Imperial College London

Job Description

Job Title:	Research Associate in Machine Learning for Complex Epidemics
Department/Division/Faculty:	Infectious Disease Epidemiology/Public Health/Medicine
Campus/Location:	White City Campus, London
Job Family/Level:	Research Job Family, Research Associate* (Research salary scale)
Responsible to:	Dr Kris V Parag (https://www.imperial.ac.uk/people/k.parag)
Key Working Relationships (Internal):	Researchers in the MRC Centre for Global Infectious Disease Analysis, the Dyson School of Engineering Design and the Department of Mathematics, all at Imperial College London.
Key Working Relationships (External):	Collaborators based at Departments of: (i) Statistics and (ii) Biology, Oxford University, (iii) Automatic Control, Lund University (iv) Applied Mathematics, INRAE (Paris), (v) Epidemiology and Biostatistics, Hong Kong University and (vi) School of Public Health, Tel Aviv University.
Contract type:	Full time and fixed term for 2 years. Flexible working will be considered, and details can be discussed at interview.

Purpose of the Post

This post is part of a Medical Research Council (MRC) UK award targeted at developing novel control and reinforcement learning algorithms for optimising the efficiency and effectiveness of epidemic or pandemic suppression and prediction across scales (e.g., from individual to population levels). The post holder will be a central member of the EpiEng group (led by Dr Parag), which is supported by this award and leverages methodology from engineering, complex systems, network and data science to improve the understanding, modelling and real-time response to infectious diseases and other contagious processes.

The post holder will extend existing disease modelling paradigms (multilayer network, metapopulation and renewal models) to (i) more accurately characterise salient drivers of spread (e.g., social behaviours and heterogeneities), (ii) design scalable data-driven strategies for counteracting those drivers and (iii) better leverage diverse data streams (e.g., cases, sequences, wastewater), using tools that can span network theory, reinforcement learning, causal statistics, graphons, complex systems and feedback control.

This research will be done in partnership with multidisciplinary collaborators including Prof Ben Cowling (public health), Dr Richard Pates (control engineering), Prof Nuno Faria (phylodynamics), Prof Samir Bhatt (machine learning), Dr Anne Cori (epidemic models), Dr Moritz Kraemer (complex systems), Dr Uri Obolski (causal methods), Dr Ben Lambert (computer science), Prof Christl Donnelly (statistics) and others.

Typical activities will include developing novel disease transmission models and data science algorithms for controlling spread, confronting and optimising these models using multiresolution data (e.g., from SARS 2003 and COVID-19 epidemics) and implementing open-source R (or MATLAB/Python/Julia) packages that can contribute to real-time outbreak analyses and support the evidence base for policymaking. The post holder will be expected to submit publications to high quality refereed journals, present at international or national conferences/meetings and contribute to applications for external funding.

While the research programme undertaken will align with the objectives of the MRC award, flexibility will be provided to allow the post holder to develop their own research ideas at the broad intersect of machine learning, engineering, statistics and epidemiology. Support and funding to attend conferences and training workshops (which may be inter-disciplinary) for personal and professional development, will be provided.

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Key Responsibilities

Research Duties:

- Develop novel epidemic models to realistically describe transmission across scales
- Devise reinforcement learning and feedback control algorithms to improve interventions
- Incorporate behavioural loops, spatial coupling and other key dynamics in approaches
- Apply models and algorithms developed to improve epidemic prediction and suppression
- Validate outputs on multiresolution time series, spatial, mobility, network and other data
- Develop new software packages in R/MATLAB/Python to make outputs accessible
- Engage with multidisciplinary collaborators to improve model robustness and flexibility
- Conduct and plan own scientific work with appropriate supervision and mentoring
- Take initiatives in the planning, design, delivery and dissemination of research
- Conduct data analysis and model inference in an open, rigorous and reproducible way
- Present findings at conferences and meetings both nationally and internationally
- Publish research papers in high quality, peer reviewed journals and conferences
- Attend relevant workshops and conferences for training and development as needed
- Develop contacts and collaborations across the college and the wider community
- Co-supervise undergraduate, MSc and PhD students as required
- Contribute to bids and proposals for research grants and pump priming funding
- Engage with internal and external collaborators, which may require international travel

Other Duties:

- Undertake any necessary training and/or development (including departmental courses)
- Undertake any appropriate administration, educational or teaching tasks
- Any other duties as may be deemed reasonable by the group leader, college or funder

The role is ideally suited for those with quantitative and data science backgrounds looking to transition into epidemic modelling. However, the required expertise is flexible. Motivated candidates showing an aptitude for learning new skillsets and approaching problems from multidisciplinary perspectives are encouraged to apply. For more information or unofficial discussion about the post please get in touch at k.parag@imperial.ac.uk. For informal chats about the wider group research culture and work style please contact Dr Sandor Beregi at s.beregi@imperial.ac.uk.

