



SCHOOL OF MATHEMATICS AND STATISTICS

Statistics Group

Annual Report 2017

The Open University Statistics Group

2017 Report

1. Membership

Miss A. Bromley
Miss C. Calvert
Professor F. Critchley (to December)
Dr F. Elfadaly
Dr Á.E. Faria
Professor P.H. Garthwaite
Mrs A. Gibb (from April)
Dr R.M. Hilliam
Professor M.C. Jones
Dr C.M. Queen
Dr R. Sabolová (to March)
Dr N.T. Trendafilov
Dr S.K. Vines
Dr Y.G. Weldeselassie (to May)
Dr H.J. Whitaker

Long-term associates

Professor C.P. Farrington [Emeritus Professor]
Professor J.C. Gower [Emeritus Professor]
Professor K.J. McConway [Emeritus Professor]
Dr A. Noufaily (Warwick Medical School) [Visiting Research Fellow]
Dr Y.G. Weldeselassie (Warwick Medical School) [Visiting Research Fellow]

Full-time research students

Mr T.G. Gebru (to June)
Mr M.Z. Rahman Shabuz

Part-time research students

Mr T.G. Gebru (from July)
Mr R. Harris

2. Introduction

Here is an overview of the substantial activity in Statistics at the Open University in 2017, in both research and teaching.

On the research side, all our usual activities and outputs are described in Section 4 onwards of this report. In the course of the year, members of the Group published 15 papers in refereed journals, along with a number of other outputs (see Section 5). Pre-publication papers can be found in our technical report series, at

<http://www.mathematics.open.ac.uk/research/statistics/technical-reports>

On the teaching side, well over 2600 students were enrolled on the Statistics modules presented for study from dates in 2017 (see Section 3).

Our esteemed colleague, Frank Critchley, retired at the end of the year after a successful 18 year stint as a Research Professor. Frank was a highly valued colleague with many contributions to the research life of the group/department/school (seminars will never be the same again!) and deep insights into and knowledge of his specialist areas of the subject, in multivariate analysis and, most recently, in the links with and impact of informational geometry in statistics. Best wishes to Frank for a long and happy retirement.

We were also sad to see two more excellent postdocs move on to the next stages of their careers, Radka Sabolová to commercial life in Prague, Czech Republic, and Yonas Weldeselassie to Warwick Medical School, Coventry. We wish them very well too, of course.

Mrs Ann Gibb joined as a staff tutor. This takes to a record four the number of staff tutors associated with the statistics group.

The Statistical Advisory and Consultancy Services continue to run successfully, supporting research in other disciplines across the Open University. These are run by Álvaro Faria and Paul Garthwaite. Two web pages explain the services:

<http://www.mathematics.open.ac.uk/research/research/statistics/advisory-service>

<http://www.mathematics.open.ac.uk/research/statistics/statistical-consultancy-service>

Further information on the Group's research activities is available through our general web pages at <http://www.mathematics.open.ac.uk/research/statistics>

3. Teaching

Presentation

The Group continued to present six modules of 30 CATS points each with one of them (M140) being presented twice in the year. These, with numbers of students starting the presentations of each module in 2017 given in square brackets, are:

- [M140](#) *Introducing Statistics* (Chair: Calvert) [February 494; October 981]
- [M248](#) *Analysing Data* (Chairs: Faria, Queen) [372]
- [M249](#) *Practical Modern Statistics* (Chair: Whitaker) [157]
- [M343](#) *Applications of Probability* (Chair: Trendafilov) [319]
- [M346](#) *Linear Statistical Modelling* (Chair: Vines) [189]
- [M347](#) *Mathematical Statistics* (Chairs: Jones, Garthwaite) [131].

The first level mathematics module, [MU123](#) *Discovering Mathematics*, also contains a little statistical material.

Production

It was the result of a huge amount of effort, but we got there in the end: our considerable revision of [M248 *Analysing Data*](#) was completed and was first presented in October 2017. This work was undertaken in order to take account of the predecessor module [M140](#), to improve parts of the material, and to update aspects of the presentation of the module. Catriona Queen led this effort by extremely hard-working example.

Qualifications

Our modules are compulsory components of degrees in [Mathematics and Statistics](#), [Mathematics, Computing & IT and Statistics](#), [Mathematics and its Learning](#) and [Economics and Mathematical Sciences](#), as well being specified options in certain other qualifications. The Mathematics and Statistics degree was awarded to 181 students in 2017. The undergraduate Diploma in Statistics, no longer available to new students, is still awarded to current students who successfully study a large proportion of our modules; the Diploma was awarded to 2 students in 2017. A further 88 students were awarded other joint degrees that include a substantial element of statistics.

