Christopher Nemeth
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General Information

Employment History

Professor of Statistics, Lancaster University, UK 2022-
Senior Lecturer in Statistics, Lancaster University, UK 2020-2022
Lecturer in Statistics, Lancaster University, UK 2015-2020
STOR-i Impact Fellow, Lancaster University, UK 2014-2015
Industrial Collaboration during PhD, MBDA UK 2011-2014
Graduate Teaching Assistant, Lancaster University 2011-2014
Research Analyst, KSS fuels Jun - Sep 2010

Academic and Professional Qualifications

Ph.D. Statistics and Operational Research, Lancaster University 2011-2014
Thesis: *Parameter estimation for state space models using Sequential Monte Carlo algorithms*
Supervisors: Prof. Paul Fearnhead & Dr. Lyudmila Mihaylova
Examiners: Dr. Sumeetpal Singh & Dr. Gareth Ridall
Viva date: 21st October 2014
MRes. Statistics and Operational Research, Lancaster University 2010-2011
Dissertation: *Sequential Monte Carlo filtering for target tracking applications*
BSc. Mathematics, University of Manchester 2003-2006

Research and Scholarly Work

Research Interests

My research is in the areas of computational statistics and statistical machine learning, specifically Markov chain Monte Carlo, sequential Monte Carlo, Gaussian processes and statistical network analysis. Currently, my research is focused on problems related to efficient Bayesian inference for big data problems via distributed computing and data sub-sampling. My research has impact in a variety of application areas including, target tracking, econometrics and environmental data science.

Research Funding

Principal Investigator:

- *EP/V022636/1: Probabilistic Algorithms for Scalable and Computable Approaches to Learning (PASCAL)* - UKRI-EPSRC Turing AI Acceleration Fellowship (£**1,097,295**) 2021-2026
- *Bayesian inverse modelling and data assimilation of atmospheric emissions* - Contribution towards PhD studentship funded by Shell (£**35,000**) 2022-2025
- *Diffusion-based deep generative models* - Contribution towards PhD studentship funded by Microsoft Research (£**40,000**) 2022-2026
- *EP/V033980/1: EPSRC Core Equipment* - Graphical Processing Units (£**233,413**) 2020-2022
- *NE/T004002/1: Explainable AI for UK agricultural land use decision-making* - NERC Landscape decision-making (£**43,151**) 2019-2020
- *Statistical analysis of large-scale hypergraph data* - Contribution towards PhD studentship funded by GCHQ (£**30,000**) 2019-2022
- *Learning to group research profiles through online academic services* - Contribution towards PhD studentship funded by Elsevier (£**30,000**) 2019-2022
- *EP/S00159X/1: Scalable and Exact Data Science for Security and Location-based Data* - UKRI-EPSRC Innovation Fellowship (£**523,575**) 2018-2021
- *DSI: Bayesian Latent Space Modelling for Chemical Interactions* - Lubrizol-funded research project (£**4,700**) 2018

Co-Investigator:

- *EP/Y028783/1: ProbAI: A Hub for the Mathematical and Computational Foundations of Probabilistic AI* - EPSRC (£**8,576,838**) 2024-2029
- *NE/T012307/1: Detecting soil degradation and restoration through a novel coupled sensor and machine learning framework* - NERC Signals in the Soil (£**811,651**) 2020-2022
- *Optimising in-store price reductions through markdowns* - Contribution towards PhD studentship funded by Tesco (£**116,000**) 2021-2024
- *EP/R01860X/1: Data Science of the Natural Environment* - EPSRC New approaches to Data Science (£**2,656,400**) 2018-2023

Publications

Books:

- Fearnhead, P., Nemeth, C., Oates, C. and Sherlock, C. (2024). Scalable Monte Carlo for Bayesian Learning. *Cambridge University Press*.

Journals:

