3 Year PhD Studentship available for September 2019

Department: Health Sciences & Cardiovascular Sciences

Supervisors:
Dr Michael Crowther (Health Sciences) michael.crowther@le.ac.uk, Dr Michael Sweeting (Health Sciences) michael.sweeting@le.ac.uk & Dr David Adlam (Cardiovascular Sciences) da134@leicester.ac.uk

Eligibility: UK/EU applicants only

Project Title: Statistical and machine learning approaches to risk prediction: Development, comparison and application of multi-state survival methods to modelling complex disease trajectories

Project Description:

Multi-state survival models allow rich insights into complex disease pathways, where a patient may experience many non-fatal/intermediate events, and we wish to the investigate covariate effects for each specific transition between two states, not just for example, on the first event, or a terminal event [1]. With the growth in availability of electronic health records (EHRs), there is substantial opportunities to build biologically complex, yet plausible, disease risk models, which take into account an entire disease trajectory, rather than just a single event of interest (such as a myocardial infarction or stroke). The size of such datasets also opens up possibilities to utilise data-hungry machine learning methods in new fields of application.

The aim of this PhD is to bring together established biostatistical approaches, with emerging machine learning techniques to answer important clinical questions in the field of cardiovascular disease (CVD). The PhD has the following potential goals:

- To conduct a review of survival analysis methods applied to CVD risk prediction
- To compare statistical and machine learning (ML) approaches to survival analysis/risk prediction through extensive simulation studies, including for example, flexible parametric survival models [2], penalisation approaches, neural networks [3], random forests
- To develop and extend existing survival analysis methods to incorporate machine learning techniques, for example combining flexible parametric survival models with
an artificial neural network. There will be the opportunity to develop and release open-source user-friendly software packages associated with the new methods.

- To extend the developed approach to a general multi-state setting, allowing any number of states and transitions [4]
- To develop a prediction model using big data/EHRs in cardiovascular disease and cancer, for example using data from the first whole country cardio-oncology research platform (VICORI) to predict multimorbid events in a stable coronary artery disease population

The PhD student will join the Biostatistics Research Group, which is an internationally regarded hub of biostatistical methods development. The group is home to leading researchers in the field of survival analysis (Michael Crowther, Michael Sweeting, Mark Rutherford and Paul Lambert), whose research focus on development of methods for the analysis of complex survival data, motivated by applications to electronic health records. There will be the opportunity to attend specialist training courses such as ‘Parametric competing risks and multi-state survival models’ (taught by Michael Crowther and Paul Lambert at the Swiss Winter Epidemiology School), and attend and present at international conferences, such as the International Society for Clinical Biostatistics’ annual conference.

References:


Funding details:
The College of Life Sciences (CLS) HDRUK Studentship will provide a tax-free stipend at RCUK rates (£15,009 for 2019/20) and UK/EU fees for 3 years.

Entry requirements:
Applicants are required to hold/or expect to obtain a data science related UK Bachelor Degree 2:1 or better (e.g. Computer Science, Bioinformatics, Biostatistics), and preferably also a similar MSc qualification. The University of Leicester English language requirements apply where applicable.

How to apply:
You should submit your application using our online application system.

Apply for a PhD in Health Sciences Research
In the funding section of the application please indicate you wish to be considered for a **CLS HDRUK Studentship**

In the proposal section please provide the **name of the supervisor and project** you want to be considered for – please list both your **first and second choices**.

**Project / Funding Enquiries:** Dr Michael Crowther  
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**Application enquiries** to  
[pgradmissions@le.ac.uk](mailto:pgradmissions@le.ac.uk)

**Closing date for applications:** 3**nd** April 2019

**Interviews are likely to be week commencing 8**th or 15**th** April 2019