MICHALIS K. TITSIAS

CONTACT DETAILS

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RESEARCH INTERESTS

My research interests include topics such as - Machine Learning, Deep Learning and Data Science - Continual Learning, Transfer Learning - Statistical Methodology and Bayesian Methods - Markov chain Monte Carlo and Approximate Inference

EDUCATION

PhD (2001-2005), School of Informatics, University of Edinburgh, UK.
Thesis title: Unsupervised Learning of Multiple Objects in Images.
Supervisor: Prof. Christopher K. I. Williams.

MSc (1999-2001), Department of Computer Science, University of Ioannina, Greece.
Thesis title: Mixture Models for Classification.
Supervisor: Prof. Aristidis Likas.

BSc (Ptychion) (1995-1999), Department of Computer Science, University of Ioannina, Greece.

PROFESSIONAL HISTORY

Google DeepMind Staff Research Scientist, Google UK Ltd, October 2018-present.

Assistant Professor, August 2017-September 2018.
Department of Informatics, Athens University of Economics and Business, Greece.

Lecturer, 2012- August 2017
Department of Informatics, Athens University of Economics and Business, Greece.

Academic visitor. From 2013 to present I have been visiting (five visits so far where each lasted two to three weeks) the Department of Statistics in the University of Oxford where I work in statistical methodology related projects in collaboration with Professor Chris Holmes and Dr Christopher Yau.

Postdoctoral research scientist, 2011-2012.
I worked in statistical cancer genomics at the Wellcome Trust Centre for Human Genetics and the Department of Statistics in the University of Oxford. The position was funded by the Wellcome Trust and the UK Department of Health.

Research associate, 2007-2011.
I worked in the Machine Learning and Optimization Research Group at the School of Computer Science of the University of Manchester, under the supervision of Professor Neil Lawrence and Professor Magnus Rattray. This work was funded by EPSRC Grant No EP/F005687/1 "Gaussian Processes for Systems Identification with Applications in Systems Biology".

TEACHING EXPERIENCE

Undergraduate Courses (as main instructor)

- 2015-2017, Introduction to Computer Programming, Department of Informatics, AUEB.
- 2014-2017, Machine Learning, Department of Informatics, AUEB.
- 2014, Artificial Intelligence, Department of Informatics, AUEB.
- 2012-2013, Statistics for Informatics, Department of Informatics, AUEB.
- 2012-2013, MATLAB lab courses for Computational Mathematics, Department of Informatics, AUEB.

Postgraduate courses (as main instructor)

- 2013-2017, Machine Learning, MSc in Computer Science, Department of Informatics, AUEB.
- 2016-2017, Machine Learning and Computational Statistics, MSc in Data Science, School of Information Sciences and Technology, AUEB.
- 2015, Machine Learning, MSc in Information Systems, AUEB.

Courses as teaching assistant

- 2001, Learning from Data, MSc in Artificial Intelligence, Department of Informatics, University of Edinburgh.
- 2003-2004, Data Mining and Exploration, MSc in Artificial Intelligence, Department of Informatics, University of Edinburgh.

PUBLICATIONS

Journal articles

1. A. Alexopoulos, P. Dellaportas and M. K. Titsias. Variance reduction for Metropolis–Hastings samplers. Statistics and Computing 33, 6, 2023.
2. M. K. Titsias, J. Sygnowski and Y. Chen. Sequential Changepoint Detection in Neural Networks with Checkpoints. Statistics and Computing, 32: 26, 2022.
3. Petros Dellaportas, Michalis K.Titsias, Katerina Petrova and Anastasios Plataniotis. Scalable inference for a full multivariate stochastic volatility model. Journal of Econometrics, 2021.
4. A. Panos, P. Dellaportas and M. K. Titsias. Large scale multi-label learning using Gaussian processes. Machine Learning, Volume 110, 965–987, 2021.
5. M. K. Titsias and O. Papaspiliopoulos. Auxiliary gradient-based sampling algorithms. Journal of the Royal Statistical Society: Series B, 80: 749-767, 2018.
6. M. K. Titsias and C. Yau. The Hamming Ball Sampler. Journal of the American Statistical Association (JASA), 112:520, 1598-1611, 2017
7. A. Damianou*, M. K. Titsias* and N. Lawrence. Variational Inference for Latent Variables and Uncertain Inputs in Gaussian Processes. Journal of Machine Learning Research (JMLR), 17(42):1-62, 2016.
8. M. K. Titsias, C. C. Holmes, and C. Yau. Statistical Inference in Hidden Markov Models using k-segment constraints. Journal of the American Statistical Association (JASA), Theory and Methods, 111(513):200-215, 2016.
9. R. Clifford, T. Louis, P. Robbe, S. Ackroyd, A. Burns, A. T. Timbs, G. W. Colopy, H. Dreau, F. Sigaux, J. G. Judde, M. Rotger, A. Telenti, Y-L Lin, P. Pasero, J. Maelfait, M. Titsias, D. Cohen, S. J. Henderson, M. Ross, D. Bentley, P. Hillmen, A. Pettitt, J. Rehwinkel, S. J. L. Knight, J. C. Taylor, Y. J. Crow, M. Benkirane and A. Schuh. SAMHD1 is mutated recurrently in chronic lymphocytic leukaemia and is involved in response to DNA damage. Blood, 123(7), 1021-31, 2014.

