
Dr. Alexander G. de G. Matthews

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EMPLOYMENT

University of Cambridge. Research Associate. (10/2016-present)

- Working with Prof. Zoubin Ghahramani.
- Part of the Machine Learning Group in the Engineering Department.
- New interests in Deep Learning and privacy aware machine learning.
- Continued work on Gaussian processes, approximate inference, open source software.
- Mentoring PhD students.

Navetas Energy Management. Senior Research Developer. (2/2009-6/2012)

- Spin-off from University of Oxford, Department of Engineering.
- Working on smart meters and energy efficiency.
- Third employee at a company that had eleven when I left.
- Developed a prototype for Panasonic, Japan.
- Lead development teams.
- Research lead directly to patents which I co-wrote.
- Software work included bespoke algorithmic C++ for an embedded system.

Winton Capital Management. Quantitative Analyst. (9/2008-11/2008)

- Internship at a leading black box quantitative investment fund.
- Worked directly with a senior researcher.
- Studied portfolio theory and covariance estimation.

Oxford Science Studies. Private Tutor. (8/2008, 1/2009)

- Mathematics and science tutoring.
- Responsible for pupils from 14-18 years of age.

University of Plymouth. Summer Programmer. (2002, 2007)

- Adapted Pore-Cor software for industrial agent Thermo-Electron.
- Developed a new modular purchase system that stimulated sales.
- Improved stochastic model leading to new research papers.

EDUCATION

Engineering Department, University of Cambridge, UK. (10/2012-9/2016)

PhD student. Statistical Machine learning.

- Supervised by Prof. Zoubin Ghahramani.
- Thesis title: *Scalable Gaussian process inference using variational methods*
- Applications to classification, regression and spatial statistics.

St. John's College, University of Cambridge, UK. (2004-2008)

MSci. Experimental and Theoretical Physics. *Class II.I*

- Project placed joint 5th in the year and published in leading journal.

BA. Natural Sciences.

- Part II. Experimental and Theoretical Physics. *Class I*
- Part IB. Physics. Advanced Physics. Mathematics. *Class I*
- Part IA. Physics. Chemistry. Biology of Cells. Mathematics. *Class I*

- A-Level. Physics, Chemistry, Biology, Maths, Further Maths. *All Grade A*
- GCSE. 12 subjects including Maths and English. *All Grade A**
- Academic and Music Scholarships. Head of House. School Prefect.
- Mathematics, Physics, Social Service prizes. Top 30, UK Physics Olympiad.

COMPETITIVELY REVIEWED ACADEMIC PAPERS

- Alexander G. de G. Matthews, Jiri Hron, Mark Rowland, Richard E. Turner, and Zoubin Ghahramani. Gaussian Process Behaviour in Wide Deep Neural Networks. In *6th International Conference on Learning Representations*, Vancouver, Canada, April 2018.
- Alexander G. de G. Matthews, Mark van der Wilk, Tom Nickson, Keisuke Fujii, Alexis Boukouvalas, Pablo León-Villagrà, Zoubin Ghahramani, and James Hensman. GPflow: A Gaussian Process Library using TensorFlow. *Journal of Machine Learning Research*, 18(40):1–6, 2017.
- Alexander G. de G. Matthews, James Hensman, Richard E. Turner, and Zoubin Ghahramani. On Sparse variational methods and the Kullback-Leibler divergence between stochastic processes. In *19th International Conference on Artificial Intelligence and Statistics*, Cádiz, Spain, May 2016.
- James Hensman, Alexander G. de G. Matthews, Maurizio Filippone, and Zoubin Ghahramani. MCMC for variationally Sparse Gaussian Processes. In *Advances in Neural Information Processing Systems 28*, Montreal, Canada, December 2015.
- James Hensman, Alexander G. de G. Matthews, and Zoubin Ghahramani. Scalable Variational Gaussian Process Classification. In *18th International Conference on Artificial Intelligence and Statistics*, pages 351–360, San Diego, California, USA, May 2015.
- G. Peter Matthews, Giuliano M. Laudone, Andrew S. Gregory, Nigel R. A. Bird, Alexander G. de G. Matthews, and W. Richard Whalley. Measurement and simulation of the effect of compaction on the pore structure and hydraulic conductivity of grassland and arable soil. *Water Resources Research*, 22:881–930, 2010.
- Alexander G. de G. Matthews and Nigel R. Cooper. Scattering theory for quantum Hall anyons in a saddle point potential. *Physical Review B*, 80:165309, October 2009.