- Cabezas, A., Battiston, M., Nemeth, C. (2024). Robust Bayesian Nonparametric Variable Selection for Linear Regression. *Stat*. Vol. 13(2).
- Turnbull, K., Lunagomez, S., Nemeth, C., Airoldi (2024). Latent Space Representations of Hypergraphs. *Journal of the American Statistical Association*.
- Shu, Q., Killick, R. Leeson, A., Nemeth, C., Fettweis, X., Hogg, A., Leslie, D. (2023). Characterising the ice sheet surface in North East Greenlandusing Sentinel-1 SAR data. *Journal of Glaciology (accepted)*.
- Aicher, C., Putcha, S., Nemeth, C., Fearnhead, P., Fox, E.B. (2023). Stochastic Gradient MCMC for Nonlinear State Space Models. *Bayesian Analysis*. Vol. 1(1), pp. 1-23.
- Oyebamiji, O., Nemeth, C., Harrison, P., Dunford, R., Cojocaru, G. (2023). Multivariate sensitivity analysis for a large-scale climate impact and adaptation model. *Journal of the Royal Statistical Society: Series C*. Vol. 72(3), pp. 770-808.
- Coullon, J., South, L.F., Nemeth, C. (2023). Efficient and Generalizable Tuning Strategies for Stochastic Gradient MCMC. *Statistics and Computing*. Vol. 33 (3).
- Turnbull, K., Nemeth, C., Nunes, M., McCormick, T. (2023). Sequential Estimation of Temporally Evolving Latent Space Network Models.*Computational Statistics and Data Analysis*. Vol. 179, 107627.
- South, L., Karvonen, T., Nemeth, C., Girolami, M., Oates, C. (2022). Semi-Exact Control Functionals From Sard's Method. *Biometrika*. Vol. 109(2), pp. 351-367.
- Vyner, C., Nemeth, C, Sherlock, C. (2022). SwISS: A scalable Markov chain Monte Carlo divide-and-conquer strategy. *Stat*. Vol. 12(1). pp. 1-11.
- Fairbrother, J., Nemeth, C., Rischard, M., Brea, J., Pinder, T. (2022). *GaussianProcesses.jl: A Bayesian nonparametric package for the Julia language*. *Journal of Statistical Software*. Vol. 102, pp. 1-36.
- Coullon, J., Nemeth, C. (2022). SGMCMCJax: a lightweight JAX library for stochastic gradient Markov chain Monte Carlo algorithms. *Journal of Open Source Software*. Vol. 7(72), 4113.
- Nemeth, C., Fearnhead, P. (2021). Stochastic gradient Markov chain Monte Carlo. *Journal of the American Statistical Association*. Vol. 116(533), pp. 433-450.
- Verjans, V., Leeson, A.A., Nemeth, C., Stevens, C.M., Kuipers Munneke, P., Noël, B., van Wessem, J. M. (2019). Bayesian calibration of firn densification models. *The Cryosphere*. Vol. 14(9), pp.3017-3032.
- South, L, Nemeth, C., Oates, C. (2020). Discussion of "Unbiased Markov chain Monte Carlo with couplings" by Pierre E. Jacob, John O'Leary and Yves F. Atchadé. *Journal of the Royal Statistical Society*. Vol. 82, pp.543-600.

- Baker, J., Fearnhead, P., Fox, E.B., Nemeth, C. (2019). Control Variates for Stochastic Gradient MCMC. *Statistics and Computing*. Vol. 29(3), pp.599–615.
- Baker, J., Fearnhead, P., Fox, E.B., Nemeth, C. (2019). sgmcmc: An R package for Stochastic Gradient Markov chain Monte Carlo. *Journal of Statistical Software*. Vol. 91(3),1-27.
- Nemeth, C., Sherlock, C. (2018). Merging MCMC subposteriors through Gaussian-process approximations. *Bayesian Analysis*. Vol. 13(2), pp.507-530.
- Nemeth, C., Sherlock, C., Fearnhead, P. (2016). Particle Metropolis-adjusted Langevin algorithms. *Biometrika*. Vol. 103(3), pp. 701-717.
- Nemeth, C., Fearnhead, P., Mihaylova, L. (2016). Particle approximations of the score and observed information matrix for parameter estimation in state space models with linear computational cost. *Journal of Computational and Graphical Statistics*. Vol. 25(4), pp. 1138-1157.
- Nemeth, C., Fearnhead, P., Mihaylova, L. (2014). Sequential Monte Carlo methods for state and parameter estimation in abruptly changing environments. *IEEE Transactions on Signal Processing*. Vol. 62(5), pp. 1245-1255.

