Ollscoil Mhá Nuad
Maynooth University

Department of Computer Science and the Hamilton Institute
Post-Doctoral Researcher: Formal Verification and ML
Specified Purpose Contract

The Role

Maynooth University is committed to a strategy in which the primary University goals of excellent research and scholarship and outstanding education are interlinked and equally valued.

The Department of Computer Science at Maynooth University, Ireland, has a further opportunity for a postdoctoral researcher to join the RINN – Research Ireland Centre for Data Science and Artificial Intelligence, within the Formal Verification and Machine Learning research theme.

This role is part of a national Centre, Rinn Artificial Intelligence – Research & Innovation in Data Science and AI, a multi-institutional interdisciplinary National Centre for Data Science and AI funded by Research Ireland. This position for Post-Doctoral research will sit within the Faculty of Science and Engineering under the supervision of Rinn AI Research Ireland Principal Investigator, Professor Rosemary Monahan.

The successful candidate will join an interdisciplinary team of researchers working at the interface of formal software verification and artificial intelligence. In this role, the researcher will work heavily with differentiable logics for machine learning. The developed methodologies are expected to contribute to the advancement of safe, reliable, and verifiable AI systems for safety-critical applications.

The Project: Correct-by-Construction Neural Networks via Differentiable Logics

Neural networks often fail to learn safety and correctness properties from data alone. While formal verification can determine whether a trained neural network satisfies these properties, it does not inherently guide the network toward satisfying them during the training process. Currently, differentiable logics attempt to bridge this gap by

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incorporating logical specifications directly into training—interpreting them as real-valued loss terms. However, while this improves performance, it typically does not translate to formally verified constraint satisfaction.

This project will further recent advancements in differentiable logic-based training and verification. Specifically, the research will investigate the combination of abstract interpretation and differentiable logics to develop methodologies for obtaining "correct-by-construction" neural networks.

Principal Duties

Research & Technical Development

- Conduct independent and collaborative research at the intersection of formal verification and machine learning.
- Develop novel methodologies aimed at obtaining correct-by-construction neural networks.
- Design and execute a practical case study to demonstrate the real-world applicability and practicalities of the research.
- Contribute to open science by disseminating research software and reproducible computational tools.

Collaboration & Interdisciplinary Teamwork

- Work closely with the Principal Investigator (PI) and co-supervisors across the Department of Computer Science, the Hamilton Institute, and the Principles of Programming research group at Maynooth University.
- Collaborate with researchers from RINN (Research Ireland Centre for AI), and closely within the research theme on Formal Verification and ML.
- Actively contribute to broader interdisciplinary research activities.

Academic Dissemination & Leadership

- Publish research outcomes in leading international journals and conferences.
- Present research findings at national and international scientific meetings.
- Contribute to the supervision and mentorship of undergraduate, MSc, and PhD students where appropriate.
- Participate in the preparation of future research proposals and other collaborative academic activities.

The ideal candidate will have:

Essential

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- **Educational Background:** A PhD (awarded or viva successfully completed prior to the start date) in Computer Science or a related discipline.
- **Technical Expertise:** A strong background in neural network formal verification, including practical experience with relevant tools/techniques, and knowledge of differentiable logics and abstract interpretation.
- **Proven Output:** A track record of relevant peer-reviewed publications and the ability to consistently meet project deliverables.
- **Working Style:** A highly analytical and detail-oriented approach to problem-solving, with the initiative and flexibility to work autonomously.
- **Collaboration & Communication:** Excellent interpersonal, written, and oral communication skills, with a genuine eagerness to collaborate effectively within a team environment.

Desirable

- Working knowledge of tools for embedding logical specifications into neural networks.
- Experience working with VNNCOMP Benchmarks.

Faculty and Research Institutes

The Faculty of Science and Engineering comprises the departments of Biology, Chemistry, Computer Science, Electronic Engineering, Experimental Physics, Mathematics and Statistics, Psychology, and Theoretical Physics. The role of the Faculty is to co-ordinate the academic activities of individual departments, to oversee the strategic development of departments and to support interdepartmental programmes. The University has also developed a number of interdisciplinary institutes to support excellent research and to build research capacity across disciplines.

Department of Computer Science

The Department of Computer Science was established in 1987 and has a current complement of 35 full-time staff. The members of the department, including academic staff, post doctorates, and PhD students are active in a number of key research areas with established groups in: Artificial Intelligence, Cognitive modelling, Computer Science education, Computer vision, Data analytics, Dependable software; DNA and Molecular computing; Formal Methods and software verification; Foundations of Computer Science, Geocomputation, Image and optical processing; Information theory; Machine Learning; Multimedia signal processing; Natural language processing; Robotics; Theoretical computer science;

The Department offers a vibrant learning environment for taught undergraduate and postgraduate programmes including:

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- BSc Computer Science with Award Pathways in Software Engineering and Interactive Digital Media
- BSc Computer Science and Artificial Intelligence
- BSc Computational Thinking
- BSc Robotics and Intelligent Devices
- MSc in Software Engineering
- MSc in Computer Science Applied
- Erasmus Mundus Joint MSc in Advanced Systems Dependability
- Higher Diploma in Software Development

The department's staff, post doctorates, and PhD students also contribute to research centres and institutes in the University, in particular to the Hamilton Institute, the National Centre for Geocomputation, Assisted Living and Learning (ALL) Institute, Innovation Value Institute (IVI), and the Lonsdale Human Health institute.

