Daniel Kelshaw

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Education

Imperial College London: *PhD in Machine Learning, Supervisor: Prof. Luca Magri*	**2021 – 2025**
The University of Manchester: *MEng Aerospace Engineering, First Class Honours, Top in Class.*	**2016 – 2021**

Publications

Daniel Kelshaw, and Luca Magri. 'Manifold-Augmented Eikonal Equations: Geodesic Distances and Flows on Differentiable Manifolds'. *NeurIPS 2023 Workshop on Symmetry and Geometry in Neural Representations*, October 2023

Daniel Kelshaw, and Luca Magri. 'Short and Straight: Geodesics on Differentiable Manifolds'. *arXiv preprint*, May 2023

Daniel Kelshaw, and Luca Magri. 'Physics-Informed Convolutional Neural Networks for Corruption Removal on Dynamical Systems'. *NeurIPS 2022 Workshop on Machine Learning and the Physical Sciences*, November 2022

Daniel Kelshaw, Georgios Rigas, and Luca Magri. 'Physics-Informed CNNs for Super-Resolution of Sparse Observations on Dynamical Systems'. *NeurIPS 2022 Workshop on Machine Learning and the Physical Sciences*, November 2022

Daniel Kelshaw, Steffen Mauceri, Steven Lu, Liang Xu, Sassan Saatchi. 'Gaussian Processes for Prediction and Uncertainty Quantification of Global Vegetation Structure from Active Satellite Sensors', *American Geophysical Union,* November 2021

Presented Talks

Daniel Kelshaw, Luca Magri. 'Dealing with faulty sensors: a physics-informed convolutional neural network approach for recovering solutions to governing equations', *IACM Computational Fluids Conference*, April 2023

Luca Magri, **Daniel Kelshaw**, Anh Khoa Doan. 'What is machine learning learning? Autoencoders for reduced-order modelling of turbulence', *IACM Computational Fluids Conference,* April 2023

Daniel Kelshaw, Luca Magri. 'Super-resolution of sparse spatial-observations of Navier-Stokes: a physics-informed convolutional neural network approach', *Leeds Fluids Institute: Workshop on data-driven methods in fluid mechanics,* December 2022

Daniel Kelshaw, Luca Magri. 'Extracting Navier-Stokes solutions from noisy data with physics-constrained convolutional neural networks', *American Physical Society, Division of Fluid Dynamics,* September 2022

Invited Panels / Workshops

Luca Magri, **Daniel Kelshaw.** 'Data-Driven Modelling and Control for Fluid Mechanics', *Newton Institute workshop on 'The mathematical and statistical foundation of future data-driven engineering',* May 2023

Audrey Gaymann, **Daniel Kelshaw**, Luca Magri, Georgios Rigas. 'Panel on Data-Centric Aerospace', *Imperial College,* July 2022

Research Experience:

NASA Jet Propulsion Lab – Machine Learning Research Intern   **07/2021 – 10/2021**
- Researched the use of spatio-temporal machine learning methods for predicting global vegetation structure.
- Developed a range of uncertainty-aware models using LiDAR / RaDAR / Multispectral imagery from satellite sensors.

ESA: European Space Agency – Machine Learning Research Intern   **07/2021 – 10/2021**
- Researched the use of implicit neural scene representation networks for point cloud data sources.
- Developed models capable of directly learning signed distance function representations from LiDAR point cloud data.

Mind Foundry: Oxford University Spinout – Machine Learning Research Intern   **04/2021 – 07/2021**
- Modelled geospatial-temporal data using techniques such as Gaussian Processes and Log Gaussian Cox Processes.
- Developed and deployed a framework for optimisation of electric vehicle charge point placement, based on local demographics.

Dyson – Machine Learning Research Intern   **06/2019 – 06/2020**
- Researched the use of gradient-free optimisation methods for aerodynamic design applications.
- Developed surrogate models with uncertainty quantification to accelerate the design process, in conjunction with optimisation.

BAE Systems – Research Engineering Intern   **06/2018 – 09/2018**
- Deep leaning methods for prediction of strain on the Eurofighter Typhoon aircraft, for use in digital twins.

Notable GitHub Repositories

github.com/magrilab/**riemax**: JAX library for Riemannian geometry, allowing operations on arbitrary differentiable manifolds.
github.com/magrilab/**kolsol:** Differentiable pseudo-spectral solver for the Navier-Stokes equations.

Technical Skills:

Languages \ Frameworks: Python, Jax, PyTorch, TensorFlow, XLA, Julia, C++.