Peer-Reviewed Conference Proceedings:

- Dodd, D., Sharrock, L. and Nemeth, C. (2024). Learning-Rate-Free Stochastic Optimization over Riemannian Manifolds. *Internaional Conference on Machine Learning*.
- Papamarkou, T., Skoularidou, M., Palla, K., Aitchison, L., Arbel, J., Dunson, D., Filippone, M., Fortuin, V., Hennig, P., Hernández-Lobato, J.M., Hubin, A., Immer, A., Karaletsos, T., Khan, M.E., Kristiadi, A., Li, Y., Mandt, S., Nemeth, C., Osborne, M.A., Rudner, T.G.J., Rügamer, D., Teh, Y.W., Welling, M., Wilson, A.G. and Zhang, R. (2024). Position: Bayesian Deep Learning is Needed in the Age of Large-Scale AI. *International Conference on Machine Learning*.
- Sharrock, L., Dodd, D., Nemeth, C. (2024). Tuning-Free Maximum Likelihood Training of Latent Variable Models via Coin Betting. *International Conference on Artificial Intelligence and Statistics.*
- Sharrock, L. Mackey, L., Nemeth, C. (2023). Learning Rate Free Sampling in Constrained Domains. *Neural Information Processing Systems*.
- Sharrock, L., Nemeth, C. (2023). Coin Sampling: Gradient-based Bayesian Inference without Learning Rates. *International Conference on Machine Learning*. 202, pp. 30850-30882.
- Cabezas, A., Nemeth, C. (2023). Transport Elliptical Slice Sampling. *Internaional Conference on Artificial Intelligence and Statistics*. pp. 3664-3676.
- Putcha, S., Nemeth, C., Fearnhead, P. (2023). Preferential Subsampling for Stochastic Gradient Langevin Dynaics. *Internaional Conference on Artificial Intelligence and Statistics*. pp. 8837-8856.
- Nemeth, C., Lindsten, F., Filippone, M., Hensman, J. (2019). Pseudo-extended Markov chain Monte Carlo. *Neural Information Processing Systems*, pp. 4314–4324.
- Baker, J., Fearnhead, P., Fox, E.B., Nemeth, C. (2018). Large-scale stochastic sampling from the probability simplex. *Neural Information Processing Systems*, pp.6721–6731.
- Nemeth, C., Fearnhead, P., Mihaylova, L., Vorley, D. (2012). Bearings-only tracking with particle filtering for joint parameter and state estimation. *15th International Conference on Information Fusion*, Singapore, pp. 824-831.
- Nemeth, C., Fearnhead, P., Mihaylova, L., Vorley, D. (2012). Particle learning for state and parameter estimation. *9th IET Data Fusion and Target Tracking Conference (DF&TT 2012)*, London U.K.

Pre-prints:

- Fearnhead, P., Grazzi, S., Nemeth, C. and Roberts, G.O. (2024). Stochastic Gradient Piecewise Deterministic Monte Carlo Samplers. `https://arxiv.org/abs/2406.19051`.

- Trojan, C., Fearnhead, P. and Nemeth, C. (2024). Diffusion Generative Modelling for Divide-and-Conquer MCMC. https://arxiv.org/abs/2406.11664.
- Cabezas, A., Sharrock, L. and Nemeth. C. (2024). Markovian Flow Matching: Accelerating MCMC with Continuous Normalizing Flows. https://arxiv.org/abs/2405.14392.
- Chacón-Montalván, E.A., Atkinson, P.M., Nemeth, C., Taylor, B.M. and Moraga. P. (2024). Spatial Latent Gaussian Modelling with Change of Support. https://arxiv.org/abs/2403.08514.
- Gong, M., Killick, R., Nemeth, C. and Quinton, J. (2023). A changepoint approach to modelling non-stationary soil moisture dynamics. *Journal of the American Statistical Association (in submission)*, https://arxiv.org/abs/2310.17546
- Bolt, G., Lunagomez, S. and Nemeth, C. (2022). Modelling Populations of Interaction Networks via Distance Metrics. *Journal of Machine Learning Research (in submission)*, https://arxiv.org/abs/2206.09995.
- Bolt, G., Lunagomez, S. and Nemeth, C. (2022). Distances for Comparing Multisets and Sequences, https://arxiv.org/abs/2206.08858.
- Pinder, T., Turnbull, K., Nemeth, C., Leslie, D. (2021). Hypergraph Gaussian Processes. https://arxiv.org/abs/2106.01982.
- Pinder, T., Hollaway, M., Nemeth, C., Young, P., Leslie, D. (2021). A Probabilistic Assessment of the COVID-19 Lockdown on Air Quality in the UK. https://arxiv.org/abs/2104.10979.
- Pinder, T., Nemeth, C., Leslie, D. (2020). Stein Variational Gaussian Processes. https://arxiv.org/abs/2009.12141.