The Hamilton Institute

Maynooth University's Hamilton Institute promotes interdisciplinary research spanning applied mathematics, computer science, engineering, and statistics. It aims to bridge the gap between theory and its application in science and technology. It boasts over thirty-five affiliated faculty drawn from departments across the university, and currently hosts six internationally recognised research teams working in applied probability, data privacy, molecular computing, telecommunications, and statistics and machine learning. It has strong links to a broad range of national research centres, including the SFI Research Centres CONNECT, iCRAG, I-FORM, INSIGHT and LERO. It hosts European Research Council, Science Foundation Ireland, and EU Horizon 2020 grants. It co-hosts the €22M Science Foundation Ireland Centre for Research Training in the Foundations of Data Science, which provides a steady stream of funded PhD studentships as well as pre-existing relationships with industry and enterprise to cognate faculty.

The Institute's commitment to real applications work is reflected in its long history of industry links. It's commitment to research excellence is reflected in its research output, active links with leading international research groups (at Harvard University, Imperial College London, Institute Curie, the Massachusetts Institute of Technology, and many others), and consistently high ratings in external quality reviews carried out over the last 20 years as part of research project assessments and university governance. The Institute hosts a sizeable PhD cohort, has an active international visitor programme, and organises a number of high-profile international workshops each year.

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The University



Maynooth University is a very distinctive university, a collegial institution focused on science and engineering, humanities, and social sciences, and equally committed to research, teaching and community engagement. Located in Ireland's only university town, its distinctive features and character owe much to its unique history and heritage. It provides a high-quality educational experience to over 17,000 students on a campus with 18th century roots and 21st century dynamism.

Maynooth University is a place of lively contrasts – a modern institution, dynamic, rapidly-growing, research-led and engaged, yet grounded in historic academic strengths and scholarly traditions. We offer a range of programmes at undergraduate, postgraduate and doctoral level in the humanities, science and engineering and social sciences, including business, law and education, along with a range of international programmes and partnerships.

The strategic trajectory and accomplishments of Maynooth University, since its establishment as an autonomous public university, are exceptional and a source of great pride to the university community, staff, students and alumni. Maynooth University ranked in the top 90 global Times Higher Education (THE) Young University rankings in 2024. Maynooth University's growing global reputation is based on the originality, quality, importance and impact of its research and scholarship, commitment to teaching and learning, the quality of academic programmes, and its leadership in widening participation in higher education. The sources of success are the dedication of its staff and the energy and engagement of its students.

Maynooth University's Values

Our values define who we are, what we believe in and how we act as a community. They underpin our future success and guide our expectations of ourselves and each other. Our values apply to everyone in the University community:

- Integrity
- Collegiality

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- Responsibility
- Freedom of expression
- Ambition

Maynooth University Strategic Plan 2023 – 2028

The University's Strategic Plan 2023 - 2028 builds on our rich academic history and strong foundations to set out an ambitious and forward-looking path for the future of our University. This roadmap underscores our commitment to adapt to a changing world while staying true to our values. Our vision is to be a university of excellence, opportunity and impact, having a significant stake in all three. For more information about Maynooth University's future direction, please visit: https://strategy.maynoothuniversity.ie/

Plean Straitéiseach Ollscoil Mhá Nuad 2023 - 2028

Tógann Plean Straitéiseach na hOllscoile 2023 - 2028 ar ár stair acadúil shaibhir agus ar ár mbunchlocha láidre chun conair uaillmhianach agus cheannródaíoch a leagadh amach do thodhchaí ár nOllscoile. Soiléiríonn an treochlár seo ár dtiomantas do dhul i dtaithí ar dhomhan atá ag síorathrú agus ár ngníomhaíochtaí a chur in oiriúint dó, agus san am céanna a bheith dílis dár luachanna Ollscoile. Is í an fhís atá againn a bheith mar ollscoil feabhais, deiseanna agus tionchair, agus lámh láidir a bheith againn i ngach ceann de na trí ghné seo.

