Surya T. Sathujoda

Contact Information

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Work Status: UK Permanent Resident

Education

University of Cambridge
M.A.St., Mathematics (Part III of Mathematical Tripos) Sept. 2022 - Jun. 2023
- Dissertation Topic: "Deep Learning for Partial Differential Equations"

University of Southampton
B.Sc., Physics Sept. 2019 - June 2022
- Dissertation Topic: "In Anticipation of Dark Matter Discovery - A Phenomenological study"

University of Manchester
B.Sc., Computer Science Sept. 2015 - June 2018
- Dissertation Topic: "Pattern Recognition of Stock Price Movement"

Awards and Grants

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

University of Southampton: Best Bachelor of Science Thesis Award, 2022

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

Royal Astronomical Society: Summer Undergraduate Research Bursary, 2021

University of Southampton: Dept of Physics and Astronomy Research Assistantship, 2021

Publications

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

[2] Sheth, S.M., Shaykattarov, M., Dias, D. **Sathujoda, S.T.**, and Coker, O. (2023). Physics Informed Machine Learning Models for Simulating CO2 Injection into Saline Aquifer. *SPE ADIPEC* 2023.

[3] **Sathujoda, S.T.** and S.M. Sheth. (2023). Physics-informed Localized Learning for Advection-Diffusion-Reaction Systems. *International Conference on Machine Learning* (ICML) Frontiers4LCD Workshop 2023.

Professional Experience

Schlumberger, Abingdon, UK
Data Scientist - Physics Team September 2023 - Present

Working on various **Machine Learning** projects to accelerate Carbon Capture and Storage. Developing physics-informed models for **Partial Differential Equations** governing Fluid Dynamics, Geochemistry and Thermodynamics. Implementing models using **Python** and **Tensorflow** and integrating into INTERSECT numerical simulator on HPC using **C++** and software workflows, such as **Azure DevOps** and **Git**. **Recent work published at ADIPEC 2023**.

Schlumberger, Abingdon, UK
Data Science Intern - Physics Team June 2022 - September 2022

Conducted research on simulating fluid dynamics using **Physics-informed Deep Learning** and implemented a novel TensorFlow model to predict future state variables in subsurface fluid simulations for optimizing carbon capture and storage. Achieved a significant reduction in training time from 45 hours to 3 hours on an NVIDIA Tesla V100 GPU, by introducing a new model comprising a localized auto-encoder, residual networks, and physics-informed losses. **Work published at ICML 2023 Workshop**.

Fidessa, London, UK
Software Development Intern June 2017 – September 2017

Worked in an Agile Scrum Development team on a Post-Trade FinTech product for financial order management. Responsible for implementing live **low-latency C++** code and utilising TCL to build and run the test framework. Collaborated with team using **Perforce** version control, **Jenkins** Continuous Integration and **Jira** for project management

Research Internships

Cambridge Image Analysis Group, University of Cambridge, UK
Machine Learning Research Intern June 2023 - September 2023

Conducted research on **Generative AI** for image generation. Worked specifically on methods to speed up training and inference for Physics-informed **Diffusion models** for Flow Super-resolution using Neural Operator layers. Also implemented framework to integrate the Continuous UNet architecture with **Denoising Diffusion Restoration Models** (DDRM). Contribution has laid the foundation for ongoing research in the group.

Machine Intelligence CDT, University of Southampton, UK
Machine Learning Research Intern June 2021 - August 2021

Conducted research funded by UKRI EPSRC on **Graph Neural Networks** at MINDS CDT, implementing GNN models using PyTorch and PyTorch-Geometric for classification tasks such as Protein-Protein Interaction and Citation Networks. Analyzed the performance of Graph Attention Networks and quantified the effect of thresholded attention dropout on attention weights distribution.

Astrophysics Group, University of Southampton, UK
Astrophysics Research Assistant August 2021 - October 2021

Conducted research on machine learning inference for Accretion Disks of Active Galactic Nuclei, jointly funded by the Royal Astronomical Society and University of Southampton. Developed expertise in training **Gaussian Processes** using Python package Starfish for characterizing exoplanet spectral properties and building parameter inference models using GPs for Monte-Carlo radiative transfer simulations of SS Cygni.

Other experience

Teaching Assistant for Programming and Data Analysis Module
Department of Physics and Astronomy - University of Southampton Oct 2021 - Jan 2022

In charge of running weekly programming workshops with 20+ undergraduates and marking module assessments. Required to be able to explain programming concepts in Python and demonstrate examples introduced in lecture set. Responsible for thoroughly explaining Statistical/Data analysis concepts such as Statistical Distributions, Hypothesis Testing, Uncertainty, Model fitting and Parameter estimation via Least-squares and Chi-squared.

Institute of Physics (IOP) Student Representative
Campus Ambassador & SE England National Student Committee Rep. Mar 2021 - June 2022

Chair of 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 follow their passion for Physics to Higher Education.

Computer Skills

- *Languages*: Python, C++, C, Java, HTML/CSS, JavaScript
- *Statistical Computing & Toolkits*: R, MATLAB, NumPy, SciPy, Matplotlib, Pandas, Origin
- *Machine Learning Libraries*: Tensorflow, Keras, PyTorch, PyTorch-Geometric, Scikit-Learn
- *Data Technologies*: Relational Database Management Systems, SQL
- *Development Tools*: Git, Azure DevOps, Perforce, Jenkins, Jira, HP Quality Centre