Studying Statistics, Optimization, and Operational Research in Edinburgh

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Studying in Edinburgh

Edinburgh is an exciting city in which to study statistics, machine learning, and operational research (OR), and is experiencing several key developments:

- Two highly ranked universities: the University of Edinburgh and Heriot Watt, both with strong statistics/ML/OR groups that have links to other major departments within the universities, with PhD programmes linked through the Maxwell Institute.
- The Bayes Centre: A £45 million institute in the centre of Edinburgh that aims to develop and apply statistical, machine learning and data-centric research to society at large.
- City Deal: £790 million of government funding being invested in Edinburgh to support technological research, with £270 million set aside for "data driven innovation".
- An established tech sector featuring many companies - both small and large - with an interest in data science. Several of these were spin-offs from the universities.

Some Potential Funding Sources

There are several sources of funding available for statistics and OR PhDs. Several of our students come with their own money (e.g. paid for by their own governments, or international scholarships such as the Commonwealth Scholarship).

1. Departmental scholarships: a small number of scholarships are available each year at the School of Mathematics (UoE)
   The best way to proceed is to directly contact a relevant supervisor at either university and discuss potential projects and then submit an application.
   Note: some deadline are very soon (School scholarships 31 January!), so directly submitting an application is also an option!
2. CDT funding: Currently there are several programmess which fund statistics and OR related projects; MAC-MIGS (EPSRC CDT) for applied modelling and mathematics, E4 (NERC DTP) at Edinburgh for geoscience related projects, SENSE (NERC CDT) for Earth Observations.
3. Industry: private companies often fund PhD projects to work on topics of interest to their business. This is typically handled through individual supervisors.

Some Potential Funding Sources

Useful links:

- Maxwell Institute Projects:
  General info: `http://www.maxwell.ac.uk/graduate-school/`
  Funding info:
`https://www.maths.ed.ac.uk/school-of-mathematics/studying-here/pgr/funding-opportunities`
  Applying:

Statistics: `https://www.ed.ac.uk/studying/postgraduate/degrees/index.php?r=site/view&id=516`
OOR: `https://www.ed.ac.uk/studying/postgraduate/degrees/index.php?r=site/view&id=514`

- MAC-MIGS CDT:
  `https://www.mac-migs.org.uk/`
- NERC E4 DTP:
  `https://www.ed.ac.uk/e4-dtp`
  A variety of projects related to geoscience, many of which have heavy statistical/OR elements.
- NERC SENSE CDT:
  `https://eo-cdt.org/`
  A variety of projects related to satellite data in environmental science, many of which have heavy statistical/OR elements.

Research Areas

The academics at UoE have a wide range of interests, and will often work on a wide variety of projects.

For more information on the groups and staff research interests, see the group pages:

- UoE and HW: https://www.maxwell.ac.uk/research/data-and-decisions/
- Statistics: https://www.maths.ed.ac.uk/school-of-mathematics/research/statistics
- Operational Research: https://www.maths.ed.ac.uk/school-of-mathematics/research/oor

Typically there are two ways to find a PhD project: either find a specific project listed on a website such as `findaphd.com`, a CDT, or general advert, or directly contact a supervisor whose research area you find interesting and ask if they have project opportunities in the areas you are interested.
Note: The school scholarships do not require a specific listed project.

What is a Statistics PhD?

For the last 100+ years, statisticians have worked closely with scientists in many fields, developing models and algorithms to help analyse data and build/test theories.

Substantial contributions by statisticians in fields such as biology, genetics, geosciences, epidemiology, finance, economics, and many others.

In the modern era, statisticians and computer scientists often work directly on the design of algorithms for solving problems of interest.

What is a Statistics PhD?

Statisticians work on a wide variety of topics which span the natural sciences, social sciences, and machine learning. This means that there any many different 'types' of statistics PhD projects available.

Some statisticians work largely on theory, focusing on 'pen and paper mathematics', theorem proving, etc. Others work largely on data, applying statistical modelling, estimation, and prediction methods to the analysis of data and scientific problems.

Most are somewhere in the middle, combining elements of theory, algorithm design, and data applications.

Research Areas at UoE

Research Areas at UoE include (but are not limited to):

- Geosciences
- Financial markets and financial risk
- Extreme values
- Genomics
- Ecology
- Forensics
- Medical statistics and biostatistics, including links to BioSS (Biomathematics and Statistics Scotland)
- Bayesian methods and nonparametric Bayes
- Markov Chain Monte Carlo and Sequential Monte Carlo
- Hidden Markov Models
- Point processes and Time Series

+ others

Statistics group

- A rapidly expanding group in the past 5 years
- $\sim$ 20 academic staff
- $\geq$ 20 PhD Students
- The Centre for Statistics: a multidisciplinary centre in the university lead by the School of Mathematics, connecting statisticians and statistical activities across the university

The next few slides contain some sample projects (this list is not remotely exhaustive, it just means to give a flavour of the diversity of research being carried out in the group).
If you have interests in a specific topic not contained in this list then please contact me (finn.lindgren@ed.ac.uk) and I can try to put you in touch with a relevant supervisor

Sample Projects (past, present, and future)

- Natalia Bochkina, n.bochkina@ed.ac.uk
  Theory of Nonparametric Bayesian Inference
- Vanda de Carvalho, vanda.inacio@ed.ac.uk
  Bayesian flexible models for the statistical evaluation of medical diagnostic tests
- Chris Dent, chris.dent@ed.ac.uk
  Bayesian decision analysis and uncertainty management for energy system planning
- Victor Elvira, victor.elvira@ed.ac.uk
  Sequential Bayesian inference in complex and realistic dynamical systems
- Ruth King, ruth.king@ed.ac.uk
  State-space models and efficient Monte Carlo techniques
- Finn Lindgren, finn.lindgren@ed.ac.uk
  Spatial and spatio-temporal modelling for environmetrics and ecology
  Fast computational Bayeisan methods for random field estimation with SPDEs

Sample Projects

- Yiannis Papastathopoulos, ipapasta@ed.ac.uk
  Graphical modelling of multivariate extremes
  Statistical modelling of grid cell firing using log Gaussian Cox processes through the SPDE approach.
- Daniel Paulin, dpaulin@ed.ac.uk
  Scalable optimization methods for sparse statistical models
- Gordon Ross, gordon.ross@ed.ac.uk
  Statistical Analysis of Literature and Social Media
  Earthquake Forecasting Using Machine Learning and Statistics
- Simon Wood, simon.wood@ed.ac.uk
  Computational statistics, smoothing and statistical ecology