PREPRINTS AND WORKSHOP PAPERS

- Alexander G. de G. Matthews, Jiri Hron, Richard E. Turner, and Zoubin Ghahramani. Sample-then-optimize posterior sampling for Bayesian linear models. In *NIPS workshop on Advances in Approximate Bayesian Inference*, Long Beach, California, December 2017.
- Jiri Hron, Alexander G de G Matthews, and Zoubin Ghahramani. Variational Gaussian Dropout is not Bayesian. In *NIPS workshop on Bayesian Deep Learning*, Long Beach, California, December 2017.
- John Bradshaw, Alexander G de G Matthews, and Zoubin Ghahramani. Adversarial Examples, Uncertainty, and Transfer Testing Robustness in Gaussian Process Hybrid Deep Networks. In *ICML workshop on Reliable Machine Learning in the Wild*, Sydney, Australia, August 2017.
- Alexander G. de G. Matthews, James Hensman, and Zoubin Ghahramani. Comparing lower bounds on the entropy of mixture distributions for use in variational inference. In *NIPS workshop on Advances in Variational Inference*, Montreal, Canada, December 2014.

PATENTS

- James Donaldson, Sarah Surrall, Alexander G. de G. Matthews, and Malcolm McCulloch. Determining background utility consumption levels using NILM. GB 2478166, August 2011.
- James Donaldson, Malcolm McCulloch, Sarah Surrall, and Alexander G. de G. Matthews. Identifying the operation of a specified type of appliance. GB 2472251, February 2011.
- James Donaldson, Sarah Surrall, Alexander G. de G. Matthews, Semen Trygubenko, and Malcolm McCulloch. Non-intrusive utility monitoring. GB 2471536, January 2011.

TEACHING, COMMUNITY AND AWARDS

Lecturing, Advanced Machine Learning, University of Cambridge. (2018)

- MPhil in Machine Learning Speech and Language Technologies.
- Topics: Bayesian Neural Networks, Hamiltonian Monte Carlo, Gaussian process approximations.
- Involved preparing novel teaching material.

Undergraduate Mathematics Supervision, University of Cambridge. (2018)

- Supervised statistics for 2nd year mathematics undergraduates.
- Topics: Confidence intervals, Hypothesis testing, Bayesian inference, Linear models.

Google Cloud Computing Award. (2017)

- Google Europe \$12K cash award to support research using cloud computing.

Academic peer review.

- International Conference on Learning Representations (ICLR). (2018)
- International Conference on Machine Learning (ICML). (2017)
- International Conference on Artificial Intelligence and Statistics (AISTATS). (2017)
- Journal of Machine Learning Research (JMLR). (2016)
- International Conference on Artificial Intelligence and Statistics (AISTATS). (2016)

Founding developer, GPflow, a Gaussian process library for TensorFlow. (2016-present)

- Open source library available at <https://github.com/GPflow/GPflow>.
- Uses automatic differentiation to provide concise code.
- Using Google's TensorFlow library allows fast distributed software.

Open Source Software Award, Contributions to Google TensorFlow. (2016)

- Nominated by Google software engineer.
- Contributed C++ Cholesky backpropagation code to core main code base.
- Removed the main barrier to implementing Gaussian process inference in TensorFlow.

Application reviewer, Cambridge-Tübingen PhD Fellowships in Machine Learning. (2015, 2016)

4th year project supervision, University of Cambridge, UK.

- John Bradshaw. Co-supervision with Zoubin Ghahramani. (2014-2015)
‘Using Bayesian graph kernel methods for QSAR and for Bayesian optimization.’ *Distinction*
- Simon Schulz. Co-supervision with James Lloyd and Zoubin Ghahramani. (2013-2014)
‘Bayesian nonparametric graph kernel methods for regression and classification.’ *Distinction*

Internal seminars.

- *Deep generative models*, with Jonathan Gordon. (2/2018)
- *Differential privacy*, with John Bradshaw. (3/2017)
- *Natural gradient descent and variational inference*, with Mark van der Wilk. (2/2016)
- *PAC Bayes*, with Nikola Mrksic. (11/2014)
- *Loopy belief propagation*, with Yingzhen Li. (4/2014)
- *Spectral clustering*, with Roger Grosse. (11/2012)

External talks.

- Gatsby Computational Neuroscience Unit, University College London, UK. (6/2016)
‘Scalable Gaussian process inference using variational methods.’
- Microsoft Research, Cambridge, UK. (3/2016)
‘A variational framework for approximate Gaussian process inference.’
- University of Oxford, Statistics Department, UK. (12/2015)
‘Variational inference for scalable Gaussian process approximations.’

SOFTWARE SKILLS

- **Low level languages:** C++ (3 years commercial), C (1 year commercial), Fortran.
- **Scripting languages:** Python, MATLAB, Mathematica.
- **Machine learning software:** TensorFlow, PyTorch, GPy, GPflow, GPML toolbox, Church, Anglican, Stan.
- **Utilities:** Subversion, Git, GitHub, Valgrind, SQL.
- **Parallel computing:** Amazon EC2, OpenMP, GPU, Grid Engine.
- **OS experience:** Linux, Microsoft Visual Studio.

REFERENCES

Prof. Zoubin Ghahramani, University of Cambridge.

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Dr. Richard Turner, University of Cambridge.

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Email: ret26@cam.ac.uk

Dr. James Hensman, Prowler.IO limited.

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