Edward Gunning

Data Scientist & Statistician

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Curriculum Vitae
August, 2024

Education

September 2019 - October 2023

Ph.D. in Statistics

University of Limerick

- **Thesis Title**: *Statistical Modelling of Second-Generation Functional Data with Application in Biomechanics and Human Movement Research*
- **Supervisor**: Prof. Norma Bargary

September 2015 - May 2019

B.Sc. Financial Mathematics and Actuarial Science

University College Cork

- First-class honours (82% overall) degree
- Awarded title of 'College Scholar' for academic year (AY) 2017 & 2018

Experience

January 2024 – Present

Postdoctoral Researcher - Biomedical Data Science

Division of Biostatistics, Epidemiology and Informatics, University of Pennsylvania

- Postdoctoral researcher advised by Prof. Jeffrey Morris and Prof. Giles Hooker (Wharton)
- Working on Functional Data Analysis methodology for biomedical applications

September 2023 - December 2023

Lecturer

Department of Mathematics & Statistics, University College Cork

- Delivered module *ST4001 Biostatistics II* to final-year science (B.Sc.) students
- This module provides an understanding of biostatistical methods applicable to the design of experiments and the reporting and presentation of data analyses
- Responsible for delivering lectures and practical sessions, design of content, examinations and continuous assessment

March 2022 - June 2022

Visiting Student Researcher

University of California, Berkeley

- Research visit to Prof. Giles Hooker in the Department of Statistics, University of California, Berkeley
- Worked on the development and application of differential-equation models for functional data

June 2020 - August 2020

Data Science PhD Intern

Novartis

- PhD internship with Novartis Data Science and Artificial Intelligence (DSAI) team
- Worked on data from wearable sensor technologies, collected as part of a collaboration between Novartis, the Insight Centre for Data Analytics and University College Dublin
- Explored the use of functional data analysis techniques for kinematic and kinetic data from wearable sensors, linking my PhD research to an industrial application

- ➤ Communicated findings to a diverse team which included clinical scientists, physiotherapists, engineers, data scientists and statisticians
- ➤ Gave in-house presentations to the Irish and Global DSAI teams

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Peer-Reviewed Publications

Gunning, E., Warmenhoven, J., Harrison, A.J., Bargary, N. (2024) *Functional Data Analysis in Biomechanics: A concise review of core techniques, applications and emerging areas.* SpringerBriefs in Statistics. (Code: https://github.com/FAST-ULxNUIG/SpringerBriefs).

Warmenhoven, J., Bargary, N., Liebl, D., Harrison, A., Robinson, M. A., **Gunning, E.**, & Hooker, G. (2021). *PCA of waveforms and functional PCA: a primer for biomechanics.* Journal of Biomechanics, 116, 110106.

Under Review

Gunning, E., Golovkine, S., Simpkin, A. J., Burke, A., Dillon, S., Gore, S., Moran K., O'Connor, S., Whyte, E. & Bargary, N. (2024). Analysing kinematic data from recreational runners using functional data analysis. arXiv preprint arXiv:2408.08200.

Gunning, E., Golovkine, S., Simpkin, A. J., Burke, A., Dillon, S., Gore, S., Moran K., O'Connor, S., Whyte, E. & Bargary, N. (2024). A Multivariate Multilevel Longitudinal Functional Model for Repeatedly Observed Human Movement Data. arXiv preprint arXiv:2408.08481.

Golovkine, S., **Gunning, E.**, Simpkin, A. J., & Bargary, N. (2023). On the estimation of the number of components in multivariate functional principal component analysis. arXiv preprint arXiv:2311.04540.

Golovkine, S., **Gunning, E.**, Simpkin, A. J., & Bargary, N. (2023). On the use of the Gram matrix for multivariate functional principal components analysis. arXiv preprint arXiv:2306.12949.

Pre-prints/ Working papers

Gunning, E., & Hooker, G. (2024). An Understanding of Principal Differential Analysis. arXiv preprint arXiv:2406.18484.

