

James Hensman

Machine Learning Research Leader

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Employment History

- 2017 - **Head of Probabilistic Modelling**, PROWLER.io.
- present I lead a research team at tech startup PROWLER.io. I lead a team of eight internationally recognised researchers, producing world leading machine learning papers at venues including NIPS, as well as integrating the latest technology into the PROWLER.io platform. I serve on the company's leadership team.
- 2015 - **Lecturer in Biostatistics**, *Faculty of Medicine*, Lancaster University.
- 2017 I joined Lancaster University as part of the 50th anniversary lectureship scheme. I worked in CHICAS (Center for Health Information, Computation and Statistics) led by Professor Peter Diggle, and I was also a member of the Lancaster Data Science Institute. I developed computational methods for problems in health statistics, building on and continuing my MRC fellowship.
- 2013 - **MRC Research Fellow**.
- 2017 I was awarded an MRC career development fellowship in Biostatistics to study probabilistic models of high-throughput sequencing data, with a focus on computationally efficient methods based on Gaussian processes. I spent the majority of the first two years in Sheffield, with visits to Cambridge, Manchester, Oxford, Stockholm and Helsinki.
- 2010 – **Research Associate**, *Dept. Computer science*, Sheffield University.
- 2013 I was previously a post-doc in the machine learning lab in Sheffield, based in the neuroscience research facility, SITraN, with Professors Magnus Rattray and Neil Lawrence. I developed machine learning methods for inference in gene networks and worked on generalized Gaussian process models. I collaborated with researchers in SITraN and at Manchester's Faculty of Life Sciences.
- 2009 – **EPSRC Doctoral Prize Research Fellow**, *Dept. Mech. Engineering*, Sheffield University.
- 2010 I was awarded a one year EPSRC Fellowship to study statistical methods for acoustic emission. I develop a statistical approach based on spatial-scanning, as well as developing methods for inference in nonlinear dynamical systems.
- 2009 – **Research Associate**, *Dipartimento di Ingegneria Meccanica*, Politecnico di Torino.
- 2010 I spent six months working with Professore Gherlone at the Politecnico Di Torino, Italy. I applied probabilistic modelling methods to vibration data and demonstrated the links between several popular signal processing techniques, notably modal analysis and proper orthogonal decomposition.
- Autumn **University Teacher**, *Dept. of Control and Systems Engineering*, Sheffield University.
- 2008 Towards the end of my PhD I took a teaching post to deliver the course *An Introduction to Neural Networks*. In this part time post I evolved the course material, delivered lectures to MEng and MSc students, set and marked the exam.

Education

- Awarded **PhD Mechanical Engineering**, *Dept. of Mechanical Engineering*, Sheffield University.
- 2009 My thesis is entitled "Novel Techniques for the Detection of Fatigue Fractures during Acoustic Emission Monitoring of Landing Gear". It was the core of a large project involving researchers at the University of Sheffield, Cardiff University and the National Physical Laboratories (NPL), with industrial input from Messier-Dowty and Physical Acoustics. Supervised by Keith Worden, I developed signal processing methodologies which were specific to acoustic emission, chiefly regarding source location and fracture classification. I began to develop an interest in statistical machine learning approaches, and on graduating I sought positions in the statistical area.
- Awarded **MEng Aerospace Engineering**, *Dept. of Mechanical Engineering*, Sheffield University.
- 2005 I studied for my first degree in Aerospace Engineering, gaining skills in applied mathematics, computing and analysis.

Funding

- I was awarded an EPSRC doctoral-prize fellowship (approx £60k).
- I was awarded a MRC career development fellowship in Biostatistics (approx £450k).
- I have been successful in obtaining smaller funding opportunities such as postdoctoral travel awards and project-seed awards, including an NCSML project award (£2k with N. Golding) and a *bridging the gaps* award (£3k with S. Wilkinson).
- I have submitted a grant on high dimensional longitudinal studies with F. Dondelinger and P. Diggle (PI)
- I have submitted a grant on statistical complexity in infectious disease models with S. Funk (LSHTM) (CI)

Teaching Responsibilities

MSc Supervision.

I have two MSc students this year, from the Data Science Institute in Lancaster. I also co-advise a student in Maths & stats

Visiting students.

I have hosted visiting PhD students from Oxford, Turin, Madrid, Manchester and Stockholm.

Gaussian Process summer school.

I have lectured at three Gaussian Process summer schools, hosted by Neil Lawrence's group in Sheffield. I have taught a session on sparse Gaussian processes and have prepared the material for several tutorial sessions

DTU machine learning summer school.

I have given a day of lectures and tutorial sessions at the Danish Technical University, as part of the machine learning summer school

Engineering challenge.