10. M. Lázaro-Gredilla, M. K. Titsias, J. Verrelst and G. Camps-Valls. Retrieval of Biophysical Parameters with Heteroscedastic Gaussian Processes. IEEE Geoscience and Remote Sensing Letters, 11(4), 838-842, 2014.
11. M. K. Titsias*, A. Honkela*, N. D. Lawrence and M. Rattray. Identifying targets of multiple co-regulating transcription factors from expression time-series by Bayesian model comparison. BMC Systems Biology 6:53 (2012).
12. C. Constantinopoulos, M. K. Titsias and A. Likas. Bayesian Feature and Model Selection for Gaussian Mixture Models. IEEE Trans. on Pattern Analysis and Machine Intelligence, 28(6), 1013-1018, June 2006.
13. C. K.I. Williams and M. K. Titsias. Greedy Learning of Multiple Objects in Images using Robust Statistics and Factorial Learning. Neural Computation, 16(5), 1039-1062, May 2004.
14. M. K. Titsias and A. Likas. Class Conditional Density Estimation using Mixtures with Constrained Component Sharing. IEEE Trans. on Pattern Analysis and Machine Intelligence, 25(7), 924-928, July 2003.
15. M. K. Titsias and A. Likas. Mixture of Experts Classification using a Hierarchical Mixture Model. Neural Computation, 14(9), 2221-2244, September 2002.
16. M. K. Titsias and A. Likas. Shared Kernel Models for Class Conditional Density Estimation. IEEE Trans. on Neural Networks, 12(5), 987-997, September 2001.

Conference proceedings (refereed)

1. M. K. Titsias, A. Galashov, A. Rannen-Triki, R. Pascanu, Yee Whye Teh and J. Bornschein. Kalman Filter for Online Classification of Non-Stationary Data. 12th International Conference on Learning Representations (ICLR), 2024.
2. M. K. Titsias. Optimal Preconditioning and Fisher Adaptive Langevin Sampling. In Advances in Neural Information Processing Systems (NeurIPS), 2023.
3. J. Shi, Y. Zhou, J. Hwang, M. K. Titsias and L. Mackey. Gradient Estimation with Discrete Stein Operators. Neural Information Processing Systems (NeurIPS), 2022. NeurIPS 2022 **(Outstanding Paper Award)**.
4. M. K. Titsias and J. Shi. Double Control Variates for Gradient Estimation in Discrete Latent Variable Models. 25rd International Conference on Artificial Intelligence and Statistics (AISTATS), 2022.
5. Shengyang Sun, Daniele Calandriello, Huiyi Hu, Ang Li, M. K. Titsias. Information theoretic Online Memory Selection for Continual Learning. 10th International Conference on Learning Representations (ICLR), 2022.
6. M. K. Titsias, Jiaxin Shi. Double Control Variates for Gradient Estimation in Discrete Latent Variable Models. 25th International Conference on Artificial Intelligence and Statistics (AISTATS), 2022.
7. M. Hirt, M. K. Titsias, P. Dellaportas. Entropy-based adaptive Hamiltonian Monte Carlo. In Advances in Neural Information Processing Systems (NeurIPS), 35, 2021.
8. M. K. Titsias, F. J. R. Ruiz, S. Nikoloutsopoulos and A. Galashov. Information Theoretic Meta Learning with Gaussian Processes. 37th Conference on Uncertainty in Artificial Intelligence (UAI), 2021.
9. F. J. R. Ruiz, M. K. Titsias, T. Cemgil and A. Doucet. Unbiased Gradient Estimation for Variational Auto-Encoders using Coupled Markov Chains. 37th Conference on Uncertainty in Artificial Intelligence (UAI), 2021.
10. J. Shi, M. K. Titsias and A. Mnih. Sparse Orthogonal Variational Inference for Gaussian Processes. 23rd International Conference on Artificial Intelligence and Statistics (AISTATS), 2020.

