

The Alan Turing Institute

Senior Postdoctoral Research Associate in Geometry of Deep Learning, Turing-Roche partnership

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 500 researchers, a rapidly growing team of in house research software engineers and data scientists and a business team.

BACKGROUND

[The Health and Medical Sciences Programme](#) at Turing delivers research into the theory and methods of AI, statistics, and data analytics underpinning medical and health applications that will enable scientists to do better science, without compromising respect for privacy and patient trust.

Hoffman La-Roche (Roche) has been committed to improving lives since it was founded in 1896 in Basel, Switzerland. Today, Roche creates innovative medicines and diagnostic tests that help millions of patients globally and was one of the first companies to bring targeted treatments to patients.

In 2021 the Alan Turing Institute and Roche initiated a world-leading industry and academic partnership in advanced analytics strategic focused on enabling the transformative benefits of personalized healthcare to become a reality for patients around the world.

The [Turing-Roche Strategic Partnership](#) covers multiple activities, with the "North Star" of developing new data science methods to investigate large, complex, clinical and healthcare datasets to better understand how and why patients respond differently to treatment, and how treatment can be improved. Understanding such "treatment heterogeneity" is a problem at the forefront of modern medicine and is an essential first step toward the ambitious goal of developing a personalized healthcare.

ROLE PURPOSE

The Turing-Roche partnership is now recruiting a Senior Postdoctoral Research Associate to investigate how tools from geometry and network science can be used to better understand the uncertainty associated with predictions from deep learning models and make recommendations on how this can be minimized in future models. Deep learning represents a very powerful method for learning complex, multiscale patterns in data and is used often in healthcare. However, the fundamental mechanisms by which this learning is achieved are not well understood. This project will use tools from geometry, topology, and network science to derive a more detailed understanding of how deep learning works and how uncertainty propagates in deep neural networks, in order design more robust learning methods that require less tailoring for specific datasets and algorithms. The ultimate aim of this work is to develop theoretical understandings that can then be applied in order to advance deep learning in personalized healthcare applications. The candidate will have freedom to develop their own programme of work in this area, under supervision, but it is expected to include topics such

as explore how network tools such as discrete curvature can be applied to interpret deep neural network architectures; exploring geometric approaches to deep learning, using tools from differential geometry; in particular, correspondences between deep learning and Ricci flow; exploring intersections between statistical mechanics and geometric approaches to deep learning, in order to leverage synergies, all developed with a view on applying these learnings to models in healthcare to improve patient outcomes. These theoretical discoveries are expected to be explored in tandem with their application in healthcare and contribute towards the progression of the clinical AI domain.

The successful candidate will also contribute to developing and shaping the direction of research in the Turing-Roche partnership, including working with Turing and Roche scientists on other established research projects. The successful candidate will form part of the Turing's Health and Medical Sciences programme team, led by Director Professor Chris Holmes and Deputy Director Professor Ben MacArthur and supported by the Business Team for the programme. They will work closely with colleagues at the Turing and advanced analytics leaders and scientists at Roche and will have the opportunity for regular interactions with the partnerships' advisory group of senior academic experts.

As well as working closely with colleagues at the Roche site at Welwyn within the UK, they will be supported to travel internationally to collaborate with Roche colleagues at other sites (particularly, San Francisco and Basel). The successful candidate will be expected to spend some time working at one or more of the Roche sites to develop relationships and an increased understanding of the pharmaceutical industry.

This is a stand-out opportunity to join a prestigious, national research institute and shape its agenda at an important and exciting time in its development. Working within the partnership will give the successful candidate visibility of many facets of the pharmaceutical industry and support to develop a network of contacts in both academia and industry. As well as being exposed to a variety of analytical methodologies and applications within the partnership they will also have the freedom to develop their own area of aligned research under the mentorship from senior leaders in both academia and industry.