In 2014 and 2015, I was a tutor for the Sheffield undergraduate program 'Global Engineering Challenge', part of the Engineers Without Borders scheme

Engineering Lecturing.

Materials Selection & Design Mech. Eng. 1st year, Sheffield 2008.

An Introduction to Neural Networks Cont. & Sys. Eng., 4th year MEng and MSc, Sheffield 2008, 2009.

Maths Tutoring.

In 2012 I was an engineering mathematics tutor with MASH (Maths And Stats Help), a Sheffield University-wide service to assist students with mathematics.

Professional Responsibilities

Reviewing and editing

- NIPS Best Reviewers award 2014, 2016 (20 of approx 1500 reviewers).
- Invited to be an area chair for NIPS 2016
- Regular reviewer papers for top machine learning journals JMLR and TPAMI.
- Reviewer for the leading machine learning conferences NIPS, ICML and AISTATS.
- Reviewer for Biostatistical journals including Bioinformatics and journals in the PloS series and Nature Methods.
- Previously machine-learning guest-editor for Mechanical Systems and Signal Processing.
- Reviewed grant proposals for MRC and the Swiss academy of science.

Examining

- External examiner for Chris Lloyd's PhD thesis (Oxford 2018)
- External examiner for Owen Thomas' PhD thesis (Oxford 2017)
- External examiner for Young Jun Ko's PhD thesis (EPFL 2017)
- Internal examiner for Anis Ghazali's PhD transfer (Lancaster 2016)
- External examiner for Roger Frigola's PhD thesis (Cambridge, 2015)
- Pre-examiner for Jaako Luttinen's PhD thesis (Aalto, Helsinki, 2015)
- External examiner for Sean Anderton's MSc thesis (Aston, 2014)
- Internal examiner for Daniel Beck's PhD transfer (Sheffield, 2014)

Workshops etc.

- Organising committee for the NIPS 2013 workshop on probabilistic models for big data.
- Organising committee for the NIPS 2013 workshop on open source software (MLOSS)
- Organised a round-table workshop on deep probabilistic models (2014)
- Lead organizer of several Gaussian Process Summer Schools (gpsss.cc), attended by hundreds of students from across Europe and beyond.
- Lead organizer and host of MASAMB, *Mathematical and Statistical Aspects of Molecular Biology*, Sheffield 2014.
- Organized meetings and previous board member of the Natural Computing Applications Forum (NCAF).

Consulting etc.

- Organised a sponsored MSc project with Spacelabs Healthcare
- Statistical consulting for a leading F1 team.
- Technical advisor for the startup company Quirkos (quirkos.com)
- Consultant for Physical Acoustics (PAC Ltd) on machine learning.

Invited Talks

- I've been invited to give seminars at Universities across the UK, including Cambridge, Oxford, Manchester, Bristol, Newcastle, Warwick, Imperial, UCL and more.
- I've been invited to give seminars at Universities in Europe including Ecole des Mines, Helsinki, Aalto, Stockholm, Turin, Danish Technical University.
- Invited presentation at RADIANT project meeting, Curie Institute, Paris 2014.
- Invited to speak at a workshop on efficient Gaussian processes, DTU, Copenhagen.
- Invited to speak at an IET event, "Machine Learning in Healthcare", Baliol College Oxford, 2015.
- Invited to speak at a NIPS workshop on Variational inference (December 2015).
- Invited to speak at MCMski workshop on variational Bayes (January 2016)
- Invited to speak at a Schloss Dagstuhl seminar in Germany (November 2016).
- Invited to speak at a NIPS workshop on kernel methods (December 2016).

Software

- Lead author of GPpy and GPflow, software libraries in Python for Gaussian process models.
- GPpy software is used by hundreds in academia, F1 teams, BAE systems, NASA and many others.
- The impact of GPpy software is in the top 3% of academic software (<http://depsy.org/package/python/GPy>).
- GPflow is a new project, but already has contributions from Universities of Cambridge, Manchester, Edinburgh, Tokyo. Thousands of views on github.
- Authored GPclust, for Dirichlet-process mixtures of Gaussian processes. Used by researchers in Cambridge (EBI), Chicago and many others.
- Python, git and the jupyter notebook to assist in maintaining the reproducibility of my work.

Publications

- 2018 Hugh Salimbeni, Stefanos Eleftheriadis, and **James Hensman**. Natural gradients in practice: Non-conjugate variational inference in Gaussian process models. In *AISTATS*, 2018.
- ST John and **James Hensman**. Large-scale cox process inference using variational Fourier features. In *ICML*, 2018.
- James Hensman**, Nicolas Durrande, and Arno Solin. Variational Fourier features for Gaussian processes. *Journal of Machine Learning Research*, 18(151):1–52, 2018.
- Alexis Boukouvalas, **James Hensman**, and Magnus Rattray. Bgp: Branched Gaussian processes for identifying gene-specific branching dynamics in single cell data. *Geneome Biology*, 19, 2018.
- 2017 Mark van der Wilk, Carl Edward Rasmussen, and **James Hensman**. Convolutional Gaussian processes. In *NIPS*, pages 2845–2854, 2017.
- Hossein Soleimani, **James Hensman**, and Suchi Saria. Scalable joint models for reliable uncertainty-aware event prediction. *IEEE transactions on pattern analysis and machine intelligence*, 2017.

