## Surya T. Sathujoda


CONTACT INFORMATION

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RESEARCH INTERESTS

Deep Learning for Partial Differential Equations, Learning methods for Unstructured Grids and Meshes, Graph Neural Networks, ML4PhysicalSciences

EDUCATION

**University of Cambridge**, Cambridge UK

M.A.St., Mathematics (Part III of Mathematical Tripos), June 2023

- Dissertation Topic: "Deep Learning for Partial Differential Equations"
- Advisors: Dr. Angelica Aviles-Rivero, Prof. Carola-Bibiane Schönlieb
- Group: Cambridge Image Analysis

**University of Southampton**, Southampton UK

B.Sc., Physics, June 2022

- Dissertation Topic: "In Anticipation of Dark Matter Discovery - A Phenomenological study"
- Advisors: Prof. Alexander Belyaev
- Group: Theoretical Particle Physics

**University of Manchester**, Manchester UK

B.Sc., Computer Science, June 2018

- Dissertation Topic: "Pattern Recognition of Stock Price Movement"
- Advisors: Prof. Xiao-jun Zeng
- Group: Machine Learning and Optimization

HONORS AND AWARDS

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

PREPRINTS

[1] **Sathujoda, S.T.** and S.M. Sheth. Physics-informed Localized Learning for Advection-Diffusion-Reaction Systems. arXiv:2305.03774. Submitted to *International Conference on Machine Learning* (ICML) Frontiers4LCD Workshop 2023.

[2] Oliver, M.C.A., **S.T. Sathujoda**, and U. Bhatt. Generalized Human-Aligned Risk Minimization. Submitted to *Neural Information Processing Systems* (NeurIPS) Conference 2023.

PROFESSIONAL EXPERIENCE

**Schlumberger**, Abingdon, UK

*Data Scientist 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.

**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.

**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

## Academic Theses

**Deep Learning for Partial Differential Equations**

*Cambridge Image Analysis Group - University of Cambridge* **Jan 2023 - May 2023**

Literature survey of Neural Operators to approximate PDEs and studied possibilities for the extension for current models, such as Fourier Neural Operators (FNO) and Physics-informed Neural Operators (PINO), to be applied to unstructured grids and meshes.

**In Anticipation of Dark Matter Discovery**

*Theoretical Particle Physics Group - University of Southampton* **Oct 2021 - Jan 2022**

Predicted, visualised and studied particle interactions beyond the Standard Model. Analysed the Inert Two Higgs Doublet and Minimal Fermion Dark Matter models by calculating cross-sections, relic densities and branching ratios to search for Dark Matter candidates using CalcHEP and micrOMEGAs C packages.

**Pattern Recognition of Stock Price Movement**

*Machine Learning and Optimization Group - University of Manchester* **Sept 2017 - June 2018**

Conducted research on Unsupervised methods, clustering Financial Time-Series data using K-Means and evaluating performance using metrics such as the DB Index. Performed feature extraction and calculated technicals like Moving Averages and Bollinger Bands using MATLAB.

## Computer Skills

- *Languages*: Python, Java, C++, C, HTML, CSS, PHP, 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, Perforce, Jenkins, Jira, HP Quality Centre