DUTIES AND AREAS OF RESPONSIBILITY

- To assist with the development and delivery of an ambitious programme of research in the area of geometry and deep learning including generating high quality research outputs, aligned with the aims and objectives of the partnership.
- To undertake high-quality independent research, which will support the partnership in its goal of understanding patient heterogeneity.
- Write or contribute to publications or disseminate research findings using other appropriate media.
- To communicate research outputs to diverse stakeholders, through conferences, events, meetings, and press opportunities as appropriate.
- To work closely with the Turing and Roche communications teams to disseminate and publicise key findings, communicating complex ideas through a variety of mediums.
- Present research updates at meetings both within the Turing and Roche and contribute to both the internal and external visibility of the partnership and the Institute.
- To hold regular meetings with partnership members, and travel as necessary to present work and meet with external collaborators.
- Represent the partnership at relevant external conferences and events and contribute to the public communication strategy around the partnership.
- Cultivate strong relationships with internal stakeholders, liaising with the Turing's Programme Management team, Business team, Public Policy team and associated delivery partners across the Institute and its wider network.
- Drive collaboration with academic experts and broader research partners from across the Turing, Roche and the wider Turing / project community.
- Adhere to and promote principles of reproducible and ethical data science

- Ensure compliance with secure handling of data and health and safety in all aspects of work.
- Contribute to the broader research aims and challenges of the Turing Health and Medical Sciences programme, and ensure positive feedback to the project partnership.
- Contribute to the life of the Institute and support its community

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. This job description is written at a specific time and is subject to changes as the demands of the Institute and the role develop.

PERSON SPECIFICATION

Skills and Requirements Post holders will be expected to demonstrate the following	Essential (E) Desirable (D)	Tested at application(a) Tested at interview (i)
Education/Qualification		
A PhD (or equivalent experience and/or qualifications) in a relevant area which will include Statistics, Mathematics, Computer Science, or related discipline	E	A,I
Knowledge and Experience		
Substantial experience in statistical modelling and/or data analytics on significant real-world problems, including knowledge of geometry/topology, network science and/or deep learning	E	A,I
Substantial experience of using modern statistical programming languages (such as R and Python)	E	A,I
Ability to understand and apply the principles of reproducible data science	E	A,I
Experience in working with modern artificial intelligence technologies	E	A,I
Experience of developing and documenting analysis workflows for scientific research projects	E	A,I
Ability to perform relevant literature reviews	E	A,I
Ability to critically evaluate experimental results and derive evidence-driven conclusions	E	A,I
Communication		

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	E	I
Liaison and Networking		
Ability to collaborate successfully with colleagues in a multidisciplinary environment within the organisation or externally to share knowledge and information in order develop practice or help others learn	E	A
Ability to represent the partnership at practitioner events and high level meetings	E	A
Ability to establish academic collaborations nationally and internationally	E	A,I
Project Management and Project Delivery		
Ability to keep accurate and up to date knowledge of services available in own and related areas of work	E	I
Ability to work across the partnership to contribute and assist in diverse research activities	E	A,I
Ability to develop and lead collaborative research and innovation	E	A,I
Decision Making		
Ability to work with others to make collaborative decisions	E	A
Initiative and Problem Solving		
Ability to use own judgement to analyse and solve problems	E	A,I
Ability to consider possible solutions and identify with evidence those which offer widest benefits.	E	A,I
Ability to lead one's own work, including planning and execution, and to prioritise work to meet deadlines	E	A,I
Analysis and Research		
Ability to organise working time, take the initiative, and carry out research independently	E	A
Other Requirements		
Commitment to EDI principles and to the Organisation values	E	I

OUR VALUES

The Alan Turing Institute is committed to equality diversity and inclusion and to eliminating discrimination. All employees are expected to embrace, follow and promote our [EDI Principles](#) and Our [Values](#).



APPLICATION PROCEDURE

If you are interested in this opportunity, please click the apply button below. You will need to register on the applicant portal and complete the application form including your CV and covering letter. If you have questions about the role or would like to apply using a different format, please contact us on 020 3862 3533 or 0203 862 3516, or email recruitment@turing.ac.uk.

CLOSING DATE FOR APPLICATIONS: 10 May 2023 at 23:59

TERMS AND CONDITIONS

This full-time post is offered on a fixed term basis for 2 years. The annual salary is £53,576- £55,125 plus excellent benefits, including flexible working and family friendly policies, <https://www.turing.ac.uk/work-turing/why-work-turing/employee-benefits>

EQUALITY, DIVERSITY AND INCLUSION

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 reassignment, marital or civil partnership status, pregnancy and maternity, religion or belief, sex and sexual orientation.

We are committed to building a diverse community and would like our leadership team to reflect this. We therefore welcome applications from the broadest spectrum of backgrounds.

We are committed to making sure our recruitment process is accessible and inclusive. This includes making reasonable adjustments for candidates who have a disability or long-term condition. Please contact us at adjustments@turing.ac.uk to find out how we can assist you.

Please note all offers of employment are subject to obtaining and retaining the right 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.