Please apply online and include a CV with full publication list and a statement (1-2 pages) on how your skills, background and outputs make you well-suited for this role.

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Person Specification

Requirements Candidates/post holders will be expected to demonstrate the following:	**Essential (E)/ Desirable (D)**
Education	
Research Associate: Hold a PhD in a quantitative or computational discipline e.g., artificial intelligence, engineering, statistics, computer science, mathematics, physics, computational biology, epidemiology or ecology, data science or a related field. **Candidates who have not yet been officially awarded their PhD will be appointed as Research Assistant.*	E
Experience	
Strong mathematical and statistical skills evidenced in publications and qualifications	E
Research experience in developing and realising novel dynamical or network models	E
Experience coding and developing software packages in R or MATLAB/Python/Julia	E
Experience fitting and validating stochastic models on spatiotemporal data	E
Experience with inference, optimisation, data science tools and related methodology	E
Strong publication record in refereed journals in relevant quantitative disciplines	E
Research experience in infectious disease epidemiology or phylodynamics	D
Knowledge	
Knowledge of common practices in modelling (in relevant quantitative fields)	E
Knowledge of complex systems and/or multilayer network theory	E
Knowledge of reinforcement learning and/or optimal control methods	E
Knowledge of processing and working with real and complex datasets	E
Specific topic knowledge of issues relevant to the project	D
Skills & Abilities	
Ability to conduct a detailed review and appraisal of recent literature	E
Ability to learn, develop and apply new concepts from different fields	E
Creative approach to problem-solving and model/method development	E
Excellent verbal communication skills and ability to deal with a wide range of people	E
Excellent written communication skills and the ability to write clearly for publication	E
Ability to organise own work with minimal supervision and to prioritise deadlines	E
Advanced computer skills, including programming, LaTeX, GitHub and others	E
Other	
Willingness to work as part of a team and to be open-minded and cooperative	E
Flexible and disciplined attitude towards work and regard for data confidentiality	E
Willingness to undertake any necessary training or learning for the role	E
Willingness to travel abroad to conduct research and attend conferences (1-2 weeks)	D

Further Information

Please note that job descriptions cannot be exhaustive, and the post-holder may be required to undertake other duties, which are broadly in line with the above key responsibilities.

Imperial College is committed to equality of opportunity and to eliminating discrimination. All employees are expected to follow the Imperial Values & Behaviours framework. Our values are:

- Respect
- Collaboration
- Excellence

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- Integrity
- Innovation

Employees are also required to comply with all College policies and regulations paying special attention to: Confidentiality, Conflict of Interest, Data Protection, Equal Opportunities, Financial Regulations, Health and Safety, Information Technology, Smoking, Private Engagements and Register of Interests. They must also undertake specific training and assume responsibility for safety relevant to specific roles, as set out on the College Website Health and Safety Structure and Responsibilities page.

The College is a proud signatory to the San-Francisco Declaration on Research Assessment (DORA), which means that in hiring and promotion decisions, we evaluate applicants on the quality of their work, not the journal impact factor where it is published. For more information, see https://www.imperial.ac.uk/research-and-innovation/about-imperial-research/research-evaluation/

The College believes that the use of animals in research is vital to improve human and animal health and welfare. Animals may only be used in research programmes which are ultimately aimed towards finding new treatments and making scientific and medical advances, and where there are no satisfactory or reasonably practical alternatives to their use. Imperial is committed to ensuring that, in cases where this research is deemed essential, all animals in the College's care are treated with full respect, and that all staff involved with this work show due consideration at every level. Find out more about animal research at Imperial.

We are committed to equality of opportunity, to eliminating discrimination and to creating an inclusive working environment for all. We therefore encourage candidates to apply irrespective of age, disability, marriage or civil partnership status, pregnancy or maternity, race, religion and belief, gender reassignment, sex, or sexual orientation. We are an Athena SWAN Silver Award winner, a Disability Confident Leader and a Stonewall Diversity Champion.

March 2024