UNIVERSITY OF LEEDS

CANDIDATE BRIEF

Research Fellow in Urban Analytics (4 posts available)

School of Geography, Faculty of Environment

Salary: Grade 7 (£33,797 – £40,322 p.a.)

Reference: ENVGE1104

Closing date:

Fixed term for 2 years

We will consider job share/flexible working arrangements

Research Fellow in Urban Analytics

School of Geography, Faculty of Environment

Are you an ambitious researcher looking for your next challenge? Do you have a background in computer simulation, statistics, and data analytics? Do you want to further your career in one of the UK's leading research-intensive Universities?

Cities have emerged as the dominant form of economic and social organisation at a global scale. The new science of urban analytics envisions step changes in the health, prosperity, welfare and the quality of life for city inhabitants. It proposes to do this through the extraction of value from new and emerging forms of data, and by the development and deployment of methods in artificial intelligence and data science. As a long-established centre of excellence for spatial analysis and geocomputation, Leeds is taking a leading role in driving the international research agenda for urban analytics.

The Leeds Institute for Data Analytics (LIDA) at the University of Leeds, in partnership with the Alan Turing Institute, is seeking 4 new post-doctoral researchers to join our emerging Urban Analytics group. We are looking for ambitious and driven researchers with the capability, inventiveness and initiative to work alongside our established team of internationally recognised academics to drive this activity to higher levels.

LIDA currently hosts 36 major programmes with research funding in the order of £50 million (www.lida.ac.uk). Successful applicants will also have the opportunity to develop international collaborations and relationships by working with scientists overseas at our partner Universities. This position will therefore provide outstanding new networks for postdoctoral researchers to develop an exceptional programme of research innovation in line with the main aims of each project.

You should have a PhD (or be near to completion - i.e. your initial thesis needs to have been handed in at the point of application) in Geography, Computer Science, Mathematics/Statistics, Physics – or a related discipline with a significant component of programming and/or data science – and be able to demonstrate expertise in a range of data science approaches.



You will be primarily responsible for carrying out research on one of the named projects below, but will also work collaboratively with other members of the urban analytics team. Therefore a flexible approach will be required in this role. When applying, please indicate if you have a preference for one of the projects in particular. The lead contact for each project is indicated next to the project and further information on each project can be found in the Additional Information section.

1. **SPENSER – a Synthetic Population Estimation and Scenario Projection model.** Dr Nik Lomax (n.m.lomax@leeds.ac.uk).

2. **Uncertainty in agent-based models for smart city forecasts:** Professor Nick Malleson (n.s.malleson@leeds.ac.uk).

3. **Capturing relationships between individuals: Integrating Causal Inference and Agent-based modelling:** Professor Alison Heppenstall (a.j.heppenstall@leeds.ac.uk).

4. **Data Assimilation for Agent-Based Models (DUST):** Professor Nick Malleson (n.s.malleson@leeds.ac.uk).

What does the role entail?

The duties for all Research Fellows include:

- Contributing new ideas and perspectives to the wider Urban Analytics group;
- Writing high quality, robust, well documented computer software;
- Producing high quality research papers for publication in academic journals;
- Disseminating findings from the research project by preparing and delivering research presentations at conferences or other forums;
- Contributing to the development of new research funding applications, either in a leading role or as a co-investigator;
- Planning and managing your own research activity in collaboration with the project investigator and other members of the Urban Analytics team;
- Working both independently and also as part of a larger team of researchers, both at Leeds and the Alan Turing Institute, engaging in knowledge-transfer activities where appropriate and feasible;



- Maintaining your own continuing professional development and acting as a mentor to less experienced colleagues as appropriate;
- Contributing to the training of both undergraduate and postgraduate students where appropriate, including assisting with the supervision of projects in areas relevant to the project(s).

These duties provide a framework for the role and should not be regarded as a definitive list. Other reasonable duties may be required consistent with the grade of the post.

What will you bring to the role?

As Research Fellow you will have:

- A PhD or near completion - i.e. the initial thesis needs to have been handed in at the point of application in Geography, Computer Science, Mathematics, Statistics, Physics or a related discipline with a significant component of programming and/or data science;
- An ability to think creatively when standard techniques or libraries are not suitable, in order to develop novel, innovative solutions to complex problems;
- Expertise in a range of data science approaches, for example machine learning, agent-based modelling, monte-arlo methods, statistical modelling, or microsimulation;
- Experience in developing new computer software for modelling and/or data analysis and knowledge of (or an enthusiasm to learn) languages that are commonly used in the research group such as Python, C++, and Java;
- An ability to write high-quality research papers with an emerging track record in the publication of scholarly articles in peer-reviewed journals;
- Excellent communication skills including evidence of having presented work at a high academic level and an ability to explain complicated technical work to colleagues in diverse fields;
- A proven ability to work closely with a small group of scientists and collaborate with a wider, multidisciplinary team;
- A strong commitment to your own continuous professional development;
- Ability to use initiative to develop and pursue new research ideas and algorithms in line with the requirements of the project.