11. M. K. Titsias, J. Schwarz, A. G de G Matthews, R. Pascanu and Y. W. Teh. Functional regularisation for continual learning with Gaussian processes. 8th International Conference on Learning Representations (ICLR), 2020.
12. M. K. Titsias, P. Dellaportas. Gradient-based Adaptive Markov Chain Monte Carlo. In Advances in Neural Information Processing Systems (NeurIPS), 33, 2019.
13. F. J. R. Ruiz, M. K. Titsias. A Contrastive Divergence for Combining Variational Inference and MCMC. International Conference on Machine Learning (ICML), 2018.
14. M. K. Titsias F. J. R. Ruiz. Unbiased Implicit Variational Inference. 22th International Conference on Artificial Intelligence and Statistics (AISTATS), 2019.
15. K. Martens, M. K Titsias, C. Yau. Rejection-free Ensemble MCMC with applications to Factorial Hidden Markov Models. 22th International Conference on Artificial Intelligence and Statistics (AISTATS), 2019.
16. F. J. R. Ruiz, M. K. Titsias, A. B. Dieng, and D. M. Blei. Augment and Reduce: Stochastic Inference for Large Categorical Distributions. International Conference on Machine Learning (ICML), 2018.
17. T. Rukat, C. C. Holmes, M. K. Titsias, C. Yau. Bayesian Boolean Matrix Factorisation. Proceedings of the 34th International Conference on Machine Learning (ICML), 2017.
18. M. K. Titsias. One-vs-Each Approximation to Softmax for Scalable Estimation of Probabilities. In Advances in Neural Information Processing Systems (NIPS), 29, December 2016.
19. F. J. R. Ruiz, M. K. Titsias and D. M. Blei. The Generalized Reparameterization Gradient. In Advances in Neural Information Processing Systems (NIPS), 29, December 2016.
20. F. J. R. Ruiz, M. K. Titsias and D. M. Blei. Overdispersed Black-Box Variational Inference. In Uncertainty in Artificial Intelligence (UAI), 2016.
21. M. Karaliopoulos, I. Koutsopoulos and M. K. Titsias. First Learn then Earn: Optimizing Mobile Crowdsensing campaigns through data-driven user profiling. In Proceedings of ACM International Symposium on Mobile Ad-Hoc Networking and Computing (Mobihoc), 2016.
22. M. K. Titsias and M. Lázaro-Gredilla. Local Expectation Gradients for Black Box Variational Inference. In Advances in Neural Information Processing Systems (NIPS), 28, 2015.
23. R. Bardenet* and M. K. Titsias*. Inference for determinantal point processes without spectral knowledge. In Advances in Neural Information Processing Systems (NIPS), 28, 2015.
24. M. K. Titsias, C. Yau. Hamming ball Auxiliary Sampling for Factorial Hidden Markov Models. In Advances in Neural Information Processing Systems (NIPS), 27, 2960-2968, 2014.
25. M. K. Titsias and M. Lázaro-Gredilla. Doubly Stochastic Variational Bayes for non-conjugate Inference. In Proceedings of the 31st International Conference on Machine Learning (ICML), 1971-1979, 2014.
26. M. K. Titsias and M. Lázaro-Gredilla. Variational Inference for Mahalanobis Distance Metrics in Gaussian Process Regression. In Advances in Neural Information Processing Systems (NIPS), 26, 2013.
27. A. C. Damianou, C. H. Ek, M. K. Titsias and N. D. Lawrence. Manifold Relevance Determination. In Proceedings of the 29st International Conference on Machine Learning (ICML), 2012,
28. M. K. Titsias and M. Lázaro-Gredilla. Spike and Slab Variational Inference for Multi-Task and Multiple Kernel Learning. In Advances in Neural Information Processing Systems (NIPS), 24, 2011.
29. A. C. Damianou, M. K. Titsias and N. D. Lawrence. Variational Gaussian Process Dynamical Systems. In Advances in Neural Information Processing Systems (NIPS), 24, 2011.
30. M. Lázaro-Gredilla and M. K. Titsias. Variational Heteroscedastic Gaussian Process Regression. International Conference on Machine Learning (ICML), 2011, **Distinguished Paper Award**.

