



The Alan Turing Institute

MATHEMATICAL INSTITUTE
ANDREW WILES BUILDING

Job Description and Selection Criteria

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| Job title | Postdoctoral Research Associate in Data Science for Mental Health |
| Division | Mathematical, Physical and Life Sciences |
| Department | Mathematical Institute (in association with the Department of Psychiatry and the Alan Turing Institute) |
| Location | Mathematical Institute, Andrew Wiles Building, Radcliffe Observatory Quarter, Woodstock Road, Oxford, OX2 6GG. Department of Psychiatry, Warneford Hospital, Warneford Lane, Headington, Oxford OX3 7JX Alan Turing Institute, British Library, 2QR, John Dodson House, 96 Euston Rd, London NW1 2DB |
| Grade and salary | Grade 7: £33,309 - £40,927 per annum |
| Hours | Full Time; the individual will be based in the Mathematical Institute and the Department of Psychiatry at the University of Oxford. They will be required to spend at least 25% of their time in the Department of Psychiatry, and up to two days per week at the Alan Turing Institute in London (in particular, to attend the liaison meetings of the team). |
| Contract type | Fixed-term (3 years, funded to 30 th April 2025) |
| Reporting to | Professor Terry Lyons |
| Vacancy reference | 155387 |
| Additional information | <p>This is a full-time position that cannot be held concurrently with any other substantive post without the explicit permission of the Head of Department.</p> <p>This post is subject to a 12-month probationary period.</p> <p>The funds supporting this research project are provided by EPSRC grant (EP/S026347/1) - Unparameterised multi-modal data, high order signatures, and the mathematics of data science.</p> <p>(PLEASE NOTE: Applicants are responsible for contacting their referees and making sure that their letters are received by the closing date)</p> |



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| <p>Recent publications</p> | <p>Imanol Perez Arribas, Guy Goodwin, John Geddes, Terry Lyons and Kate Saunders, 'A signature-based machine learning model for distinguishing bipolar disorder and borderline personality disorder'. <i>Translational Psychiatry</i> volume 8, Article number: 274 (2018).</p> <p>Bo Wang, Maria Liakata, Hao Ni, Terry Lyons, Alejo Nevado-Holgado and Kate Saunders, 'A Path Signature Approach for Speech Emotion Recognition', <i>International Speech Communication Association 2019</i>, pp. 1661–1665, 15 Sep 2019</p> <p>Bo Wang, Yue Wu, Nemanja Vaci, Maria Liakata, Terry Lyons and Kate Saunders, 'Modelling Paralinguistic Properties in Conversational Speech to Detect Bipolar Disorder and Borderline Personality Disorder', <i>International Conference on Acoustics, Speech and Signal Processing (ICASSP)</i>, pp. 7243-7247, 6 Jun 2021</p> <p>Bo Wang, Yue Wu, Niall Taylor, Terry Lyons, Maria Liakata, Alejo J Nevado-Holgado and Kate EA Saunders, 'Learning to Detect Bipolar Disorder and Borderline Personality Disorder with Language and Speech in Non-Clinical Interviews', <i>International Speech Communication Association 2020</i>, pp. 437–441, 16 Nov 2020</p> <p>John Pougue Biyong, Bo Wang, Terry Lyons and Alejo J Nevado-Holgado, 'Information Extraction from Swedish Medical Prescriptions with Sig-Transformer Encoder', <i>ACL Anthology 2020</i>, pp. 41–54, 1 Nov 2020</p> <p>Paul Moore, Terry Lyons and John Gallacher, 'Random forest prediction of Alzheimer's disease using pairwise selection from time series data', <i>Alzheimer's Disease Neuroimaging Initiative</i>, 14 Feb 2019</p> <p>Paul Moore, Terry Lyons and John Gallacher, 'Using path signatures to predict a diagnosis of Alzheimer's disease', <i>PLoS ONE</i> 14(9): e0222212, 19 Sep 2019</p> <p>Yue Wu, Terry Lyons and Kate Saunders, 'Deriving information from missing data: implications for mood prediction', <i>arXiv:2006.15030</i>, 8 July 2020</p> |
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The role

Applications are invited for a Postdoctoral Research Associate at the Mathematical Institute, University of Oxford. The position is funded by DataSig and is one of the core application areas for the project. The postholder will join a multi-university research group (Imperial College London, University College London and the University of Oxford) with a hub at the Alan Turing Institute focusing on innovative data science, as well as working with Psychiatrists in Oxford.

