

Surya T. Sathujoda

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British Citizen

Education

University of Cambridge

M.A.St. Mathematics (Part III)

2023

Dissertation: "Deep Learning for Partial Differential Equations"

University of Southampton

B.Sc. (Hons) Physics

2022

Dissertation: "Phenomenology of Dark Matter Candidates Beyond the Standard Model"

University of Manchester

B.Sc. (Hons) Computer Science

2018

Focus on Machine Learning, Time-series Analysis, Financial Applications

Selected Conference Papers

[1]: **Sathujoda, S.T.**, Sheth, S.M. (2025). *Coupled Graph Neural Network and Fourier Neural Operator Architecture for Ensemble Workflows in 3D Reservoir Simulation*. SPE Reservoir Simulation Conference 2025.

[2]: **Sathujoda, S.T.**, Veegar, L., Sheth, S.M., Jönsthövel, T., Yorke-Smith, N. (2024). *Modeling Complex Fluid Flow in Porous Media Using Graph Neural Networks*. European Conference for Mathematics of Geological Reservoirs 2024.

[3]: **Sathujoda, S.T.***, Wang, Y.*, Gandhi, K. (2023). *Exciton-Polariton Condensations: A Fourier Neural Operator Approach*. Conference on Neural Information Processing Systems (**NeurIPS**), AI4Science Workshop.

[4]: **Sathujoda, S.T.**, Sheth, S.M. (2023) *Physics-Informed Localized Learning for Advection-Diffusion-Reaction Systems*. International Conference on Machine Learning (**ICML**), Frontiers for Learning, Control, and Dynamics Workshop.

Professional Experience

SLB (formerly Schlumberger), UK

Data Scientist (Numerical Simulation Team)

2023–Present

- C++ developer for *INTERSECT* numerical simulator and Python developer for machine learning surrogate workflows.
- Developed **physics-informed ML models** (Fourier Neural Operators, GNNs) for **PDEs in fluid dynamics** to speed up solutions.
- Prototyped Flow Super-resolution using **Denosing Probabilistic Diffusion Models** (DDPMs) for Reservoir simulation results.
- Implemented C++ features in reservoir simulator to use Machine Learning to predict time-evolving thermodynamic quantities.
- Supervised a PhD intern to port ML framework into **JAX** for efficiency on GNNs, leading to a 50% speed up in training times.
- Published 3 first author conference papers at **ICML workshop**, ECMOR and SPE Reservoir Simulation Conference, and **2 patent memos** on Deep Learning for Partial Differential Equations since joining.

SLB (formerly Schlumberger), UK

Research Intern (Numerical Simulation Team)

2022

- Developed a novel '*localised learning*' technique to predict subsurface fluid flow on large 3D grids using domain decomposition.
- Achieved 15x speed up in training times, while using physics-informed losses, compared to previous in-house model with similar accuracy. Published at **ICML Frontiers4LCD** workshop.

Awards & Grants

2022: Best BSc. (Hons) Physics Degree Performance Award - University of Southampton

2022: Best BSc. (Hons) Thesis Award – University of Southampton

2021: UKRI Research Grant – Machine Intelligence for Nano-Devices CDT

2021: Royal Astronomical Society Summer Research Bursary

Research Experience

University of Cambridge

Machine Learning Research Intern (DAMTP)

2023

- Applied Fourier Neural Operators to the Gross-Pitovksi equation in Exciton-Polariton systems, published at **NeurIPS** AI4Science.
- Extended this work to model real experimental data using neural operators, currently under review for journal publication.
- Studied the **flow super-resolution** capabilities of **Denoising Diffusion Probabilistic Model** compared to Fourier Neural Operators for a 2D Navier-Stokes problem.

University of Cambridge

Part III Mathematics Tripos Essay

2023

- Wrote thesis on the mathematical theory of **Neural Operators** for approximating solutions to partial differential equations.
- Studied the mathematics of extending current models, such as Fourier Neural Operators (FNO) and Physics-informed Neural Operators (PINO), to approximating solutions to PDEs on unstructured grids and meshes

University of Southampton

Undergraduate Honors Thesis

2022

- Predicted, visualised and studied particle interactions beyond the Standard Model using CalcHEP and micrOMEGAs C packages.
- Analysed Inert Two Higgs Doublet and Minimal Fermion **Dark Matter models** by calculating cross-sections, relic densities and branching ratios to conduct a phenomenological survey of Dark Matter candidates. **Awarded Best Bachelors Thesis Award.**

University of Southampton

Astrophysics Research Intern

2021

- Applied a machine learning toolkit to infer the dynamics of **Accretion Disks of Active Galactic Nuclei**, jointly funded by the Royal Astronomical Society and University of Southampton.
- Developed scripts with the **Gaussian Process** framework in Starfish Python package to characterise exoplanet spectral properties.
- Built parameter inference models using Gaussian Processes for the Monte-Carlo radiative transfer simulations of SS Cygni.

University of Southampton

Machine Learning Research Intern

2021

- Conducted research on quantisation methods in **Graph Neural Networks** funded by UKRI EPSRC at Machine Intelligence CDT.
- Analysed the effect of thresholded attention dropout on attention weight distribution of Graph Attention Networks.
- Benchmarked models using PyTorch-Geometric for classification tasks such as Protein-Protein Interaction and Citation Networks.

Additional Experience

University of Southampton

Teaching Assistant - Programming and Data Analysis Module

2021

- Led weekly programming workshops for 20+ first year undergraduate students and performed marking of module assessments.
- Responsible for explaining programming/data analytics concepts in Python and demonstrating examples introduced in lectures.
- Responsible for explaining statistics concepts such as Statistical Distributions, Hypothesis Testing, Uncertainty Quantification, Model fitting and Parameter estimation via Least-squares and Chi-squared, and implementing in them Python.

Institute of Physics (IOP)

Campus Ambassador & SE England National Student Committee Rep.

2021

- Chaired IOP run coding workshops on 'Introduction to Julia' and 'Introduction to R for Data Analysis' with 100+ participants.
- Part of organising committee of coding workshops on 'Introduction to C++ for Physicists' and 'C++ libraries for Physical Simulations' with speakers from CERN.
- Part of IOP Limit Less campaign to encourage and support young students, from diverse backgrounds, to pursue Physics.

Technical Skills

Programming: C/C++ (including 17, 20, 23, Boost Libraries, Eigen Library), Python, Rust

Statistical Computing & Toolkits: R, MATLAB, NumPy, SciPy, Matplotlib, Pandas

Machine Learning Libraries: PyTorch, TensorFlow, Scikit-Learn

ML/DS: Graph Neural Networks, Neural Operators, Diffusion Models, LLMs, RAGs, LangChain, Milvus