You may also have:

- Evidence of winning funding for research projects (all projects);
- Expertise in the use of mathematical/statistical packages such as Matlab or R (all projects);
- An awareness of simulation techniques and enthusiasm to apply them in the context of modelling cities (projects 1, 2 and 4);
- Expertise in building agent-based models (projects 2, 3 and 4);
- Expertise in developing microsimulation models (project 1);
- Experience with data assimilation and/or related techniques (project 4).

How to apply

You can apply for this role online; more guidance can be found on our How to Apply information page. Applications should be submitted by 23.59 (UK time) on the advertised closing date.

Contact information

To explore the post further or for any queries you may have, please contact one of the individual project leads:

Professor Alison Heppenstall
Tel: +44 (0)113 343 3361
Email: A.J.Heppenstall@leeds.ac.uk

Professor Nick Malleson
Tel: +44 (0) 113 343 5248
Email: N.S.Malleson@leeds.ac.uk

Dr Nik Lomax
Tel: + 44(0)113 343 3321
Email: N.M.Lomax@leeds.ac.uk

Additional information

Find out more about the Faculty of Environment

Find out more about the School of Geography



Find out more about Athena Swan in the Faculty

A diverse workforce
The Faculty of Environment has received a prestigious Athena SWAN Silver award from Advance HE, the national body that promotes equality in the higher education sector. This award represents the combined efforts of all schools in the Faculty and shows the positive actions we have taken to ensure that our policies, processes and ethos all promote an equal and inclusive environment for work and study.

Details about the individual projects

1. SPENSER – a Synthetic Population Estimation and Scenario Projection model.
Lead: Dr Nik Lomax (n.m.lomax@leeds.ac.uk)

SPENSER is a synthetic population estimation and projection model which uses dynamic microsimulation. It provides the framework for estimates and projections of populations under different demographic, socioeconomic, infrastructure or other scenarios. SPENSER also provides a comprehensive set of tools for user created customisable scenario projections. The interactive interface allows users to set assumptions for the future (e.g. around economic, policy, health changes) which are translated to underlying demographic constraints (e.g. mortality, fertility, migration). The model draws on longitudinal datasets to estimate transition probabilities under different assumptions and allows users to generate 'what if' scenarios which can be translated to small area projections.

2. Uncertainty in agent-based models for smart city forecasts
Lead: Professor Nick Malleson (n.s.malleson@leeds.ac.uk)

Individual-level modelling approaches, such as agent-based modelling (ABM), are ideally suited to modelling the behaviour and evolution of social systems. However, there is inevitably a high degree of uncertainty in projections of social systems, so one of the key challenges facing the discipline is the quantification of uncertainty within the outputs of these models. The aim of this project is to develop methods that can be used to better understand uncertainty in individual-level models. In particular, it will explore and extend the state-of-the-art in two related areas: *ensemble modelling* and *emulators* (aka *surrogate models*) for use in individual-level models.



3. Capturing relationships between individuals: Integrating Causal Inference and Agent-based modelling.
Lead: Professor Alison Heppenstall (a.j.heppenstall@leeds.ac.uk)

This project will connect ongoing work in casual inference modelling to agent-based simulations to capture and simulate relationships between individuals. The integration of these methods will be explored, to enable sophisticated use of large and complex data that possess both overarching and fine granular information, and to aid the design of future complex simulations using an increasing number of novel forms of big data. One of the main outputs will be the development of a set of new methods drawn from causal inference modelling that can be readily applied to a range of case-studies (simulated via agent-based models) containing different types of relationships. Indicative Smart City problems that these methods can readily be applied to includes addressing problems around route choice or housing market behaviour.

4. Data Assimilation for Agent-Based Models (DUST)
Lead: Professor Nick Malleson (n.s.malleson@leeds.ac.uk)

The aim of the DUST project is to develop a comprehensive agent-based simulation that can be used to model the current state of an urban area and provide valuable information to policy makers. Agent-based modelling is an ideal methodology for this type of simulation but one that suffers from a serious drawback: **models are not able to incorporate up-to-date data to reduce uncertainty**. There is a wealth of new data being generated in 'smart' cities that could inform a model of urban dynamics (e.g. from social media contributions, mobile telephone use, public transport records, vehicle traffic counters, etc.) but we lack the tools to incorporate these streams of data into agent-based models. The work on this project will involve further developing these *data assimilation* methods and working on a new agent-based model simulate the flows of people around urban areas in real time.

Working at Leeds

You can find out more about our generous benefits package and more about what it is like to work at the University and live in the Leeds area on our Working at Leeds information page.

Candidates with disabilities



Information for candidates with disabilities, impairments or health conditions, including requesting alternative formats, can be found on our Accessibility information page or by getting in touch with us at disclosure@leeds.ac.uk.

Criminal record information

Rehabilitation of Offenders Act 1974
A criminal record check is not required for this position, however, all applicants will be required to declare if they have any 'unspent' criminal offences, including those pending.

Any offer of appointment will be, in accordance with our Criminal Records policy. You can find out more about required checks and declarations in our Criminal Records information.