Two new qualifications came on stream in 2017: a [Professional Certificate in Practical Statistics](#), which is awarded for successful study of M140, M248, M249 and M346, and a [Graduate Certificate in Theoretical Statistics and Probability](#), for M343 and M347.

We are also in the process of introducing an undergraduate degree in Data Science which, of course, will feature a number of our modules as well as others from computing and mathematics.

4. Research interests

The Statistics Group is home to three Research Groups:

Multivariate Statistics: Trendafilov (co-ordinator), Critchley, Faria, Garthwaite, Gower, Jones, Queen, Rahman Shabuz, Sabolová, Vines.

Bayesian Statistics: Faria (co-ordinator), Elfadaly, Garthwaite, McConway, Queen, Vines.

Medical Statistics: Whitaker (co-ordinator), Farrington, Garthwaite, Hilliam, Noufaily, Vines, Weldeselassie.

Clearly, these three general groupings cover a huge variety of research projects in Statistics. Research also continues, of course, on topics not directly covered by these Research Groups, of which single case studies, distribution theory, robust statistics, time series forecasting, improved confidence intervals and statistics in the media are but a selection. Strong ongoing collaborations continue in areas such as medicine, psychology, traffic modelling, earth sciences and ecology.

For details, see the publications, talks and other items to follow.

5. Publications

5.1 Publications in refereed journals

Albers, C. & **Gower, J.** (2017) Visualising interactions in bi- and triadditive models for three-way tables. *Chemometrics and Intelligent Laboratory Systems*, **167**, 238-247.

Anacleto, O. & **Queen, C.** (2017) Dynamic chain graph models for time series networks. *Bayesian Analysis*, **12**, 491-509.

Critchley, F. & Marriott, P. (2017) On the limiting behaviour of the fundamental geodesics of information geometry. *Entropy*, **19**: 524.

Elfadaly, F.G. & **Garthwaite, P.H.** (2017) Eliciting Dirichlet and Gaussian copula prior distributions for multinomial models. *Statistics and Computing*, **27**, 449-467.

Enki, D.G., Noufaily, A., **Farrington, P.**, **Garthwaite, P.**, Andrews, N. & Charlett, A. (2017) Taylor's power law and the statistical modelling of infectious disease surveillance data. *Journal of the Royal Statistical Society Series A*, **180**, 45-72.

Garthwaite, P.H., **Elfadaly, F.G.** & Crawford, J.R. (2017) Modified confidence intervals for the Mahalanobis distance. *Statistics and Probability Letters*, **127**, 131-137.

Ghebremichael-Weldeselassie, Y., **Whitaker H.J.**, Douglas I.J., Smeeth L. & **Farrington C.P.** (2017) Self-controlled case series with multiple event types. *Computational Statistics and Data Analysis*, **113**, 64-72.

Ghebremichael-Weldeselassie, Y., **Whitaker H.J.** & **Farrington C. P.** (2017) Spline-based self-controlled case series method. *Statistics in Medicine*, **36**, 3022-3038.

Gower, J., Gardner, S. & Le Roux, N.J. (2017) Data analysis: good but *Italian Journal of Applied Statistics*, **29**, 293-304.

Hannachi, A. & **Trendafilov, N.** (2017) Archetypal analysis: Mining weather and climate extremes. *Journal of Climate*, **30**, 6927-6944.

Hilliam, R. & **Calvert, C.** (2017) Interactive statistics: Can we use experience from a large diverse student cohort to provide professional development for a wider population? *New Directions in the Teaching of Physical Sciences*, **12**.

King, M., Lodwick, R., Jones, R., **Whitaker, H.** & Petersen, I. (2017) Death following partner bereavement: A self-controlled case series analysis. *Plos One*, **12**: e0173870.

Leonard, C.E., Brensinger, C.M., Bilker, W.B., Kimmel, S.E., **Whitaker, H.J.** & Hennessy, S. (2017) Thromboembolic and neurologic sequelae of discontinuation of an antihyperlipidemic drug during ongoing warfarin therapy. *Scientific Reports*, 2017, **7**: 18037.

Trendafilov, N.T., Fontanella, S. & Adachi, K. (2017) Sparse exploratory factor analysis. *Psychometrika*, **82**, 778-794.