31. M. K. Titsias and N. D. Lawrence. Bayesian Gaussian Process Latent Variable Model. Thirteenth International Conference on Artificial Intelligence and Statistics (AISTATS), 2010.
32. M. Alvarez, D. Luengo, M. K. Titsias and N. D. Lawrence. Efficient Multioutput Gaussian Processes through Variational Inducing Kernels. Thirteenth International Conference on Artificial Intelligence and Statistics (AISTATS), 2010.
33. P. Zacharouli, M. K. Titsias and M. Vazirgiannis. Web Page Rank Prediction with PCA and EM Clustering. WAW 2009: 104-115.
34. M. K. Titsias. Variational Learning of Inducing Variables in Sparse Gaussian Processes. Twelfth International Conference on Artificial Intelligence and Statistics (AISTATS), 2009.
35. M. K. Titsias, N.D. Lawrence and M. Rattray. Efficient Sampling for Gaussian Process Inference using Control Variables. In Advances in Neural Information Processing Systems (NIPS), 22, 2009.
36. M. K. Titsias. The Infinite Gamma-Poisson Feature Model. In Advances in Neural Information Processing Systems (NIPS) 21. 2008.
37. M. K. Titsias, C. K. I. Williams. Unsupervised Learning of Multiple Aspects of Moving Objects from Video. In Advances in Informatics, 10th Panhellenic Conference on Informatics, Volos, Greece, LNCS 3746 Springer, pp 746-756, 2005.
38. M. Allan, M. K. Titsias and C. K.I. Williams. Fast Learning of Sprites using Invariant Features. British Machine Vision Conference, 2005.
39. M. K. Titsias and C. K. I. Williams. Fast Unsupervised Greedy Learning of Multiple Objects and Parts from Video. Generative-Model Based Vision Workshop, 2004.
40. C. K.I. Williams and M. K. Titsias. Learning About Multiple Objects in Images: Factorial Learning without Factorial Search. In Advances in Neural Information Processing Systems (NIPS) 15, 2003.
41. C. Constantinopoulos, M. K. Titsias and A. Likas. A Bayesian Regularization Method for the Probabilistic RBF Network, Hellenic Conference on Artificial Neural Networks, pp. 337-345, 2002.
42. M. K. Titsias, D. I. Fotiadis and A. Likas. Estimation of the Concrete Characteristics using Pattern Recognition methods. Proc. of the 6th National Congress on Mechanics, Greece, 2001.
43. M. K. Titsias and A. Likas. A Probabilistic RBF Network for Classification. Proc. of the Int. Joint Conference on Neural Networks (IJCNN'2000), Como, Italy, 2000.

Book chapters

1. N. Lawrence, M. Rattray, A. Honkela, and M. K. Titsias. Gaussian Process Inference for Differential Equation Models of Transcriptional Regulation. In M. P. H. Stumpf, D. J. Balding, and M. Girolami, eds., Handbook of Statistical Systems Biology, pp. 376-394, John Wiley & Sons, Chichester, UK (2011).
2. M. K. Titsias, M. Rattray and N.D. Lawrence. Markov chain Monte Carlo algorithms for Gaussian processes. In Barber, Chiappa and Cemgil (eds), Bayesian Time Series Models, Cambridge University Press, 2011.
3. N. D. Lawrence, M. Rattray, P. Gao and M. K. Titsias. Gaussian processes for missing species in biochemical systems. In N. D. Lawrence, M. Girolami, M. Rattray and G. Sanguinetti (eds), Learning and Inference in Computational Systems Biology, MIT Press, Cambridge, MA. 2010.
4. M. K. Titsias and C. K. I. Williams. Sequential Learning of Layered Models from Video. In C. S. J. Ponce, M. Herbert and A. Zisserman (Eds.), Proceedings Sicily Workshop on Object Recognition, Sicily, 2005.

Theses

1. M. K. Titsias, Unsupervised Learning of Multiple Objects in Images. Ph.D. Thesis, School of Informatics, University of Edinburgh, 2005.

2. M. K. Titsias, Classification using Gaussian Mixture Models. M.Sc. Thesis, Dept. of Computer Science, University of Ioannina, 2001.

*Joint first author.

Google scholar:
According to google scholar my h-index is 33 and my work so far has received 6653 citations (January 2024).

PEER REVIEWING AND PROFESSIONAL SERVICE

Reviewer for Journals:
Journal of Machine Learning Research, Machine Learning, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Neural Networks, Neurocomputing, Journal of the American Statistical Association, Statistics and Computing, Electronic Journal of Statistics.

Reviewer for Conferences:
Advances in Neural Information Processing Systems, International Conference on Machine Learning, International Conference on Artificial Intelligence and Statistics, Conference on Uncertainty in Artificial Intelligence, European Conference on Machine Learning.

