Sept., 2017
– Télécom ParisTech, France
– Title: Modelling Space Time Series with Operator-Valued Kernels
– Application to Detection of Epidemics

EMPLOYMENT

École Polytechnique, CMAP, Palaiseau, France

| | |
|---|-----------|
| Research Associate Professor University College London, CSML , London, United Kingdom Gatsby Unit | 2016– |
| Research Associate (with Prof. Arthur Gretton) Eötvös Loránd University, School of Computer Science , Budapest, Hungary | 2013–2016 |
| Research Fellow | 2009–2013 |
| Assistant Research Fellow | 2008–2009 |
| Assistant Professor | 2007–2008 |

EDUCATION

| | |
|---|-----------|
| Eötvös Loránd University , Budapest, Hungary | |
| School of Computer Science | |
| Ph.D. (Computer Science; summa cum laude) | 2009 |
| Ph.D. Candidate (Computer Science) | 2008–2009 |
| Ph.D. Student (Computer Science) | 2004–2007 |
| Faculty of Natural Sciences, Applied Mathematics | |
| Ph.D. (summa cum laude) | 2012 |
| Ph.D. Candidate | 2009–2012 |
| Ph.D. Student | 2003–2006 |
| M.Sc. (summa cum laude) | 1998–2003 |

INTERVIEW

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|---|------------|
| At TWiML & AI on our work winning best paper award at NIPS-2017 | Dec., 2017 |
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GRANT

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| Labex DigiCosme | 2017 |
| – joint work with Prof. Florence d’Alché-Buc, Prof. Arthur Tenenhaus | |

ACADEMIC HONORS, AWARDS

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|--|------|
| Best Paper Award at NIPS (awarded to 3 papers out of the 3240 submissions) | 2017 |
| Bronze Medal of the Pro Patria et Scientia Award of Hungarian Ph.D. Students | 2008 |
| Scientist of the Year Award of the School of Computer Science | 2007 |
| Outstanding Student Award of the Faculty of Natural Sciences | 2003 |

MEMBERSHIPS

| | |
|---|-----------|
| Member of the French Statistical Society (SFdS) | 2018– |
| Member of the PASCAL2 Network of Excellence | 2008–2013 |
| Member of the John von Neumann Computer Society | 2007–2013 |

PROJECTS (EÖTVÖS LORÁND UNIVERSITY)

| | |
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| EIT ICT Labs: | 2013 |
| – Projects: Playful Learning on the Cloud; Travel Dashboard; Computers as Social Actors; Medical Cyber-Physical Systems | |
| – Topic: dictionary learning, structured sparse methods, kernel techniques | |
| EuroSurge (EU FP7) | 2012–2013 |
| – Topic: natural language processing, structured sparsity, recommender systems | |
| U.S. Air Force (Innovation Engine for Blogspaces) | 2007–2011 |
| – Topic: natural language processing, structured sparsity, dictionary learning | |
| Morgan Stanley | 2008–2011 |

| | |
|--|-----------|
| – Topic: financial time series (prediction, hedging) | |
| KMOP | 2011 |
| – Topic: constrained local models | |
| TÁMOP | 2010–2012 |
| – Topic: recommender systems | |
| Archi-Data | 2009–2011 |
| – Topic: financial time series (prediction) | |
| PERCEPT (Perceptual Consciousness - Explication and Testing; EU FP6) | 2007–2010 |
| – Topic: infomax identification | |

SCHOLARSHIPS

| | |
|--|-----------|
| Scholarship of the John von Neumann Computer Society (intelligent systems) | 2005–2012 |
| Scholarship of the Bliss Foundation | 2004 |
| Scholarship of the Eötvös Loránd University | 2003 |

COMPETITION AND PROBLEM SOLVING SEMINAR DURING M.SC.

Scientific Student Competition and Conference

| | |
|--|------|
| Localization of Facial Components via Retina Based Sampling (<i>2nd</i> prize) | 2002 |
| Supervisor: Botond Szatmáry. | |

Problem Solving Seminar for Applied Mathematicians

| | |
|-----------------------------------|---------------------------|
| Skin Detection Algorithms, | 2001 Autumn – 2002 Spring |
| Supervisor: Prof. András Lőrincz. | |

LANGUAGES

- English (fluent), Spanish (basic), Hungarian (native).
- Programming languages: Matlab/Octave, Python, Maple, L^AT_EX, HTML.