Invited Research Presentations

- Conference - International Society of Bayesian Analysis, Venice — Jul 2024
- Seminar - ProbAI Hub, Online seminar series — Jun 2024
- Seminar - Integreat Research Centre, University of Oslo — Mar 2024
- Seminar - Department of Mathematics, University of Edinburgh — Oct 2023
- Workshop - Turing AI Fellows Retreat, Natural History Museum, London — May 2023
- Workshop - Bayes4Health & CoSinES, Oxford University — Apr 2023
- Seminar - SecondMind — Feb 2023
- Seminar - Department of Mathematics, Imperial College London — Nov 2022
- Conference - International Society of Bayesian Analysis, Montreal — Jun 2022
- Seminar - Department of Mathematics, University of Leeds — Apr 2022
- Workshop - EPSRC AI retreat — Mar 2022
- Workshop - Stein's method, Royal Statistical Society — Dec 2021
- Seminar - Department of Mathematics and Statistics, University of Nottingham — Mar 2020
- Seminar - Statistics, quantification of uncertainty, inverse problems and data science (SQUIDS), University of Manchester — Oct 2019
- Seminar - Department of Statistics, University of Oxford — Jun 2019
- Seminar - Department of Mathematics, University of Oslo, Norway — Dec 2018
- Workshop - An afternoon of Bayesian computation, Reading University — Oct 2018
- Seminar - Department of Decision Sciences, Boconni University, Milan, Italy — Oct 2018
- Workshop - Surrogate Modelling and Emulation, Lancaster University — Jul 2018
- Seminar - Maths of Real-World Systems CDT, Warwick University — Apr 2018
- Conference - BayesComp, Barcelona, Spain — Mar 2018
- Seminar - Department of Computer Science, University of Washington, USA — Feb 2018
- Seminar - Data Science Institute, Lancaster University — Jun 2017
- Seminar - Department of Statistics, University of Warwick — Jun 2017
- Seminar - School of Mathematics and Statistics, University of Glasgow — Nov 2016
- Conference - Royal Statistical Society, Manchester — Sep 2016
- Seminar - Intractable Likelihoods project (i-like), Virtual seminar — Apr 2016
- Conference - ERCIM: Computational and Methodological Statistics, Pisa, Italy — Dec 2014
- Conference - International Society of Bayesian Analysis, Cancun, Mexico — Jul 2014

- Conference - International Conference on Information Fusion, Singapore Jul 2012
- Seminar - Statistics for Innovation, University of Oslo, Norway Jun 2012
- Conference - IET Data Fusion and Target Tracking, London May 2012
- Seminar - Institute of Mathematics and its Applications, Lancaster Feb 2012

Teaching Experience

Teaching Qualifications

Postgraduate Certificate of Academic Practice: Module 2. 2017
Postgraduate Certificate of Academic Practice: Module 1. Including HEA fellow status. 2016

Courses Taught

I have previously taught the following modules:

- *MATH454/554/654: Computationally intensive methods*
- *SCC461: Programming for data scientists*
- *MATH555: Bayesian inference for data science*
- *MATH550: Statistics in Practice*

Academic Supervision

Postdoctoral research associates:

- **Louis Sharrock** - *Tuning free approaches to Bayesian sampling* 2022-
- **Estevao Prado** - *Bayesian Additive Regression Trees* 2022-
- **Kathryn Turnbull** - *Statistical network modelling*. 2021-2022
- **Jeremie Coullon** - *Adaptive stochastic gradient MCMC*. 2020-2022
- **Mengyi Gong** - *Machine learning for soil modelling*. 2020-
- **Hongyan Chen** - *Explainable AI for UK agricultural land use decision-making*. 2019-2021
- **Leah South** - *Scalable data science for security and location-based data.* 2019-2020
- **Qingying Shu** - *Machine learning approaches to identify melt regions on the Greenland ice sheet from backscatter images*. 2019-2022
- **Oluwole Oyebamiji** - *Spatial modelling and statistical downscaling of ozone data.* 2018-2021

PhD students:

- **Francesco Barille** (visiting student) - *Exact and Scalable Inference with the Cox-Ingersoll-Ross Model.* 2023-2024
- **Dan Dodd** - *Learning-rate-free algorithms for sampling and optimisation.* 2023-2025
- **Connie Trojan** - *Diffusion-based Deep Generative Models for Large Language Models*. 2022-
- **Thomas Newman** - *Bayesian inverse modelling and data assimilation of atmospheric emissions*. 2022-
- **Katie Howgate** - *In-store price optimisation*. 2021-
- **Alberto Cabezas Gonzalez** - *Contributions to Bayesian Statistics*. 2020-2024
- **Thomas Pinder** - *Scalable Gaussian processes for modelling air quality data*. 2019-2022
- **Rachael Duncan** - *Data science approaches to projecting future global-to-local air quality and climate*. 2019-2023
- **George Bolt** - *Statistical Methods for Samples of Interaction Networks*. 2019-2023
- **Srshti Putcha** - *Scalable Monte Carlo in the general Big Data setting.* 2018-2022
- **Callum Vyner** - *Parallel Monte Carlo methods for Big Data.* 2016-2022
- **Kathryn Turnbull** - *Advancements in Latent Space Network Modelling*. 2016-2019
- **Jack Baker** - *Stochastic gradient algorithms for scalable Markov chain Monte Carlo.* 2015-2019

