3 Year PhD Studentship available for September 2019

Department: Respiratory Sciences

Supervisors: Robert Free, Alistair McEwan and Gerrit Woltmann

Eligibility: UK and EU students only

Project Title: Prediction of outcome in community acquired pneumonia admissions using Artificial Intelligence and machine learning based algorithms.

Project Description:

Community acquired pneumonia (CAP) was responsible for over 260 thousand emergency hospital admissions in the UK in 2016/17 and cost the NHS ~£1 billion, with between 2 and 30% of patients dying. Currently, managing the disease involves following a series of national guidelines. However, the likelihood of death depends on a combination of the patient’s age, how severe the disease is, what other conditions they have and potentially other previously unexplored factors that affect the outcome.

This studentship aims to apply Artificial Intelligence (AI)/machine learning techniques to help hospital staff determine the likely outcome when patients are admitted with community acquired pneumonia (CAP). The project would be suitable for a mathematician or statistician/computer scientist. Key to the work will be a good understanding of mathematics and an interest in mathematical modelling.

The research will use non-identifiable hospital data related to CAP patients which will then be used to create AI/machine learning models to predict the likelihood of death, the length of hospital stay (in days) and other outcomes related to the disease. The cause of the disease will be also be explored by using data to examine the bacteria/virus responsible (if any) and compare this to the outcomes and other data.

This project may lead to new approaches for handling admissions in hospital. This will allow staff managing the condition to better understand what can be done to help patients and allow them to make changes to the patient’s treatment to reduce the risk of death.

Background

The proposal is to use Artificial intelligence (AI)/machine learning techniques to improve risk stratification of community acquired pneumonia at the time of hospital admission.

AI/machine learning techniques have shown some success in predicting unknown outcomes for future scenarios, by training using previously conditioned data sets.
Mortality associated with CAP admissions varies between 2% and 30% depending on disease severity, co-morbidities and age, and prompt interventions are associated with significantly improved outcome. Therefore, even small improvements of outcome in association with CAP would potentially be of enormous benefit to large numbers of patients admitted to NHS hospitals every year.

**Clinical Context**

At a national level pneumonia and flu caused 269,313 emergency hospital admissions in the UK in 2016/17 which cost the NHS an estimated £1 billion. Community acquired pneumonia (CAP) is the leading cause of death in NHS hospitals.

**Hypothesis**

The project aims to demonstrate that AI and machine learning can be used to create a decision making system that improves the identification of patients at increased risk of mortality and can guide better treatment pathways.

**Experimental Methods and Research Plan**

The objective of this project is to improve risk stratification of CAP at the time of hospital admission using AI/machine learning techniques by employing clinical, demographic, physiological and pathological variables collected in routine clinical practice. This will be done with a view to using these future predictions in a clinical setting.

The main aims and objectives are:

1. **Construct anonymised multi-dimensional datasets (months 1-12)**
   - Integrate data collected across discrete clinical platforms for all patients admitted to the University Hospitals of Leicester, with a coded diagnosis of CAP. Multidimensional datasets will include clinical demographic variables, electronically recorded physiological variables and pathological variables from blood.

2. **Develop AI/machine learning methods (months 6-24)**
   - Use datasets to develop mathematical models independently predictive of mortality, length of stay and prospective escalation of antibiotic therapy. Construct multi-dimensional clinical phenotypes of CAP and determine how these correlate with our pre-specified clinical outcomes and microbial aetiology.

3. **Compare performance of models constructed using AI/machine learning with traditional statistical methodology and existing CAP severity classification tools (months 24-36).**

It is expected that this project will produce outputs and impact in several areas including:

- novel publishable results based on AI/machine learning which can be used to improve the categorisation of disease severity and develop new pathways for optimising clinical care.
• broadly applicable translational tools/approaches which can lead to the development of similar tools in other key disease areas.
• build capacity in key strategic areas by providing the student with extensive experience of clinical informatics and data science AI/machine learning.

**Funding details:**
This project is in competition for a College of Life Sciences (CLS) PhD Studentship. The Studentships are for three years, starting September 2019, and offer tuition fees at UK/EU rates and a Stipend at UK Research Council rates.

**Entry requirements:**
Applicants are required to hold/or expect to obtain a UK Bachelor Degree 2:1 or better in a relevant subject.

The project would be suitable for a mathematician or statistician/computer scientist. Key to the work will be a good understanding of mathematics and an interest in mathematical modelling.

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 [Infection, Immunity and Inflammation Research/September 2019](#)

In the funding section of the application please indicate you wish to be considered for a [LPMI/BRC/RS studentship](#).

In the proposal section please provide the name of the supervisor and project title.

You do not need to submit a proposal but please include a personal statement detailing your interest in this project.

**Project / Funding Enquiries:**

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