Dr. Alexander G. de G. Matthews

Email: alexggmatthews@googlemail.com

EMPLOYMENT

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

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

Navetas Energy Management. Senior Research Developer. **(1/2009-6/2012)**

- 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.
- Went to Japan to install and discuss prototype.
- Lead development teams.
- Developed software to strict commercial deadlines.
- 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.

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.
- Used 3DS Max and VRML for novel 3D visualisations of data.

EDUCATION

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

PhD student. 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*

Clifton College, Bristol, UK. **(1998-2003)**

- A-Level. Physics, Chemistry, Biology, Maths, Further Maths. *All Grade A*
- GSCE. 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, 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*, Cadiz, 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, 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.
- Alexander G. de G. Matthews and Zoubin Ghahramani. Classification using log Gaussian Cox processes. *ArXiv e-prints*, June 2014, 1405.4141.

PATENTS

Granted:

- 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.

Pending:

- Alexander G. de G. Matthews, James Donaldson, and Semen Trygubenko. Utility consumption identification. GB 2493985, February 2013.

TEACHING AND COMMUNITY

Developer, GPflow, a Gaussian processs library for TensorFlow. **(2016)**

- 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.

Contributor, Google TensorFlow. **(2016)**

- Contributed C++ Cholesky backpropagation code to main code base.
- Removes the main barrier to implementing Gaussian process inference in TensorFlow.
- Recognized by Google with an Open Source Software Award.

Academic peer review

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

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

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*

External talks.

- University of Oxford, Statistics Department, UK. **(12/2015)**

  'Variational inference for scalable Gaussian process approximations.'

- Microsoft Research, Cambridge, UK. **(3/2016)**

  'A variational framework for approximate Gaussian process inference.'

SOFTWARE SKILLS

- **Low level languages:** C++ (3 years commercial), C (1 year commercial), Fortran.
- **Scripting languages:** Python, MATLAB, Mathematica.
- **Machine learning software:** TensorFlow, Theano, GPy, 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.

Address: Department of Engineering, Trumpington Street, Cambridge, UK, CB2 1PZ
Email: zoubin@eng.cam.ac.uk

Dr. Richard Turner, University of Cambridge.

Address: Department of Engineering, Trumpington Street, Cambridge, UK, CB2 1PZ
Email: ret26@cam.ac.uk

Dr. James Hensman, Lancaster University.

Address: Division of Medicine, Lancaster University, Lancaster, UK, LA1 4YB
Email: james.hensman@gmail.com