Daniel Andrew Coulson

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EDUCATION

Cornell University **August 2022–Present**
PhD in Statistics (expected May 2027), 4.066 GPA Ithaca, NY, USA
Thesis Committee: Martin T. Wells, David S. Matteson, and Y. Samuel Wang.
MSc Statistics **May 2025**
Newcastle University **September 2019–June 2022**
BSc Hons Mathematics and Statistics, First Class Honours (88.3%) Newcastle Upon Tyne, UK
UK marks above 70% correspond approximately to A/A+ performance in the U.S. system.

RESEARCH PAPERS AND MANUSCRIPTS

- **Coulson, D. A**., Matteson, D. S., and Wells, M. T. (2026). Modeling Dynamic Correlation Matrices with Shrinkage Priors. Revised manuscript submitted to the Journal of the American Statistical Association, September 25, 2026. arXiv:2605.06818.
- **Coulson, D. A**. and Wells, M. T. (2026). Minimaxity and Admissibility of Bayesian Neural Networks. Submitted to The Annals of Statistics, April 5, 2026. arXiv:2604.04673.
- **Coulson, D. A.** and Wells, M. T. (2026). Foreclassing: From Forecasts to Decisions. Submitted to Neural Networks, October 28 2026. arXiv:2503.04956.
- Lin, E.*, Xu, Y.*, **Coulson, D. A**.*, Hogan, C., King, M., Horn, E., Richter, I., Beecy, A., Simonis, Q., Clerkin, K., Lotan, D., Raikhelkar, J., Kelsey, C., Ruhl, J., Tesfuzigta, N., Lancet, E., Kumaraiah, D., Sayer, G., Estrin, D., Wells, M. T., and Uriel, N. (2026). Prediction of High-Risk Right Heart Catheterization Hemodynamics from a 12-Lead Electrocardiogram and Routine Clinical Data Using a Multimodal Artificial Intelligence Model. Preparing submission to European Heart Journal – Digital Health. *Equal contribution; shared first authorship.

PRESENTATIONS AND INVITED TALKS

Oral presentations

- **Coulson, D. A**. (2026). Modeling Dynamic Correlation Matrices with Shrinkage Priors. Joint Statistical Meetings (JSM), Inference Under Dependence: Time Series, Panels, and Networks session, Boston, MA, August 4, 2026.
- **Coulson, D. A**. (2026). Minimaxity and Admissibility of Bayesian Neural Networks. Invited paper discussion, Professor Dan Kowal's Bayesian Models Reading Group, Cornell University, May 4, 2026.
- **Coulson, D. A.** (2025). ECG-Based Prediction of High-Risk Cardiac Hemodynamics Using Bayesian Deep Learning. Research presentation, Cornell–NewYork-Presbyterian Cardio AI Initiative, August 11, 2025.

Poster presentations

- **Coulson, D. A.** (2025). Poster on Foreclassing: Time-Series Forecasting and Classification. Eighth Celebration of Statistics and Data Science, Cornell University, Ithaca, NY, September 5, 2025.
- **Coulson, D. A**. (2024). Poster on Modeling Dynamic Correlation Matrices for Financial Applications. Seventh Celebration of Statistics and Data Science, Cornell University, Ithaca, NY, September 6, 2024.

HONORS, AWARDS, AND RESEARCH SUPPORT

- Graduate Research Assistantship, Cornell Cardio AI Initiative, Summer 2025 and 2026–Present.
- Cornell CALS Outstanding Teaching Assistant Award, Cornell University, May 2025.
- Graduate Summer Research Fellowship, Cornell department of Statistics and Data Science 2023 and 2024.
- Reverend Gilbert Robertson Prize for Academic Excellence, Newcastle University, July 2022.
- Selected for the London Mathematical Society Undergraduate Summer School, July 2021.
- Academic Excellence Scholarship, Newcastle University, November 2019.

TEACHING EXPERIENCE

Graduate Teaching Assistant, Cornell University August 2022 – May 2026

BTRY 6010 – Statistical Methods I (Fall 2022, 2023, 2024, 2025)

- Led computer laboratory sessions for classes of over 40 students, teaching statistical computing using R and RStudio, working through course material, and guiding students through practical statistical problems.
- Developed examination questions, graded coursework and examinations, and held office hours.

BTRY 6020 – Statistical Methods II (Spring 2023, 2024, 2025)

- Led RStudio labs, wrote exam questions, graded coursework and examinations, and held office hours.

STSCI 4780/5780 – Bayesian Data Analysis: Principles and Practice (Spring 2026)

- Designed and led laboratory sessions covering Bayesian computation.
- Graded homework assignments and examinations, proctored examinations, and held office hours.

RESEARCH EXPERIENCE

Modeling Dynamic Correlation Matrices with Shrinkage Priors

- Developed a hierarchical Bayesian model combining dynamic shrinkage priors and factor stochastic volatility to estimate time-varying correlation matrices.
- Established a posterior contraction result for the proposed model, providing theoretical guarantees for Bayesian inference under dynamic shrinkage.
- Introduced a novel scalar measure of multivariate dependence, applying the methodology to out-of-sample portfolio construction and investment decision-making.

Minimaxity and Admissibility of Bayesian Neural Networks

- Studied the decision-theoretic properties of Bayesian neural networks, proving that conventional fixed-scale priors induce non-minimax estimators in the multivariate normal means problem.
- Constructed a novel variance hyperprior yielding simultaneously minimax and admissible Bayes estimators.
- Extended these decision-theoretic guarantees to predictive density estimation under Kullback–Leibler loss.

Cornell–NewYork-Presbyterian Cardio AI Initiative

- Developed CardioBoltzNet, a multimodal Bayesian deep learning model combining ECG waveforms and clinical data to predict high-risk cardiac hemodynamics, incorporating adaptive convolutional layers and predictive uncertainty quantification.
- Applied CardioBoltzNet to a retrospective study of 6,945 patients to classify severe abnormalities in cardiac filling pressures, pulmonary artery pressure, and cardiac index, investigating its potential for noninvasive identification of high-risk cardiac patients.
- Appointed as Lead Statistician for a planned prospective cardiology clinical trial beginning Spring 2027.

Foreclassing: From Forecasts to Decisions

- Introduced and mathematically formalized Foreclassing, a machine-learning problem in which time-series labels depend on future observations, and established theoretical results characterizing the problem, including the benefits of future information during training.
- Developed ForeClassNet, a family of neural networks integrating time-series forecasting and classification, with predictive uncertainty quantification and adaptive convolutional layers.
- Applied ForeClassNet to predicting extreme-temperature events for weather warnings, identifying power-transformer oil-temperature exceedances, and earnings-based stock portfolio construction.

Undergraduate Research Assistant, Newcastle University, supervised by Dr. Lee Fawcett (June– Sept 2021)

- Investigated Bayesian methods for evaluating road-safety interventions, using negative-binomial regression to model road casualties and assess regression-to-the-mean bias in the selection of intervention sites.

INDUSTRY EXPERIENCE

Quantitative Research Summer Intern, Engineers Gate June 1– July 31 2026

- Developed a Bayesian approach to combining investment signals, subsequently deployed in live trading.
- Developed systematic equity investment signals using feature engineering, regression techniques, Bayesian methods, and out-of-sample evaluation.
- Implemented multivariate Bayesian models for portfolio construction.
- Developed statistical methods for detecting deterioration in investment signals, informing decisions about signal retention and decommissioning.
- Designed a statistical framework for systematically assessing the robustness of investment signals prior to deployment.