

The Alan Turing Institute

Research Associates – Evaluating Complex Forensic Evidence (Bayesian Methodology/Causal Bayesian Inference)

THE ALAN TURING INSTITUTE

There has never been a more significant time to work in data science and AI. There is recognition of the importance of these technologies to our economic and social future: the so-called fourth industrial revolution. The technical challenge of keeping our data secure and private has grown in its urgency and importance. At the same time, voices from academia, industry, and government are coming together to debate how these technologies should be governed and managed.

The Alan Turing Institute, as the UK's national institute for data science and artificial intelligence, plays an important part in driving forward advances in these technologies in order to change the world for the better.

The Institute is named in honour of Alan Turing, whose pioneering work in theoretical and applied mathematics, engineering and computing is considered to have laid the foundations for modern-day data science and artificial intelligence. The Institute's goals are to undertake world-class research, apply its research to real-world problems, driving economic impact and societal good, lead the training of a new generation of scientists, and shape the public conversation around data and algorithms.

After launching in 2015 with government funding from EPSRC and five founding universities, the Institute has grown an extensive network of university partners from across the UK and launched a number of major partnerships with industry, public and third sector. Today it is home to more than 400 researchers and a talented business team.

THE ROLE(S)

We are seeking up to **two** full-time post-doctoral Research Associates (RAs) to work on the Turing Project "Evaluation of Complex Forensic Evidence". Researchers will be part of a team of top Bayesian, decision theory and causal inference academics, and be based at The Alan Turing Institute. The research team includes, Anjali Mazumder (co-PI), Amy Wilson (co-PI), Jim Smith (Warwick), Philip Dawid (Cambridge), Henry Wynn (LSE), and colleagues across Europe and the US. Researchers will meet regularly with the research team and should expect to engage with domain experts.

The evaluation of forensic evidence often involves complex scenarios consisting of more than one evidence type, each with an associated uncertainty, and a hierarchy of propositions to be addressed. Data to calculate probabilities can be limited as case circumstances are often unique and propose multiple causal and decision-making pathways. This means that each case might have different sets of relevant information affecting the dependence relationship between measured and unobserved variables or events. The sensitive nature and individuality of cases often means that there is limited population and experimental data due to practical and ethical issues. This project aims to draw upon real cases to determine the multiple statistical issues and complex data structure to develop a framework for the evaluation of complex evidence evaluation.

Each role will have specific goals but will also complement each other and work jointly towards:

- Developing a coherent, systematic, and probabilistic framework for planning, inference, and interpretation of complex cases that accounts for multiple types of evidence, addresses different proposition levels and incorporates expert judgement and multiple sources of uncertainty.

- Developing statistical methods (including probabilistic graph structures) to address the computational complexities of combining different graph modular substructures, model evidence conflict (model selection), and facilitates the case circumstances and time or sequence of events.

Role 1 (Bayesian Methodology)

- Develop new statistical methods for modelling forensic evidence scenarios with a large number of variables and with complex correlation structures, for example trace and pattern evidence (e.g. drug traces, fibres, inks, toolmarks, chemometric evidence). This will also involve consideration of the robustness and sensitivity of the models to any input assumptions.

Role 2 (Causal Bayesian Inference)

- Develop causal algebraic structure and models, exploring the modern theory of causation based on DAGs to understand how models can be protected from hidden confounders using careful conditioning with observational data where there is no formal controlled experiments or randomized trial - "natural experiments", and where we aim to address activity level questions and justify decision-making.

Informal enquiries may be made to the PIs: Amy Wilson Amy.L.Wilson@ed.ac.uk and Anjali Mazumder at amazumder@turing.ac.uk.

DUTIES AND RESPONSIBILITIES

- Perform high quality research in Bayesian modelling, causal inference and its applications as relevant to the project.
- Write and contribute to research publications, documenting results of the research, to publish in relevant peer-reviewed scientific journals of international standing, to present these results at conferences and workshops, and to communicate results to a wide audience and through multiple mediums.
- Assist in the organisation of and participate in regular meetings and special workshops with the research team, designated members of staff and with other collaborators.
- Collaborate with colleagues in government and industry both on research and on taking methods developed towards wider use.
- Travel as necessary to meet with internal and external collaborators.
- Take initiative and make original contributions to the research programme wherever possible, and to contribute freely to the team research environment in a manner conducive to the success of the research project as a whole.

PERSON SPECIFICATION

Essential

- PhD (or close to completion) or equivalent experience in statistics, machine learning, (quantitative) philosophy or a related discipline
- Ability to programme in R and/or Python

- Excellent written and verbal communication skills including the ability to present complex or technical information, and to communicate effectively with analysts and other stakeholders outside the research community.
- Ability to collaborate successfully with colleagues in government and industry.
- Ability to work as a member of a team. Ability to lead one's own work, including planning and execution, and to prioritise work to meet deadlines. Ability to organise working time, take the initiative, and carry out research independently, under the guidance of the PI.

Desirable

- Specialist expertise in a relevant area of methodology, Bayesian modelling and population statistics (R1), Bayesian modelling and causal inference (R2)
- Experience of collaboration with government, or with analyst teams in other sectors outside academic research.
- Experience of collaboration with other academic disciplines.
- Interest in forensic science and/or legal reasoning.

APPLICATION PROCEDURE

If you are interested in this opportunity, please send your CV, with contact details for your referees and a covering letter to jobs@turing.ac.uk. If you have questions or would like to discuss the role further with a member of the Institute's HR Team, please contact them on 0203 862 3394 or email HR@turing.ac.uk.

Further information about the Turing, the role, duties and responsibilities can be found on the Turing website and person specification here enclosed.

The Alan Turing Institute is committed to creating an environment where diversity is valued and everyone is treated fairly. In accordance with the Equality Act, we welcome applications from anyone who meets the specific criteria of the post regardless of age, disability, ethnicity, gender, gender reassignment, marital and civil partnership status, pregnancy, religion or belief or sexual orientation. Reasonable adjustments to the interview process can also be made for any candidates with a disability.

Please note all offers of employment are subject to continuous eligibility to work in the UK and satisfactory pre-employment security screening which includes a DBS Check.

Full details on the pre-employment screening process can be requested from HR@turing.ac.uk.