DataSig is a programme underpinned by the EPSRC programme grant “Unparameterised multi-modal data, high order signatures, and the mathematics of data science”. Its researchers exploit the mathematics of rough paths, in combination with more standard techniques, to develop better analyses of complex sequential data.

Capitalising on our connections with the Department of Psychiatry at Oxford, and our technical skills in analysing multi-modal data, this role aims to build on the existing research base to create an evidenced pathway towards converting rapidly fluctuating data streams, and particularly expressed/measured emotion into long term indicators useful in mental health. The role will require an ability to apply data techniques effectively within a mental health context. Specifically, with colleagues in the Department of Psychiatry at the University of Oxford (Dr Kate Saunders and Professor John Geddes), the eMOTIVE project is working towards this goal. One aim is to capture and analyse short-term measured emotion and summarise it into clinically-validated markers that can provide personal feedback on longer-term wellbeing and improve treatment and prognosis for bipolar disorder. An online trial APFEMA (HRA/NHS approved) has been developed to capture de-identified facial emotion from controls and service users with bipolar disorder.

The DataSig team have been working with the Department of Psychiatry in Oxford to make useful inference from data concerning the mental health of individuals. The core objective of the research programme is to use modern methodologies to create a ground shift in the availability and effective use of passively captured, de-identified, high-frequency personal data (evolving mood, stress levels, CRIS) to create informed longer-term feedback on the wellbeing of patients. We aim to produce informed analysis that can be used by the individual patient and their clinicians to give better oversight.

The capture and analysis of this data generate distinct challenges. These datasets are small, sequential, and multi-modal with many complexities and will generate many new benchmarks and challenges for the wider programme. Our domain scientists are working to develop signature methods and rough path techniques as cutting-edge tools for understanding complex sequential multi-modal data. The individual appointed to this post will be expected to work together with these researchers, interacting creatively with other PDRAs to apply these methodologies challenges arising in the mental health context.

When someone engages professional medical help in support of their mental health, potentially life-changing decisions have to be made on quite limited information, from medical records, interviews, etc. The situation is exacerbated by limited budgets, reducing access to professional support and the available information. Our goal is to create tools with potential to improve the effectiveness of this support.

One obviously important part of the client experience, impacting on and reflecting their mental health, is their emotional experience. However, its assimilation into the clinical process is largely through patient report at interview, and intuitive clinical observation.

The long-term goal of this project is to create practical tools that collect some of the rapidly changing expressed-emotion signals humans produce, translate them into meaningful long-term indicators that can be used by clinicians and service users to provide feedback and improve interventions.

The ambition is to exploit innovative mathematical techniques to enhance the power of this analysis, developing an effective and de-identified classification of ‘long-term emotional experience’ with diagnostic value; a set of measurements that ideally might be used in the mental health context in a similar way to the way hba1c measurements are used in the management of diabetes. The latter allows an understanding of blood sugar management over a period of months, whereas blood sugar levels fluctuate wildly on an hourly basis.

The project is based around ongoing relationships; eMOTIVE is an important collaboration between the Department of Psychiatry (Oxford) and our team. The long-term aim of the eMOTIVE project is to develop personalised intervention and management tools for patients with mood disorders, incorporating automated analysis of longitudinal mood data. Within the eMOTIVE umbrella, APFEMA (Analysing patients' facial expressions to improve mood assessments) is the protocol for the specific study of people with bipolar disorder or treatment resistant depression. A secure online data collection platform should be available soon to allow the collection of facial mood information. The analysis of this data will be carried out by the postholder in conjunction with other members of the Team.

The project will involve working closely with our project partners in health and mental health and with the principal investigator (PI), Professor Terry Lyons FRS (University of Oxford) and co-investigators, namely Thomas Cass (Imperial College London), Hao Ni, UCL) and Harald Oberhauser (University of Oxford). The successful candidate will also need to collaborate with other PDRAs in the wider DataSig team, with software engineers. They will actively engage with the investigators and generally be an enthusiastic and committed full-time postdoctoral researcher in the team.