- Christopher Nemeth, Fredrik Lindsten, Maurizio Filippone, and **James Hensman**. Pseudo-extended markov chain monte carlo. *arXiv preprint arXiv:1708.05239*, 2017.
- Alexander G de G Matthews, Mark van der Wilk, Tom Nickson, Keisuke Fujii, Alexis Boukouvalas, Pablo León-Villagr a, Zoubin Ghahramani, and **James Hensman**. GPflow: A Gaussian process library using tensorflow. *Journal of Machine Learning Research*, 18(40):1–6, 2017.
- Karen M Holford, Mark J Eaton, **James Hensman**, Rhys Pullin, Sam L Evans, Nikolaos Dervilis, and Keith Worden. A new methodology for automating acoustic emission detection of metallic fatigue fractures in highly demanding aerospace environments: An overview. *Progress in Aerospace Sciences*, 2017.
- Stefanos Eleftheriadis, Tom Nicholson, Marc Deisenroth, and **James Hensman**. Identification of Gaussian process state space models. In *Advances in Neural Information Processing Systems*, pages 5315–5325, 2017.
- N Corrado, N Durrande, Marco Gherlone, J Hensman, M Mattone, and Cecilia Surace. Single and multiple crack localization in beam-like structures using a Gaussian process regression approach. *Journal of Vibration and Control*, page 1077546317721418, 2017.
- 2016 Alan Saul, **James Hensman**, Aki Vehtari, and Neil D Lawrence. Chained Gaussian processes. *Proc. of AISTATS*, 2016.
- Alexander G de G Matthews, **James Hensman**, Richard E Turner, and Zoubin Ghahramani. On sparse variational methods and the KL divergence between stochastic processes. *Proc. of AISTATS*, 2016.
- James Hensman** and Theodore Kypraios. Variational Bayesian non-parametric inference for infectious disease models. *Machine Learning for Healthcare Technologies*, 2:181, 2016.
- James Hensman** and Theodore Kypraios. Variational Bayesian non-parametric inference for infectious disease models. In D. Clifton, editor, *Machine Learning in Healthcare*. IET, 2016.
- Nicolas Durrande, **James Hensman**, Magnus Rattray, and Neil D Lawrence. Detecting periodicities with Gaussian processes. *PeerJ Computer Science*, 2, 2016.
- Vincent Adam, **James Hensman**, and Maneesh Sahani. Scalable transformed additive signal decomposition by non-conjugate Gaussian process inference. *Proc. of MLSP*, 2016.
- 2015 Philip B Holden, Neil R Edwards, **James Hensman**, and Richard D Wilkinson. Abc for climate: dealing with expensive simulators. *arXiv preprint arXiv:1511.03475*, 2015.
- Philip B. Holden, Neil R. Edwards, **James Hensman**, and Richard D. Wilkinson. ABC for climate: dealing with expensive simulators. In Scott Sisson, Yanan Fan, and Mark Beaumont, editors, *Methods in Approximate Bayesian Computation*. Taylor and Francis, 2015. *arXiv preprint arXiv:1511.03475*.
- James Hensman**, Magnus Rattray, and Neil D Lawrence. Fast nonparametric clustering of structured time-series. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, 37(2), 2015.
- James Hensman**, Panagiotis Papastamoulis, Peter Glaus, Antti Honkela, and Magnus Rattray. Fast and accurate approximate inference of transcript expression from rna-seq data. *Bioinformatics*, 31(24):3881–3889, 2015.
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- James Hensman**, Alexander G de G Matthews, Maurizio Filippone, and Zoubin Ghahramani. MCMC for variationally sparse Gaussian processes. *NIPS*, 2015.
- Zhenwen Dai, **James Hensman**, and Neil Lawrence. Spike and slab gaussian process latent variable models. *arXiv preprint arXiv:1505.02434*, 2015.
- Nicolò Corrado, Marco Gherlone, Cecilia Surace, **James Hensman**, and Nicolas Durand. Damage localisation in delaminated composite plates using a Gaussian process approach. *Meccanica*, 50(10):2537–2546, 2015.
- Shilu Amin, Ian J Donaldson, Denise A Zannino, **James Hensman**, Magnus Rattray, Marta Losa, François Spitz, Franck Ladam, Charles Sagerström, and Nicoletta Bobola. Hoxa2 selectively enhances meis binding to change a branchial arch ground state. *Developmental cell*, 32(3), 2015.
- 2014 Ching-Yan Chloé Yeung, Nicole Gossan, Yinhui Lu, Alun Hughes, **James Hensman**, Monika L Bayer, Michael Kjær, Karl E Kadler, and Qing-Jun Meng. Gremlin-2 is a BMP antagonist that is regulated by the circadian clock. *Scientific reports*, 4, 2014.
- Panagiotis Papastamoulis, **James Hensman**, Peter Glaus, and Magnus Rattray. Improved variational Bayes inference for transcript expression estimation. *Stat. Appl. Genet. Molec. Biol.*, 13(2), 2014.
- Ricardo Andrade-Pacheco, **James Hensman**, Max Zwieße, and Neil D Lawrence. Hybrid discriminative-generative approach with Gaussian processes. In *Proc. of AISTATS*, 2014.
- 2013 **James Hensman**, Neil D Lawrence, and Magnus Rattray. Hierarchical Bayesian modelling of gene expression time series across irregularly sampled replicates and clusters. *BMC bioinf.*, 14(1), 2013.
- James Hensman**, Nicolo Fusi, and Neil D Lawrence. Gaussian processes for big data. In *Conference on Uncertainty in Artificial Intelligence*. auai.org, 2013.
- N. Gossan, L. Zeef, J. Hensman, and others. The circadian clock in murine chondrocytes regulates genes controlling key aspects of cartilage homeostasis. *Arthritis Rheumatol*, 65(9), 2013.
- 2012 Keith Worden and **James Hensman**. Parameter estimation and model selection for a class of hysteretic systems using Bayesian inference. *Mechanical Systems and Signal Processing*, 32:153–169, 2012.
- James Hensman**, Magnus Rattray, and Neil D Lawrence. Fast variational inference in the conjugate exponential family. In *NIPS 2012*, 2012.
- Ian J Donaldson, Shilu Amin, **James Hensman**, Eva Kutejova, Magnus Rattray, Neil Lawrence, Andrew Hayes, Christopher M Ward, and Nicoletta Bobola. Genome-wide occupancy links hoxa2 to wnt- β -catenin signaling in mouse embryonic development. *Nucleic acids research*, page gkr1240, 2012.
- 2011 Keith Worden, Wieslaw J Staszewski, and **James Hensman**. Natural computing for mechanical systems research: A tutorial overview. *Mechanical Systems and Signal Processing*, 25(1):4–111, 2011.
- John Leeds, Mark E McAlindon, Julia Grant, Helen E Robson, Stephen R Morley, Gary James, Barbara Hoeroldt, Kapil Kapur, Keith Dear, **James Hensman**, and others. Albumin level and patient age predict outcomes in patients referred for gastrostomy insertion: internal and external validation of a gastrostomy score and comparison with artificial neural networks. *Gastrointestinal endoscopy*, 74(5):1033–1039, 2011.