Warmenhoven, J., Harrison, A., Quintana, D., Hooker, G., **Gunning, E.**, & Bargary, N. (2020). *Unlocking sports medicine research data while maintaining participant privacy via synthetic datasets*. (SportRxiv pre-print, doi:10.31236/osf.io/f3rz7).

Contributed Conference Presentations

A multivariate functional mixed effects model for longitudinal functional data, with application in biomechanical data from 300 recreational runners. ENAR 2023 Spring Meeting, Nashiville, TN, March 2023 (Contributed Talk).

Principal Differential Analysis: A review with extensions. 15th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2022), King's College London, December 2022 (Contributed Talk).

Processing and exploratory functional data analysis of a large biomechanical data set. 2nd Young-ISA meeting. Virtual event, January 2022 (Invited Talk).

Contributed Poster Presentations

Kinematic analysis of recreational runners using functional data analysis. University of Pennsylvania DBEI Research Day (February 2024).

Analysis of Multivariate and Multilevel Functional Data in Sports Biomechanics. 41st Conference on Applied Statistics in Ireland (Virtual Event, May 2021).

An Application of Multivariate Functional Data Analysis in Sports Biomechanics. 5th International Workshop on Functional and Operatorial Statistics (Virtual Event, June 2021).

Invited Presentations

Functional data, derivatives and applications in biomechanics. University of Pennsylvania Biostatistics Functional Data Analysis Working Group (FDA-WG) (February 2024)

Functional data, derivatives and applications in biomechanics. University College Cork Short Informal Math Seminar (SIMS) (November 2023)

Principal Differential Analysis: A review with extensions. University of Limerick Short Informal Math (SIM) talks (September 2022)

Functional Data Analysis with Application to Sports Biomechanics. Munster Technological University (MTU) Data Science Seminar (March 2022).

Functional Data in Biomechanics. Part of University of Limerick Health Research Institute Online Conversation titled *"Statistical Modelling of High-Dimensional Data"* (Virtual Event, October 2021).

Analysis of Multivariate and Multilevel Functional Data in Biomechanics. University of Limerick Short Informal Math (SIM) talks (Virtual Event, April 2021).

Exploratory data science: Functional data analysis for wearable sensor technologies. Seminar at UCD/ Insight Centre for Data Analytics Personal Sensing Group (Virtual Event, September 2020).

Recreating Nightingale's Coxcombs with the Tidyverse. Young Researchers Using Statistics Symposium (Virtual Event, May 2020).

Software Packages

`IDALearnR` *An R package publishing tutorials for the module "Introduction to Data Analytics with R"* (https://github.com/edwardgunning/IDAlearnR)

Additional Teaching Experience

July 2024

Pre-Conference Workshop: "Functional Data Analysis in Sports Biomechanics" at the International Society of Biomechanics in Sports (ISBS) Annual Conference

Salzburg, Austria

- ➤ Delivered full one-day conference on FDA in Sports Biomechanics
- ➤ Delivered lectures on theoretical material
- ➤ Coordinated interactive computer-code based practical session
- ➤ Designed full, open-source course repository to host all material: https://github.com/edwardgunning/ISBS-Short-Course

September 2019 - December 2022

Tutor and Lab Demonstrator

Department of Mathematics and Statistics, University of Limerick

- ➤ MA5021 Data Analytics with R (AY 2021-22)
- ➤ MA4128 Advanced Data Modelling (AY 2021-2022)
- ➤ MA4701 Technological Mathematics 1 (AY 2019-2020 & 2020-2021)
- ➤ MS4222 Introduction to Probability and Statistics (AY 2019-2020)
- ➤ MA4704/MA4413 Technological Mathematics 4 (AY 2020-2021)
- ➤ MA4007 Experimental Design (AY 2021-2022 & 2022-2023)

June 2021 - March 2022

UL@Work Module Designer and e-Moderator

University of Limerick

Design and instruction/ moderation for the new UL@Work Professional Diploma in Data Analytics:

- ➤ UL@Work is a project funded by the Government of Ireland, that is developing a suite of innovative, digitally led, programmes for both undergraduate and postgraduate students. The Professional Diploma in Data Analytics is a part-time programme aimed at upskilling work-based learners in a range of statistical modelling techniques.