Area Chair and Senior Program Committee:
Advances in Neural Information Processing Systems (2018, 2019, 2020, 2021), International Conference on Machine Learning (2017, 2021), International Conference on Artificial Intelligence and Statistics (2020, 2021, 2022)

SELECTED TALKS

- Information Theoretic Meta Learning with Gaussian Processes. UAI, 2021.
- Functional Regularisation for Continual Learning with Gaussian Processes. Statistics Seminar, Barcelona School of Economics, 2020.
- Gradient-based Adaptive Markov Chain Monte Carlo. 2th Symposium on Advances in Approximate Bayesian Inference, 2019.
- Gradient-based Adaptive Markov Chain Monte Carlo. Cambridge University, Department of Engineering, 2019.
- The Hamming Ball Sampler, 3rd Meeting on Statistics, 2015.
- Distributed Kernel Representations for Variational Sparse Gaussian Processes, Gaussian Process Approximations Workshop, 2015.
- Variational Inference for Gaussian and Determinantal Point Processes, Advances in Variational Inference NIPS 2014 Workshop, 2014.
- Doubly Stochastic Variational Bayes for non-Conjugate Inference, ICML, 2014.
- Bayesian Gaussian Process Latent Variable Model, AISTATS, 2010.
- Variational Model Selection for Sparse Gaussian Process Regression, BARK, 2008.
- Markov Chain Monte Carlo Algorithms for Gaussian Processes, Newton Institute workshop, 2008.
- Gaussian process modelling of transcription factor networks using Markov chain Monte-Carlo, LICSB, 2008.

ACADEMIC SUPERVISION

Current PhD student: Sotirios Nikoloutsopoulos, Department of Informatics, Athens University of Economics and Business.

I have collaborated (as co-supervisor) with several PhD students: Mauricio Alvarez (University of Manchester, 2011), Andreas Damianou (University of Sheffield, 2015), Patrick Sauer (University of Manchester, 2013), Peter Kecskemethy (University of Oxford, 2014), Owen Thomas (University of Oxford, 2017), Tammo Rukat (University of Oxford, 2018), Adji Bousso Dieng (Columbia University, 2020), Aristeidis Panos (University College London, 2019), Marcel Hirt (University College London, 2021).

MSc projects under my advice:

- Vasiliki Chira, A Variational Bayesian Method for Sparse Neural Networks, MSc in Computer Science, 2018.
- Christos Kormaris, Variational Autoencoders and Applications, MSc in Computer Science, 2018.
- Ioannis Papantonis, Adaptive Learning Rate Algorithms for Stochastic Optimization and Variational Bayesian Inference, MSc. in Data Science, 2017.
- Chatzistyli Ilia, Implementation of Face Recognition system over Spark with TensorFlow, MSc in Data Science, 2017.
- Alexander Karvouniaris, A spatial analytics approach for the ripeness estimation inside a vineyard, MSc in Data Science, 2017.
- Fotini Kolokathi, A data enrichment module based on NLP techniques for context analysis of web news, MSc in Data Science, 2017.
- Apostolos Adamakos, Optimization of Short-Term Load Forecasting using A Cluster of Artificial Neural Networks, MSc in Information Systems, 2015.
- Sevastianos Fournaris. Clustering of Cancer Genomes using Mixtures of Hidden Markov Models, MSc in Computer Science, 2014.

GRANTS AND PARTICIPATION IN PROJECTS

- 2012-2014: I participated as a principal investigator in the "Research Funding at AUEB for Excellence and Extroversion, Action 1: 2012-2014" grant.
- 2012-2014: Together with Professor Chris Holmes I awarded a "Lincoln College Michael Zilkha Fund" to support my visits at the Department of Statistics in the University of Oxford.
- Nov 2011 - Sept 2012: I participated as a full time postdoctoral research scientist (Wellcome Trust Center of Human Genetics, Oxford, UK) in the Health Innovation Challenge Fund (HICF-1009-026, WT091989/Z/10/Z), a parallel funding partnership between the Department of Health and Wellcome Trust.
- Oct 2007 - July 2011: I participated as a full time postdoctoral research assistant (University of Manchester, UK) in the EPSRC Grant No EP/F005687/1 "Gaussian Processes for Systems Identification with Applications in Systems Biology".
- Nov 2004 - April 2005: I participated as a technical contributor (University of Edinburgh, UK) for the PASCAL Visual Object Classes Challenge 2005.
- Oct 1999 - June 2001: I participated as a postgraduate research assistant (University of Ioannina, Greece) in the project "Non Destructive Methods for the Estimation of Concrete characteristics", EPET III Project supported by Greek General Secreteriat for Research and Technology.