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- James Hensman**, Cecilia Surace, and Marco Gherlone. Detecting mode-shape discontinuities without differentiation—examining a Gaussian process approach. *Journal of Physics: Conference Series*, 305(1):012001, 2011.
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- 2010 R Summan, G Dobie, **James Hensman**, SG Pierce, and Keith Worden. A probabilistic approach to robotic nde inspection. In *Review of progress in quantitative nondestructive evaluation*, volume 29, pages 1999–2006. AIP Publishing, 2010.
- Rhys Pullin, Mark J Eaton, **James Hensman**, Karen M Holford, Keith Worden, and Samuel Lewin Evans. Validation of acoustic emission (ae) crack detection in aerospace grade steel using digital image correlation. In *Applied Mechanics and Materials*, volume 24, pages 221–226, 2010.
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- James Hensman**, Robin Mills, SG Pierce, Keith Worden, and Mark J Eaton. Locating acoustic emission sources in complex structures using Gaussian processes. *Mechanical Systems and Signal Processing*, 24(1):211–223, 2010.
- 2009 Karen M. Holford, Rhys Pullin, Samuel L. Evans, Mark J. Eaton, **James Hensman**, and Keith Worden. Acoustic emission for monitoring aircraft structures. *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, 223(5):525–532, 2009.
- James Hensman**, Rhys Pullin, M Eaton, Keith Worden, Karen M. Holford, and Samuel L. Evans. Detecting and identifying artificial acoustic emission signals in an industrial fatigue environment. *Measurement Science and Technology*, 20(4):045101, 2009.
- James Hensman**. *Novel techniques for acoustic emission monitoring of fatigue fractures in landing gear*. PhD thesis, The University of Sheffield, 2009.