September 2018 - May 2019

Tutor

School of Mathematical Sciences, University College Cork

- MA1001 Calculus for Science I
- MA1002 Calculus for Science II

Duties:

- Designed module material, e.g., preparation of slide decks, course notes and interactive R programming tutorials
- E-moderated course forums to give feedback and guidance to students
- Held weekly "drop-in" Q&A tutorial sessions
- Graded the students' assessments

Professional Development for Teaching

- Undertook Tutor training
- Underwent Teaching Evaluation and Feedback as part of the UL Maths & Stats "Tutor Enhancement Programme"

Awards

- **Best Poster**, University of Pennsylvania DBEI Research Day (February 2024)
- **Best Poster**, 41st Conference on Applied Statistics in Ireland (May 2021)
- **Most Accurate Data Visualisation**, Royal Statistical Society (RSS) Young Statisticians Section (YSS) (May 2020)

Workshops and Training

Attended three weeks of *The Academy for Ph.D. Training in Statistics (APTS)* run by the University of Warwick:

- **Week 1**: Statistical Inference & Statistical Computing
- **Week 2**: Applied Stochastic Processes & Statistical Modelling
- **Week 3**: High-Dimensional Statistics & Computer-Intensive Statistics

Attended Centre for Research Training in Foundations of Data Science masterclasses:

- *Topics in the Statistical Analysis of Network Data* by Professor Eric Kolaczyk, Professor of Statistics; Founding Member, Faculty of Computing and Data Sciences; and Director, Hariri Institute for Computing; Boston University
- *Model-Based Clustering and Classification* by Professor Brendan Murphy, University College Dublin
- *A compressed introduction to compression* by Muriel Médard, Cecil H. and Ida Green Professor, Electrical Engineering and Computer Science (EECS) Department MIT, and lead of the the Network Coding and Reliable Communications Group at the Research Laboratory for Electronics, MIT
- *Deep Learning Approaches for Modeling Small Molecules* Professor Regina Barzilay, Department of Electrical Engineering and Computer Science, MIT

Undertook the following technical modules as part of the structured PhD programme:

- CE4021: Introduction to scientific computing for AI (Credits = 6, Grade = PASS)
- MS8011: Foundations of data science I (Credits = 6, Grade = PASS)
- MS8021: Foundations of data science II (Credits = 6, Grade = PASS)

Undertook the following transversal skills modules as part of the structured PhD programme:

- MP8002: Entrepreneurial, creative and innovative thinking for researchers (Credits = 6, Grade = A1)
- RM8012: Research Impact: Bridging the gap between rigour and relevance (Credits = 6, Grade = PASS)

Undertook bespoke presentation skills training from expert presentations coach Eric Fitzpatrick.

Programming Languages

- R (expert)
- LaTeX(expert)
- Python (proficient)
- SPSS (proficient)
- SQL (proficient)
- SAS (basic working knowledge)

Education, Outreach and Other Activities

- Member of the University of Limerick Health Research Institute (HRI)
- Royal Statistical Society Student e-Member
- Member of the judging panel for RSS Young Statisticians Section and History of Statistics Section 2021 Data Visualisation Challenge
- Held Treasurer (previous) and Vice-President (current) positions in the UL Society of Industrial and Applied Mathematics (SIAM) Student Chapter
- Attended workshop on “Statistics in the Era of Big Data” at the Simons Institute for the Theory of Computing, Berkeley (June 2022)
- Researcher of the week video (https://vimeo.com/636275996)
- Mathematics Applications Consortium for Science and Industry (MACSI) outreach video on the Tower of Hanoi problem (https://twitter.com/MACSIMaths/status/1359070354245906432?s=20)
- Represented the MACSI at the Munster Science Festival
- Part of the MACSI Young Modellers academic team
- Organiser of the 2022 SIAM student conference

References

Prof. Norma Bargary
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Prof. Giles Hooker
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