Jon Cockayne

Curriculum Vitae

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Education

2015-Present **PhD in Statistics**, *University of Warwick*, Supervisor: Mark Girolami.

Many inference problems rely on solution of dynamical systems such as partial differential equations, for which an explicit solution is not available. For example in inverse problems, the system of equations which we aim to estimate parameters for may depend on the solution of such a system. Typically such procedures require use of a highly accurate numerical solver, to minimize the effect of numerical error on inferences. For some systems this is prohibitively expensive in terms of computation.

I am studying numerical solvers which construct a probability measure capturing this error. I have thus far studied such solvers for linear systems of partial differential equations, and the general theoretical properties of these solvers outside of standard conjugacy assumptions. I am interested in constructing efficient solvers in this non-conjugate setting, and in how these solvers can be incorporated into pipelines of composed numerical methods.

2011-2013 **MSc in Mathematical Trading and Finance**, *CASS Business School*, Distinction.

Modules taken included pricing of derivative products using stochastic calculus and PDEs, as well as computational numerical methods.

I completed a dissertation in counterparty credit risk (CVA). This was focused on methods for pricing interest rate derivatives with possibility of default. Default uncertainty was modelled using Poisson and Cox processes.

2005-2009 **MSci in Mathematics**, *Imperial College London*, Upper Second Class Honours.

Particular areas of interest were applied statistics and computational numerical methods.

I completed a dissertation in game theory, computationally studying the optimal strategy for the multi-player variant of the Volunteer's Dilemma.

Research Interests

My current research interests are in construction of efficient probabilistic numerical methods outside of the conjugate setting of Gaussian prior distributions and linear models. In particular, I am studying how these can be applied efficiently to systems of partial differential equations.

Publications

Papers In Preparation / In Review

2018 **A Bayesian Conjugate Gradient Method**, *Jon Cockayne, Chris Oates, Tim Sullivan, Mark Girolami*, In Review at Bayesian Analysis.

`https://arxiv.org/abs/1801.05242`

2017 **Bayesian Probabilistic Numerical Methods for Industrial Process Monitoring**, *Chris Oates, Jon Cockayne, Robert Aykroyd*, In Review at Journal of the American Statistical Association.
`https://arxiv.org/abs/1707.06107`

2017 **Bayesian Probabilistic Numerical Methods**, *Jon Cockayne, Chris Oates, Tim Sullivan, Mark Girolami*, **Winner of the Best Student Paper at JSM 2018**, In Review at SIAM Review (Research Spotlights Section).
`https://arxiv.org/abs/1702.03673`

2016 **Probabilistic Meshless Methods for Partial Differential Equations and Bayesian Inverse Problems**, *Jon Cockayne, Chris Oates, Tim Sullivan, Mark Girolami*, Working Paper.
`http://arxiv.org/abs/1605.07811`

Published Works

2018 **Convergence Rates for a Class of Estimators Based on Stein's Identity**, *Chris Oates, Jon Cockayne, F-X Briol, Mark Girolami*, Bernoulli, To Appear.
`http://arxiv.org/abs/1603.03220`

2017 **On the Sampling Problem for Kernel Quadrature**, *F-X Briol, Chris J. Oates, Jon Cockayne, Wilson J. Chen, Mark Girolami*, International Conference on Machine Learning.
`https://arxiv.org/abs/1706.03369`

2017 **Probabilistic Numerical Methods for PDE-constrained Bayesian Inverse Problems**, *Jon Cockayne, Chris Oates, Tim Sullivan, Mark Girolami*, Proceedings of the 36th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering.
`https://arxiv.org/abs/1701.04006`

Employment History

2014-2015 **Statistician**, *Warwick Analytics*.
Warwick Analytics is a startup which produces bespoke machine-learning solutions for fault detection and prevention in manufacturing companies.

- Built a workflow for automatic classification of warranty claims for a large car manufacturer, based on free-text input.
- Production-line modelling for a large pharmaceutical company to determine the root cause of stoppages.

2012-2014 **Assistant Vice President Developer, MerlinPlus**, *Barclays Capital*.
MerlinPlus was the bank's system for pricing exotic interest-rate derivatives.

- Developed an external-facing trade capture platform to include new Structured Rates products, used to book thousands of trades per-week.
- Prototyped a new framework for calculating risk under 'cheapest-to-deliver' CSA agreements.
- Implemented pricing of trades on a GPU cluster.

2009-2012 **Analyst Developer, FICC Structuring Technology**, *Royal Bank of Scotland*.
FICC Structuring Technology worked closely with the Quantitative ALM Structuring desk to produce client-facing web analytics.

- Added new trade clases to a client-facing portfolio valuation and risk tool.
- Added support for US bonds to a bond portfolio optimisation tool.

2008 **Technology Intern**, *Royal Bank of Scotland*.
Developed a bond portfolio optimisation tool. Worked in a team of eight in a fundraising challenge, raising over £1000.

2007 **Technology Intern**, *Royal Bank of Scotland*.
Worked in a project management team supervising migration to a new datacenter.

Skills

Computing I have extensive experience with programming both for software development and research purposes. Known languages include Python, C++, Matlab, C#, Java, Objective C and SQL. I have experience writing parallelised code, and writing cluster computing code in map/reduce and actor paradigms. I am comfortable with the AWS and Azure cloud computing platforms.

Teaching I have supervised several tutorials in the Mathematics department at the University of Warwick.

Volunteering

DataKind UK I have worked with the data science charity DataKind to analyze data for the Royal British Legion related to grants given for veteran support. I currently sit on the steering committee for an ongoing predictive modelling project for the food bank The Welcome Center.

Hobbies and Interests

Beekeeping I keep two hives of bees, which I have raised over the last two years from new swarms to strong colonies.