Responsibilities

The successful candidate will be expected to:

- Contribute towards the aims of the programme at a high level through independent research involving the development of new methodologies and reviewing/refining existing theories as appropriate, and by acting as a source of information, advice and support to other members of the group
- Manage their own academic research and administrative activities. This involves small-scale project management, co-ordinating multiple aspects of work to meet deadlines
- Prepare and present papers at conferences or public meetings
- Contribute ideas for new research projects, develop ideas for generating research income, present ideas to colleagues, and collaborate in the preparation of research publications and book chapters
- Represent the research group at external meetings/seminars
- Collaborate and execute projects with colleagues in partner institutions and research groups

It is the policy of the Mathematical Institute to give all PDRAs the opportunity to teach, where the conditions of the grant allow this, and to require teaching if there is a departmental need. Such teaching, if undertaken, will not exceed 3 hours per week for 24 weeks of the year and additional remuneration will be paid. It will normally be delivered as classes, but it might also involve giving lectures or college tutorials.

Selection criteria

Essential selection criteria

- To have, or be close to completing, a PhD/DPhil in mathematics, multi-modal data analysis, or other field related to the Programme;
- Possess the imagination, capability, and motivation to use data science effectively to add value to our research in mental health;
- Demonstrate a willingness and ability to work effectively with a team of researchers and across disciplines, capitalise on the skill sets of the team, and contribute towards the Programme's overall aims and objectives;
- Display clear evidence of outstanding promise and originality in research, with a good publication record, commensurate with career stage
- Possess excellent written and verbal communication skills, including the ability to write clearly and succinctly for publication, present research proposals and results, and represent the research group at meetings
- Possess strong computational skills
- Have an awareness of external issues and constraints (such as confidentiality, ethics, ED&I)
- Ability to exercise initiative and judgement in carrying out research tasks, and to organise and prioritise own work independently in response to deadlines whilst keeping accurate records of research results and activity, help with reporting

Desirable selection criteria

- Successful track record of analysis of mental health data
- Experience of using rough paths in data analysis
- Ability to assess resource requirements and deploy them effectively
- Willingness and ability to report and present work to a wider community

Pre-employment screening

If you are offered the post, the offer will be subject to standard pre-employment checks. You will be asked to provide: proof of your right-to-work in the UK; proof of your identity; and (if we haven't done so already) we will contact the referees you have nominated. You will also be asked to complete a health declaration so that you can tell us about any health conditions or disabilities for which you may need us to make appropriate adjustments and a declaration of any unspent criminal convictions. The successful candidate will need to successfully complete security clearance to satisfy the ATI's usual screening policy; this will include a Criminal Records Check.

Please read the candidate notes on the University's pre-employment screening procedures at: <https://www.jobs.ox.ac.uk/pre-employment-checks>

Additional security pre-employment checks

This job includes the following duties which will require additional security pre-employment checks:

- It is expected that, subject to a satisfactory DBS check, the successful candidates will be visiting researchers at the Alan Turing Institute.
- A satisfactory Disclosure and Barring Service check due to regulated activity involving 'at risk' adults

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford's researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual's unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe's most entrepreneurial universities and we rank first in the UK for university spin-outs, and in recent years we have spun out 15-20 new companies every year. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information, please visit www.ox.ac.uk/about/organisation.

The Mathematical Institute

The Mathematical Institute, as Oxford's Department of Mathematics is known, is one of the leading mathematics departments in the world. Our mathematical research, impact and environment were all ranked first in the UK in the 2014 Research Excellence Framework exercise, a government review of research in all UK universities. The Mathematical Institute is the focus of research into both fundamental mathematics and its applications, and our inclusive nature and overall size are key factors in the provision of an outstanding research environment for our members. The large number of faculty, postdocs and students in the Mathematical Institute, all supported by excellent facilities, allows us to maintain a critical mass in research groups encompassing a wide spectrum of mathematics, while our integrated nature fosters collaboration between fields. We also host a large number of academic visitors. Our web pages (www.maths.ox.ac.uk) provide comprehensive information about all of our activities.

The research activities of the Institute as a whole can be gauged from the web pages of the research groups and centres within the Institute (www.maths.ox.ac.uk/research). The range of our research interests is well reflected by the profile of our faculty as listed at www.maths.ox.ac.uk/people. Many members of the Institute have received prestigious prizes and other special recognition for their work; some recent examples can be found at www.maths.ox.ac.uk/news/awards-and-prizes.