Léigh anseo le haghaidh breis eolais faoi thodhchaí Ollscoil Mhá Nuad: https://strategy.maynoothuniversity.ie/?lang=ga

Our Strategic Plan sets out an ambition to be an excellent place to learn and work, and an inclusive community where students and staff can flourish and make a distinctive contribution to the national system of higher education and the public good. Achieving this requires staff to have a strong sense of connection to the University and support from colleagues. We recognise that our people are our greatest resource and actively seeks to attract, develop, and retain a talented workforce by creating a positive and welcoming University environment. As well as offering a competitive salary, access to a public sector pension scheme, and annual leave allowance, the University also provides other facilities and benefits including, but not limited to:

- Family-friendly leave schemes
- Tax Saver travel scheme and Cycle to Work scheme
- On-campus crèche
- On-campus restaurants and coffee shops
- Employee Assistance Programme
- Health and Well-Being programmes
- Education support opportunities

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- Continuous Professional Development opportunities, including leadership programmes, mentoring, Aurora programme.
- Study and Exam leave
- Sports facilities and gym

To learn more about being part of the Maynooth University team, please visit our website at https://www.maynoothuniversity.ie/human-resources/come-work-with-us

Selection and Appointment

- Only shortlisted candidates will be invited to attend for interview;
- Candidates invited for interview will be required to make a brief presentation;
- It is anticipated that interviews will be held during January 2027;
- The appointment is expected to be effective as soon as possible thereafter.

Equality and Diversity

Maynooth University actively works to ensure equality, celebrate the diversity of our community, and promote inclusion. To learn more about our commitment to Equality and Diversity, please read the Maynooth University Equality and Diversity Policy / Polasaí Comhionannais agus Éagsúlachta, our policy on the Employment of People with Disabilities, and our Race and Equality action planshttps://www.maynoothuniversity.ie/edi. We aim to reflect the diversity of the community we serve and welcome applications from all individuals across our society.

Maynooth University is an equal opportunities employer and is committed to supporting applicants to enable their full participation in the recruitment process. Applicants are invited to disclose a disability during the recruitment process to ensure adequate measures are in place to enable their full participation.

Terms and Conditions

Tenure	This is a full-time, temporary post for a specified purpose, anticipated to be of 2 years duration.
Salary	Post Doctoral Researcher (2026) - €47,273 p.a. (1 point with increment) Appointments will be made in accordance with public sector pay provisions.
Hours of work	A 37-hour working week is in operation in respect of full-time positions (pro-rated for part-time positions).

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	This can be reviewed or adjusted from time to time through national agreements.
Location	The place of work is the campus of Maynooth University, Maynooth, Co. Kildare.
Annual Leave	Annual leave and public holidays are provided for in the University policy: https://www.maynoothuniversity.ie/human-resources/policies/annual-leave-policy Annual leave will be allocated on a pro-rata basis for part-time and temporary positions.
University policies and schemes	Employees of the University will be subject to the terms of the University policies and schemes, available on the University website at: https://www.maynoothuniversity.ie/university-policies https://www.maynoothuniversity.ie/human-resources/policies
Pension	This is a pensionable post. Employees of the University will enter into a public sector pension scheme, and as such, applicants must ensure they are eligible to become a member of a public sector pension scheme for the duration of the appointment. Details of the public sector pension schemes are available at: https://www.maynoothuniversity.ie/human-resources/pension-information
Eligibility	Applications from non-EU/EEA/UK candidates are welcome where eligibility to work in Ireland can be demonstrated or where an employment permit can be obtained in line with Department of Enterprise, Trade and Employment or EURAXESS requirements. Please note that not all roles are eligible for employment permits, and applicants are responsible for ensuring they meet the relevant immigration and employment permission requirements. Further information regarding eligibility is available at: https://enterprise.gov.ie/en/what-we-do/workplace-and-skills/employment-permits/employment-permit-eligibility/ and here - https://www.euraxess.ie/ireland/fast-track-work-permit-non-eu-rd-hosting-agreement-scheme/researchers Non-EEA applicants are responsible for ensuring they can secure a visa to travel to Ireland. Any offer of employment is conditional on applicants securing the appropriate employment permissions.

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	Former Irish Public Service employees - Certain Restrictions on Eligibility Eligibility of applicants formerly employed by an Irish Public Sector body, and who availed of an Irish Public Service Redundancy or Incentivised Retirement Scheme under the Schemes below, may be affected: • Collective Agreement: Redundancy Payments to Public Servants • Incentivised Scheme for Early Retirement (ISER) • Department of Health and Children Circular (7/2010) • Department of Environment, Community & Local Government (Circular Letter LG(P) 06/2013) Applicants should ensure that they are eligible to be re-engaged in the Irish Public Service under the terms of such Schemes. Applicants should address queries with their former Irish Public Sector employer.
Garda vetting	Garda vetting or clearance may be required by the University.
Medical	The University may require a medical examination as a condition of employment.

Data Protection

Applications to the University will be treated in accordance with the University Data Protection Policies. For information on the University's Data Protection Policies and Privacy Notice, please see our website: https://www.maynoothuniversity.ie/data-protection

Application Procedure

Closing Date:

23:30hrs (local Irish time) on **Sunday, 13th December 2026**

Please note all applications must be made via our **Online Recruitment Portal** at the following link:

https://www.maynoothuniversity.ie/human-resources/vacancies

Applications must be submitted by the closing date and time specified above. Any applications which are still in progress at the closing time on the specified closing date will be cancelled automatically by the system.

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Late applications will not be accepted.

Maynooth University is an equal opportunities employer

The position is subject to the Statutes of the University

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