

Isaac Reid

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Research interests

I work on developing scalable and data-efficient machine learning algorithms. I am interested in problems at the interface of ML, statistical physics and applied mathematics, especially where theoretical results have proved elusive, applications are high-impact, or both.

Education

Machine Learning Group, University of Cambridge

Oct 2022 - present

PhD in Engineering

Supervisor: [Dr Adrian Weller](#)

Advisor: [Prof. Rich Turner](#)

Subject: Scalable and data-efficient machine learning. Ongoing collaboration with [Prof. Krzysztof Choromanski](#) (Columbia University, New York and Google Brain).

Physics, University of Oxford

Oct 2017 - Jun 2021

Master of Physics, MPhys

Grade: First class, 92%, top of Oxford cohort

Modules: Theoretical physics, condensed matter, fluid dynamics, general relativity

Research project: Quantum entanglement barriers in dual-unitary circuits

Supervisor: [Dr Bruno Bertini](#)

Publications and select preprints

Quasi-Monte Carlo Graph Random Features

Under review

Isaac Reid, Krzysztof Choromanski, Adrian Weller

Synopsis: Proposal and theoretical analysis of a novel QMC scheme that induces correlations between random walks on a graph, with applications in bioinformatics and GNNs

<https://arxiv.org/abs/2305.12470>

Simplex Random Features

ICML 2023, accepted with oral presentation (top 25%)

Isaac Reid, Krzysztof Choromanski, Valerii Likhoshesterov, Adrian Weller

Synopsis: Derivation of a provably optimal random feature mechanism for unbiased approximation of the Gaussian kernel, motivated by a host of new analytical results and tested with extensive 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>

Talks

Simplex Random Features – Microsoft Research, Cambridge

Jun 2023

Synopsis: Research talk on ICML submission

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

Systems Engineer, Opsydia

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 for Dynamics and Self-Organisation, Göttingen *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

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

G-Research Grant

July 2023

Financial award to help fund attendance of ICML conference

IQ Capital DeepTech Fellowship

2023

Advising investment portfolio in climate-tech startups

Trinity College External Studentship

2022-2025

Full scholarship for a PhD in Machine Learning

Encaenia

Jun 2022

One of six undergraduate students invited to attend Oxford's historic [Encaenia ceremony](#)

Gibbs Prize

2020-2021

For submitting the highest scoring MPhys research project (87%)

Scott Prize

2017-2021

For best overall performance in the MPhys (92%)

Scott Prize

2019-2020

For best performance in the third year (92%)

Winton Capital Prize

2018-2019

For best performance in the second year (93%)

Hertford College Academic Scholarship

2018-2021

For performance in first year (88%)

Physics Practical Prize

2018-2020

For performance in laboratory and computational work