Van Beijnum, J., Wilkinson, T., **Whitaker, H.J.**, Van der Bom, J.G., Algra, A., Vandertop, W.P., Van den Berg, R., Brouwer, P.A., Rinkel, G.J.E., Kappelle, L.J., Al-Shahi Salman, R.; for the Scottish Audit of Intracranial Vascular Malformations collaborators and Klijn, C.J.M. (2017) Relative risk of hemorrhage during pregnancy in patients with brain arteriovenous malformations. *International Journal of Stroke*, **12**, 741-747.

5.2 Edited book

Nielsen, F., **Critchley, F.** & Dodson, K. (eds.) (2017) *Computational Information Geometry for Image and Signal Processing*. Springer.

5.3 Book chapters

Anaya-Izquierdo, K., **Critchley, F.**, Marriott, P. & Vos, P. (2017) Towards the geometry of model sensitivity: An illustration. In *Computational Information Geometry for Image and Signal Processing*, Eds: F. Nielsen, F. Critchley & K. Dodson, Springer, pp. 33-62.

Anaya-Izquierdo, K., **Critchley, F.**, Marriott, P. & Vos, P. (2017) On the geometric interplay between goodness-of-fit and estimation: Illustrative examples. In *Computational Information Geometry for Image and Signal Processing*, Eds: F. Nielsen, F. Critchley & K. Dodson, Springer, pp. 63-77.

Critchley, F. & Marriott, P. (2017) Information geometry and its applications: an overview. In *Computational Information Geometry for Image and Signal Processing*, Eds: F. Nielsen, F. Critchley & K. Dodson, Springer, pp. 1-31.

Gould, R., Wild, C.J., Baglin, J., McNamara, A., Ridgway, J. & **McConway, K.** (2017) Revolutions in teaching and learning statistics: a collection of reflections. Chapter 15 in *International Handbook of Research in Statistics Education*, Eds: D. Ben-Zvi, K. Makar & J. Garfield; Springer.

McConway, K. (2017) Toward a fruitful relationship between statistics and the media: one statistician's view. Chapter 13 in *News, Numbers and Public Opinion in a Data-Driven World*, Ed: A. Nguyen; Bloomsbury Academic.

5.4 Others

Calvert, C. (2017) Valuing and fostering communications skills: a dispersed approach. In *Employability Development for HE Mathematics and Statistics: Case Studies of Successful Practice*, www.sigma-network.ac.uk/sigs/employability-sig

Inns of Court College of Advocacy and Royal Statistical Society, including material by **McConway, K.** & many others (2017). *Statistics and probability for advocates: Understanding the use of statistical evidence in courts and tribunals*. The Council of the Inns of Court (COIC) and the Royal Statistical Society (RSS).

McConway, K. (2017) Contribution to the discussion of "Beyond subjective and objective in statistics", by A. Gelman & C. Hennig. *Journal of the Royal Statistical Society Series A*, **180**, 1022.

6. Conference and seminars at The Open University

In September, we hosted the *Fifth Subjective Bayesian Meeting*, a one-day statistical **conference** (chief organiser: Fadlalla Elfadaly). Speakers were:

Richard Wilkinson (University of Sheffield) *Subjectivism in inference*

Ian Vernon (Durham University) *A Bayesian computer model analysis of robust Bayesian analyses*

Laura Bojke (University of York) *Eliciting subjective priors for cost-effectiveness modelling*

Bogdan Grigore (University of Exeter) *"That's a smudge": Practical considerations on eliciting priors in health technology assessment*

Alireza Daneshkhah (Coventry University) *Uncertainty quantification using deep Gaussian processes*

Michael Goldstein (Durham University) *On the foundations of subjectivist inference*

We also ran our usual **seminar programme** with external speakers. Over the year we heard:

Maria de Iorio (University College London) *Dependent generalised Dirichlet process priors*

Heather Battey (Imperial College London) *Exploring and exploiting new structured classes of covariance and inverse covariance matrices*

Paul Jenkins (University of Warwick) *Time-dependent feature allocation models via Poisson Random Fields*

Wicher Bergsma (London School of Economics) *Regression with I-priors*

Daniel Williamson (University of Exeter) *You're looking in the wrong directions! Optimal calibration of computer models with spatio-temporal output*

Richard Samworth (University of Cambridge) *High dimensional change point estimation via sparse projection*

Chenlei Leng (University of Warwick) *A framework for distributed large-scale sparse regression*

Rodolphe Sepulchre (University of Cambridge) *How to choose a distance for statistical estimation?*

In addition, we held an **internal research students' morning** at which the speakers were Maha Moustafa, Ross Harris, Zillur Rahman Shabuz and Hugh Morgan.