The Mathematical Institute moved into the purpose-built Andrew Wiles Building in the University's Radcliffe Observatory Quarter in September 2013. As well as providing offices for all staff and graduate students, it houses a range of other facilities available to members of the

department, including the Whitehead Library, a large range of meeting rooms, teaching spaces, lecture rooms, and social spaces, and a small facility for carrying out table-top experiments. For more information, see www.maths.ox.ac.uk/about-us.

Teaching is central to the life of the Mathematical Institute and we have around 900 undergraduates on course, some on joint courses with other departments. We teach around 250 students each year across five taught master's degree courses, and have over 250 doctoral students in residence at any one time. Our doctoral programme always attracts the best research students from across the world, and we have a broad mentoring and training programme.

The Mathematical Institute strives to ensure that all staff and students are given the opportunities and support they need to achieve their potential. We are committed to equality of opportunities and to advancing women's careers. We support staff returning from long-term absence and provide flexible arrangements for staff with parental responsibilities. Further information about family support can be found in the Standard Terms and Conditions. Our Equality, Diversity and Inclusion Committee¹ contributes to many aspects of our work, see <https://www.maths.ox.ac.uk/members/governance/committees/standing-orders-and-memberships/equality-diversity-and-inclusion>.

As part of the department's commitment to openness, inclusivity and transparency, we strongly encourage applications from all who consider they meet the requirements of the post, and particularly from women and ethnic minorities.

For more information on the Mathematical Institute, please visit: www.maths.ox.ac.uk

The Mathematical Institute holds a silver Athena Swan award to recognise advancement of gender equality: representation, progression and success for all.

The Mathematical, Physical, and Life Sciences Division

The Mathematical, Physical, and Life Sciences (MPLS) Division is one of the four academic divisions of the University. In the results of the six-yearly UK-wide assessment of university research, REF2014, the MPLS division received the highest overall grade point average (GPA) and the highest GPA for outputs. We received the highest proportion of 4* outputs, and the highest proportion of 4* activity overall. More than 50 per cent of MPLS activity was assessed as world leading.

The MPLS Division's 10 departments and 3 interdisciplinary units span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. Our research addresses major societal and technological challenges and is increasingly focused on key interdisciplinary issues. MPLS is proud to be the home of some of the most creative and innovative scientific thinkers and leaders working in academe. We have a strong tradition of attracting and nurturing the very best early career researchers who regularly secure prestigious fellowships.

¹ The Mathematical Institute was a founding supporter of the London Mathematical Society's Good Practice Scheme (www.lms.ac.uk/women/good-practice-scheme). We have held an Athena SWAN Bronze Award since 2013, upgraded to Silver in 2017.

We have around 6,000 students and play a major role in training the next generation of leading scientists. Oxford's international reputation for excellence in teaching is reflected in its position at the top of the major league tables and subject assessments.

MPLS is dedicated to bringing the wonder and potential of science to the attention of audiences far beyond the world of academia. We have a strong commitment to supporting public engagement in science through initiatives including the Oxford Sparks portal (<http://www.oxfordsparks.net/>) and a large variety of outreach activities. We also endeavour to bring the potential of our scientific efforts forward for practical and beneficial application to the real world and our desire is to link our best scientific minds with industry and public policy makers.

For more information about the MPLS division, please visit: <http://www.mpls.ox.ac.uk/>

How to Apply

Applications are made through our e-recruitment system and you will find all the information you need about how to apply on our Jobs website <https://www.jobs.ox.ac.uk/how-to-apply>.

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

As part of your application you will be asked to provide details of two referees and indicate whether we can contact them now.

You will also be required to upload a curriculum vitae, list of publications, a statement of research interests and a supporting statement. The supporting statement must explain how you meet each of the selection criteria for the post using examples of your skills and experience. This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants).

Please upload all documents **as PDF files** with your name and the document type in the filename, quoting vacancy reference **155387**.

Applicants should ask their referees to send their letters of reference DIRECTLY to

The Recruitment Coordinator (Vacancies)
Mathematical Institute, Andrew Wiles Building, Radcliffe Observatory Quarter, Woodstock Road, Oxford, OX2 6GG. Tel: 01865 273525: Email: vacancies@maths.ox.ac.uk

by the closing date (a letter by email is sufficient) **quoting the vacancy reference 155387**.

