

Danny James Williams

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I want to genuinely use my knowledge in Machine Learning, AI and Statistics to help people. I don't mind where - it could be in health sciences, climate sciences, financial work, or anything else. Whilst my research has been quite broad, I am keen to move away stricter research roles and towards more interesting applications such as Natural Language Processing, which I have a lot of experience and interest in. **I am currently in the last three months of my PhD.**

Education

COMPASS CDT

University of Bristol

Began September 2019

MMath Mathematics

University of Exeter

Graduated with a first in 2019

Study

Undergraduate

- Linear Modelling
- Generalised Linear Models
- Spatial Statistics
- Time Series Analysis
- Statistical Inference
- Numerical Optimisation
- Machine Learning
- Big Data

Postgraduate

- Statistical Methods
- Statistical Computing
- Machine Learning
- Unsupervised Learning
- Deep Learning
- Bayesian Modelling
- Monte Carlo Methods
- Density Estimation
- Natural Language Processing
- Computer Vision

Teaching

- Probability/Statistics Tutor
2019-2022
- Bristol Teaching Award
nomination

Research



Truncated Kernelised Stein Discrepancies

Daniel Williams, Song Liu | ICML 2023

Developed a data-driven solution to truncated probability density estimation via solving a constrained optimisation problem and minimising a modified kernelised Stein discrepancy. I showed theoretical guarantees for this estimator and performed numerical experiments showing improvements over state-of-the-art methods.

Skills: Python • Asymptotic Theory • Machine Learning • Constrained Optimisation



Score Matching for Truncated Density Estimation on a Manifold

Daniel Williams, Song Liu | TAG in ML, ICML 2022 Workshop

I extended the theoretical approach of truncated score matching to the manifold case using an application of Stokes' theorem to rederive the objective function. I constructed alternative weighting functions for a generic spherical boundary and demonstrated strong numerical performance.

Skills: Density Estimation • Statistics Theory • Differential Geometry • R • Packaging R Code



Estimating Density Models with Truncation Boundaries using Score Matching

Song Liu, Takafumi Kanamori, Daniel Williams | JMLR

Developed an estimator of truncated probability densities where the computation of the normalizing constant is infeasible using score matching. Our estimator involved a weighting function derived from heuristics and analytical results, with demonstrable numerical advantages across a series of benchmark experiments and applications.

Skills: Density Estimation • Statistics Theory • Proofs • MATLAB



Downscaling Extremes of Precipitation

Daniel Williams, Ben Youngman | Masters, University of Exeter

Modelled the relationship between extremes of rainfall and their spatial properties for both gridded model output and point-level observations using extreme value theory. By downscaling, I predicted rainfall extremes at a high resolution via a spatial generalised additive model (GAM).

Skills: GAMs • Extreme Value Theory • Writing • Presenting • R • Packaging R Code

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Achievements

Online Courses

- Machine Learning with Tensorflow on Google Cloud Platform
- Build a Deep Learning Based Image Classifier with R
- Neural Networks and Deep Learning
- Academic Literacy

Awards

- The Exeter (Employability) Award
- Level 1 Tennis Coach

Skills

Programming

Python • R • C++ • Rcpp • MATLAB • SQL

Python Packages

NumPy (7 years) • SciPy (7 years) • PyTorch (3 years) • pandas (4 years) • TensorFlow (1 year)

Professional

Report Writing • Group Project Work • Presenting • Teaching • Critical Thinking • Time Management

Focus Labs

- Energy Forecasting Demand Hackathon with EDF Energy
- Anomaly Detection for Pipe Leaks with Wessex Water
- Consultancy with Spin Up Science
- Car Insurance Claim Prediction with LV

Personal

Weightlifting is one of my biggest passions outside of work.

I'm environmentally concious and strive to live as sustainably as I can.

Supplementary Projects

Water Pipe Leakage Detection

Worked with Wessex Water and within my PhD cohort to identify potential leaks in water pipes. The final method involved unsupervised learning of time series clusters, fitting a seasonal additive model to output residuals, and then implementing a changepoint detection algorithm on these residuals.

Natural Language Analysis

Independently analysed the sentiment and syntax of the lyrics of famous artist Kanye West (in 2020...) using Google's Natural Language API. I created interactive visualisations of the results for an online blog post on my personal website, and for an open-source repository on Github.

Gaussian Process Classification

Part of a group project during my PhD, involved learning, detailing and exploring the process of classification using Gaussian processes with an MCMC sampler. Implemented a *pseudo-marginal likelihood* approach, with intelligent subset selection for large datasets and a *Laplace* approximation for the posterior of the latent variables. All code was written into an Rcpp package.

Chicago Crime Classification

Classified whether an arrest would be made for a particular crime, using a public crime dataset for Chicago. Implemented a logistic regression approach with iteratively re-weighted least squares from scratch, whilst taking advantage of the sparsity of the model matrix to improve efficiency.

Employment

Customer Service Assistant | Libraries Unlimited (2018 - 2019)

- Social Media Management
- Customer Facing Role
- IT Systems
- Warehouse Work

Delivery Rider | Deliveroo (2017 - 2018)

- Personal Schedule
- Strict Deadline
- Physical Fitness
- Time Keeping

Customer Consultant | Dixons Carphone (2016 - 2017)

- Sales Role
- Working to Targets
- Constant Communication
- Simplifying Complex Technology

Customer Assistant | Tesco (2014 - 2015)

- Long Working Hours
- Interpersonal Skills
- Worked Under Management
- High Pressure Environment

References

Available upon request.