

# Isaac Reid

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## Research interests

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I am interested in problems at the interface of ML, statistical physics and applied mathematics. Recently, I've focussed on efficient transformers for graph-structured data and foundation models for robotics. I hold a Google PhD Fellowship in Algorithms and Theory.

## Education

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### Machine Learning, University of Cambridge, UK

*Oct 2022 - present*

PhD in Engineering

*Supervisors:* [Dr Adrian Weller](#) and [Prof. Rich Turner](#)

*Advisor:* [Prof. Carl Rasmussen](#)

*Subject:* Scalable and data-efficient machine learning. Close collaboration with [Prof. Krzysztof Choromanski](#).

### Physics, University of Oxford, UK

*Oct 2017 - Jun 2021*

Master of Physics, MPhys

*Grade:* First class, 92%, top of Oxford cohort (out of  $\sim 150$ )

*Research project:* Quantum entanglement barriers in dual-unitary circuits

*Supervisor:* [Dr Bruno Bertini](#)

## Select publications and preprints

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Please see my [website](#) for an exhaustive list of papers. Some highlights (by my assessment) are listed below.

### Gemini Robotics 1.5: Pushing the Frontier of Generalist Robots with Advanced Embodied Reasoning, Thinking, and Motion Transfer

*GDM blog*

GDM robotics team (very many authors)

*Synopsis:* A new family of robotics foundation models, with improved reasoning and cross-embodiment transfer.

[Gemini Robotics 1.5 Tech Report](#)

### Wavelet-Induced Rotary Encodings: RoPE Meets Graphs

*Preprint, under review*

**Isaac Reid\***, Arijit Sehanobish\*, Cederik Höfs\*, Bruno Mlodozieniec, Leonhard Vulpius, Federico Barbero, Adrian Weller, Krzysztof Choromanski, Richard E. Turner, Petar Veličković

*Synopsis:* You can extend rotary position encodings (RoPE) to graphs, and it automatically inherits a bunch of nice properties.

<https://arxiv.org/abs/2509.22259>

### Distributional Training Data Attribution

*NeurIPS 2025, accepted as spotlight paper*

Bruno Mlodozieniec\*, **Isaac Reid\***, Sam Power, David Krueger, Murat Erdogdu, Richard Turner, Roger Grosse

*Synopsis:* ‘Influence’ of samples can be understood by how drastically the distribution over final trained models changes if they are removed. Influence functions emerge organically from this new mathematical formulation.

<https://arxiv.org/abs/2506.12965>

### Simplex Random Features

*ICML 2023, accepted with oral presentation*

**Isaac Reid**, Krzysztof Choromanski, Valerii Likhoshesterov, Adrian Weller

*Synopsis:* Derivation of an optimal random feature mechanism for unbiased approximation of the Gaussian kernel, motivated by a host of new analytical results and tested with transformer experiments

<https://arXiv.org/abs/2301.13856>

## Entanglement Barriers in Dual-Unitary Circuits

*Phys. Rev. B* 104, 014301 – Published 1 July 2021

Isaac Reid, Bruno Bertini

*Synopsis:* Exact characterisation of the dynamics of quantum entanglement arising after a quantum quench in a many-body, locally interacting system, including both the integrable and completely chaotic regimes

<https://arxiv.org/abs/2103.12794>

## Teaching

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### Cambridge MLMI

*Lent 2025*

*Synopsis:* Guest lecturer, providing an introduction to transformers.

### Engineering 2P7

*Michaelmas 2023 - Easter 2025*

*Synopsis:* Supervisions in mathematics for engineers (vector calculus, linear algebra and probability)

### Pembroke International Summer Programme

*Jun-Aug 2023*

*Synopsis:* Research project on density ratio estimation in machine learning

## Select talks

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### Efficient Transformers – Machine Learning Group, Cambridge

*Nov 2024*

*Synopsis:* Seminar on mathematical tricks for subquadratic attention

### Quasi-Monte Carlo Graph Random Features – NeurIPS@Cambridge, Cambridge

*Dec 2023*

*Synopsis:* Invited talk to accompany NeurIPS spotlight paper

### Simplex Random Features – ICML 2023, Honolulu

*July 2023*

*Synopsis:* Oral presentation to accompany paper

### Simplex Random Features – Microsoft Research, Cambridge

*Jun 2023*

*Synopsis:* Research talk on ICML paper

### Random Features for Kernel Approximation – Machine Learning Group, Cambridge

*Mar 2023*

*Synopsis:* Seminar on random feature methods and recent QMC schemes to improve their convergence

## Experience

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### Student Researcher, Google DeepMind (NYC, US and London, UK)

*May 2025 - present*

Gemini Robotics 1.5

### Research Associate, IQ Capital (London, UK)

*Nov 2024 - April 2025*

1 day/week advising and investing in ML startups and supporting portfolio companies

### Student Researcher, Google (London, UK)

*May 2024 - Nov 2024*

Project on efficient Transformers, working closely with [Krzysztof Choromanski](#) and [Avi Dubey](#)

### Systems Engineer, Opsydia (Oxford, UK)

*Sep 2021 - Sep 2022*

R&D engineer at deep-tech startup specialising in laser technology and adaptive optics, spun out of Oxford University Engineering Department

### Research Intern, Max Planck Institute (remote, UK)

*Summer 2020*

Computational study of Bose-Einstein condensation in active matter, applying theoretical results from many-body quantum physics to classical clustering phenomena observed in Kob-Andersen particle dynamics

*Supervisors:* [Dr Benoit Mahault](#) and [Prof. Ramin Golestanian](#)

### Research Intern, Rudolf Peierls Centre for Theoretical Physics (Oxford, UK)

*Summer 2019*

Study of relationship between spectral properties of Hessian of loss function and Bayesian prior upon deep neural network initialisation, estimated using random sampling of weights and Gaussian processes

*Supervisor:* [Prof. Ard Louis](#)

## Scholarships and awards

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<b>Google PhD Fellowship in Algorithms and Theory</b> Funding from Google for remainder of PhD	<i>2024-2026</i>
<b>G-Research Grant</b> Financial award to help fund attendance of ICML conference	<i>July 2023</i>
<b>Trinity College External Studentship</b> Full scholarship for a PhD in Machine Learning	<i>2022-2025</i>
<b>Encaenia</b> One of six undergraduate students invited to attend Oxford's historic <a href="#">Encaenia ceremony</a>	<i>Jun 2022</i>
<b>Gibbs Prize</b> For submitting the highest scoring MPhys research project (87%)	<i>2020-2021</i>
<b>Scott Prize</b> For best overall performance in the MPhys (92%)	<i>2017-2021</i>
<b>Scott Prize</b> For best performance in the third year (92%)	<i>2019-2020</i>
<b>Winton Capital Prize</b> For best performance in the second year (93%)	<i>2018-2019</i>
<b>Hertford College Academic Scholarship</b> For performance in first year (88%)	<i>2018-2021</i>