Referees should preferably not all be from the same institution and whenever possible one should be the applicant's current, or most recent, supervisor. **NOTE: reference letters must be received from your referees by the closing date for your application to be complete.**

All applications must be received by **12:00 noon UK time on Monday 31st January 2022**.

Interviews are anticipated to take place in mid-February 2022.

Information for priority candidates

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing department(s).

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments).

DATA PROTECTION: All data supplied by applicants will be used only for the purposes of determining their suitability for the post, and will be held in accordance with the principles of the Data Protection Act 1998 and the department's data protection policy.

<https://www.maths.ox.ac.uk/members/policies/data-protection/statement>

Due to the large volume of recruitment that the department administers we are unable to provide feedback to non-shortlisted applicants.

If you need help

Help and support is available from: <https://hrsystems.admin.ox.ac.uk/recruitment-support>

If you require any further assistance please email recruitment.support@admin.ox.ac.uk.

To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will receive an automated email from our e-recruitment system to confirm receipt of your application. **Please check your spam/junk mail** if you do not receive this email.

Important information for candidates

Data Privacy

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University's Privacy Notice for Job Applicants at: <https://compliance.admin.ox.ac.uk/job-applicant-privacy-policy>. The University's Policy on Data Protection is available at: <https://compliance.admin.ox.ac.uk/data-protection-policy>.

The University's policy on retirement

The University operates an Employer Justified Retirement Age (EJRA) for all academic posts and some academic-related posts. The University has adopted an EJRA of 30 September before the 69th birthday for all academic and academic-related staff in posts at **grade 8 and above**. The justification for this is explained at: <https://hr.admin.ox.ac.uk/the-ejra>

For **existing** employees, any employment beyond the retirement age is subject to approval through the procedures: <https://hr.admin.ox.ac.uk/the-ejra>

There is no normal or fixed age at which staff in posts at **grades 1–7** have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

Equality of opportunity

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Benefits of working at the University

Employee benefits

University employees enjoy 38 days' paid holiday, generous pension schemes, travel discounts, and a variety of professional development opportunities. Our range of other employee benefits and discounts also includes free entry to the Botanic Gardens and University colleges, and discounts at University museums. See <https://hr.admin.ox.ac.uk/staff-benefits>

University Club and sports facilities

Membership of the University Club is free for all University staff. The University Club offers social, sporting, and hospitality facilities. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See www.club.ox.ac.uk and <https://www.sport.ox.ac.uk/>.

Information for staff new to Oxford

If you are relocating to Oxfordshire from overseas or elsewhere in the UK, the University's Welcome Service website includes practical information about settling in the area, including advice on relocation, accommodation, and local schools. See <https://welcome.ox.ac.uk/>. There is also a visa loan scheme to cover the costs of UK visa applications for staff and their dependents. See <https://staffimmigration.admin.ox.ac.uk/visa-loan-scheme>

Family-friendly benefits

With one of the most generous family leave schemes in the Higher Education sector, and a range of flexible working options, Oxford aims to be a family-friendly employer. We also subscribe to My Family Care, a service that provides practical advice and support for employees who have caring responsibilities. The service offers a free telephone advice line, and the ability to book emergency back-up care for children, adult dependents and elderly relatives. See <https://hr.admin.ox.ac.uk/my-family-care>

The University has excellent childcare services, including five University nurseries as well as University-supported places at many other private nurseries.

For full details, including how to apply and the costs, see <https://childcare.admin.ox.ac.uk/>

Disabled staff

We are committed to supporting members of staff with disabilities or long-term health conditions. For further details, including information about how to make contact, in confidence, with the University's Staff Disability Advisor, see <https://edu.admin.ox.ac.uk/disability-support>

Staff networks

The University has a number of staff networks including the Oxford Research Staff Society, BME staff network, LGBT+ staff network and a disabled staff network. You can find more information at <https://edu.admin.ox.ac.uk/networks>

The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is an organisation run by volunteers that aims to assist the partners of new staff settle into Oxford, and provides them with an opportunity to meet people and make connections in the local area. See www.newcomers.ox.ac.uk.