7. External conference papers and posters given

C. Calvert

HEA Annual Conference: Teaching in the Spotlight, Manchester *Success against the odds: Quantitative to qualitative and back again*

K.J. McConway

Stempra annual training conference, London *Putting statistics in press releases*

M.Z. Rahman Shabuz

RSS International Conference 2017, Glasgow *Identifying variables underlying multicollinearity*

N.T. Trendafilov

17th Annual Conference of the European Network for Business and Industrial Statistics, ENBIS2017, Naples, Italy *SINDSCAL: Simplified INDSCAL*

Y.G. Weldeselassie

Eastern North American Region of the International Biometric Society Spring Meeting (ENAR 2017), Washington DC, U.S.A. *Investigating the assumptions of the self-controlled case series method.*

H.J. Whitaker

Inserm Workshop 244, Methodological challenges for drug surveillance, Bordeaux, France *The self-controlled case series method*

33rd International Conference on Pharmacoepidemiology & Therapeutic Risk Management, Montreal, Canada *Self-controlled case series*

8. Other external seminars and talks given

P.H. Garthwaite

University of Waterloo, Canada *'Tweaking' variables to make them uncorrelated*

K.J. McConway

Rotary Club of Milton Keynes Grand Union, Milton Keynes *The application and mis-application of statistics*

H.J. Whitaker

University of Toronto, Canada *Self-controlled case series*

9. Editorial roles

F. Critchley

- Editorial Board Member: *Studies in Classification, Data Analysis, and Knowledge Organisation* (book series, Springer)

M.C. Jones

- Associate Editor: *Annals of the Institute of Statistical Mathematics*
- Associate Editor: *Journal of the Korean Statistical Society*
- Associate Editor: *Statistics and Probability Letters*

K.J. McConway

- Senior Editor/Statistical Advisor: *Endocrine-Related Cancer*
- Senior Editor/Statistical Advisor: *Journal of Endocrinology*
- Senior Editor/Statistical Advisor: *Journal of Molecular Endocrinology*

N.T. Trendafilov

- Associate Editor: *Behaviormetrika*
- Associate Editor: *Computational Statistics*
- Associate Editor: *Japanese Journal of Statistics and Data Science*

H.J. Whitaker

- Associate Editor: *Endocrine Connections*

10. Other activities

A. Bromley

- co-authored a talk and a poster at the Open University eSTEEeM conference

C. Calvert

- was awarded a Senior Fellowship of the Higher Education Academy
- gave one talk and co-authored another at the Open University eSTEEeM conference
- spoke at the Open University's Enabling Innovation workshop
- obtained substantial internal funding for a pilot scheme on a flexible start for M140

P.H. Garthwaite

- was member and deputy chair of the RSS Research Section committee
- had a two month research visit to the University of Waterloo, Canada

- external examiner for MSc in Applied Statistics with specialisation in Actuarial Science at the University of Mauritius

R. Hilliam

- gave one talk and co-authored another talk and a poster at the Open University eSTEEeM conference
- is a visiting Fellow in Medical Statistics at the University of Derby

K.J. McConway

- chair of the RSS Examinations Board until it ceased to exist in July
- ran training events in statistics for press officers at medwireNews (Springer) and NICE
- STEM Ambassador (working with schools and young people to promote STEM subjects), including taking part in a STEM careers session at a school in Milton Keynes
- judge for the 'STEM for Britain' parliamentary poster competition for career-young researchers
- member of the Advisory Committee of the Science Media Centre, writing invited comments on statistical aspects of scientific papers
- speaker at debate on "Toxic Smog: Hazard or Hype" at the Battle of Ideas festival, London

C.M. Queen

- external examiner for undergraduate and postgraduate statistics modules at the University of Warwick

N.T. Trendafilov

- member of the programme committee of the 3rd International Workshop on Machine Learning, Optimization and Big Data (MOD 2017), Volterra, Italy

S.K. Vines

- external examiner for undergraduate statistics modules at Kingston University London
- lead author of eSTEEeM final report on the project "Sonification of numerical data"
- co-chair of eSTEEeM project "Sonification partial pilot on M140"

H.J. Whitaker

- examined a PhD at the Manchester Metropolitan University
- is a member of the International Society for Pharmacoepidemiology working group on Guidance for the Application and Reporting of Self-Controlled Study Designs in Pharmacoepidemiology