Master's students:

- **Luke Lorenzi** - *Econometric modelling of integer time-series data*. 2018
- **Konstantinos Mylonas** - *Machine learning for delivery time prediction*. 2017
- **Sonia Aden Ahmed** - *Produce the next iteration of a machine learning responsible gambling model*. 2016

PhD Theses Examined

External:

- **Kjartan Kloster Osmundsen** - *Essays in Statistics and Econometrics*. University of Stravanger, Norway. 2020
- **Michael Bertolacci** - *Hierarchical Bayesian mixture models for spatiotemporal data with non-standard features*. University of Western Australia, Australia. 2020
- **Anthony Ebert** - *Dynamic Queuing Networks: Simulation, Estimation and Prediction*. Queensland University of Technology, Australia. 2019
- **Gernot Roetzer** - *Efficient and Scalable Inference for Generalized Student-t Process Models.* Trinity College Dublin, Ireland. 2019
- **Reinaldo A. G. Marques** - *On Monte Carlo Contributions for Real-time Probabilistic Inference.* University of Oslo, Norway. 2018

Internal:

- **Anja Stein** - *Sequential Inference with the Mallows Model*. 2023
- **Ed Austin** - *Novel Methods for the Detection of Emergent Phenomena in Streaming Data*. 2022
- **Henry Moss** - *General-purpose Information-theoretical Bayesian Optimisation*. 2021
- **Juan Manuel Escamilla Mólgora** - *Statistical modelling of species distributions on the tree of life using presence-only data*. 2020
- **Sean Malory** - *Bayesian Inference for Stochastic Processes*. 2020
- **Terry Huang** - *Data Conditioned Simulation and Inference*. 2016

Academic Leadership and Engagement

University Service

- *Turing University Academic Liason* 2023-
- *Computer Intensive Research Committee member* 2019 -
- *Data Science Theme Lead, Centre of Excellence in Environmental Data Science* 2019-2021
- *Foundations Deputy Theme Lead, Data Science Institute* 2019-2021
- *Member of the STOR-i CDT Executive Committee* 2015-2019 and 2022-2023
- *STOR-i CDT Admissions Tutor* 2016-2018
- *Convener for the STOR-i CDT National Associates Network* 2015-2019
- *Computational Statistics and Machine Learning Reading Group* 2015-2018

External Service

- *Scientific Advisory Board Member - Integreat Research Centre* 2022-
- *Associate Editor, Journal of Probabilistic Machine Learning*. 2023-
- *Machine Learning Theme Lead, N8 CIR* 2021-
- *Associate Editor, Journal of Data-Centric Engineering* 2021 -
- *Chair of the Computational Statistics and Machine Learning section of the Royal Statistical Society* 2021-2023
- *UKRI Future Leaders Fellowship Peer Review College Member* 2018-
- *EPSRC Associate College Member* 2018-
- *Committee Member of the EPSRC Mathematical Sciences Early Career Forum* 2018-2021
- *Vice-Chair of the Statistical Computing section of the Royal Statistical Society* 2018-2020

Organisation of Conference Sessions and Workshops

- *N8 Machine Learning Community Day Event*. Mar 2024

- *Gradient flow methods for inference, sampling and learning*. Dec 2023
- *Careers Showcase in Computational Statistics and Machine Learning* Nov 2021
- *Careers Showcase in Computational Statistics and Machine Learning* Nov 2019
- *Statistics in Cyber Security* Oct 2019
- *Advances in Scalable Monte Carlo* Jul 2019
- *Machine Learning in Astronomy* May 2019
- *Introduction to Deep Learning* Dec 2018
- *Computational Statistics and Machine Learning at the RSS* Jan 2018

Professional Memberships

- Fellow of the Royal Statistical Society 2018 -
- Fellow of the Alan Turing Institute 2022 -
- Member of the European Laboratory for Learning and Intelligent Systems (ELLIS) 2022 -