

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. While my research has been quite broad, I am keen to move away from strict research roles and towards more interesting applications such as Natural Language Processing, where I have a lot of experience and interest. **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

Personal Projects

- Exploring NLP Embeddings of A Game of Thrones
- How random are you? Exploring Human Randomness
- NLP Analysis of the Lyrics of Kanye West

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 (7 years) • R (8 years)
- MATLAB (8 years) • C++ (1 year)
- Rcpp (1 year) • SQL (< 1 year)

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 conscious and strive to live as sustainably as I can.

Supplementary Projects

Forecasting Air Pollutants | LV Hackathon

Implemented a multivariate, seasonal Generalised Additive Model (GAM) with vector auto-regressive residual boosting to forecast. Won best predictions at the event.

Water Pipe Leakage Detection | Wessex Water Hackathon

Unsupervised learning of time series clusters, fitting a seasonal additive model to output residuals, and then implementing a changepoint detection algorithm on the residuals to identify leaks in water pipes.

Gaussian Process Classification | PhD Group Project

Implemented classification using Gaussian processes with MCMC, with a novel *pseudo-marginal likelihood*, a posterior *Laplace* approximation and intelligent subset selection. All code was written from scratch and into an Rcpp package.

Chicago Crime Classification | PhD Group Project

Used logistic regression to classify arrests, and implemented in R an iteratively re-weighted least squares from scratch, whilst taking advantage of the sparsity of the model matrix to improve efficiency.

Relevant Employment

Research Intern | Adarga | Oct 2021 - Mar 2022

- Used NLP and other machine learning methods to explore embeddings of AI generated text.
- Worked on an unsupervised clustering technique for disinformation detection for AI safety.

Tutorial Leader | University of Bristol | Sept 2020 - Apr 2022

- Led tutorials for undergraduate students in Probability and Statistics courses.
- Nominated for the Inspiring and Innovative Teaching Bristol Teaching Award.

Other Employment

Customer Service Assistant | Libraries Unlimited | 2018 - 2019

Delivery Rider | Deliveroo | 2017 - 2018

Customer Consultant | Dixons Carphone | 2016 - 2017

Customer Assistant | Tesco | 2014 - 2015

References

Available upon request.