

# 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 • 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 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

## References

Available upon request.