

Pinak Mandal

Glebe - 2037, Sydney, NSW

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Professional Summary

PhD in applied mathematics with 8+ years of experience in developing algorithms for dynamical systems, generative AI, and data-driven optimization. Expert in designing and executing computational experiments to validate ideas. Author of several software projects with an emphasis on usability and performance.

Education and Employment

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|--|-------------|
| • University of Sydney, Sydney | 2023 - 2025 |
| Postdoc (Machine Learning and Dynamical Systems) | |
| Supervisor: Georg Gottwald | |
| • International Centre for Theoretical Sciences, Bengaluru | 2017 - 2023 |
| PhD (Applied Mathematics and Deep Learning) | |
| Supervisors: Amit Apte , Vishal Vasan | |
| Thesis: Numerical Filter Stability, Fokker-Planck Equations and Infinite Dimensional Optimization with Deep Learning | |
| • Jadavpur University, Kolkata - MSc (Mathematics) | 2014 - 2016 |
| • Jadavpur University, Kolkata - BSc (Mathematics) | 2011 - 2014 |

Work Experience

I have worked on a broad range of applied problems with a recent focus in fundamental machine learning. Some of them are listed below.

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|--|-----------|
| • Unlearning via orthogonalization in generative models, USyd | 2025 |
| Developed new model-agnostic algorithms for forgetting undesired training data in generative models that are \sim 10-20x faster than gradient surgery. | |
| https://arxiv.org/pdf/2506.04712.pdf | |
| • Learning dynamical systems from data with Random Feature Maps, USyd | 2024 |
| Developed data-driven sampling for tanh random feature maps; implemented deep and local variants of RFMs, achieving state-of-the-art forecast times for chaotic dynamical systems with \sim 15-20x smaller models than traditional ML architectures. | |
| https://www.nature.com/articles/s41467-025-61195-1 | |
| https://www.aims.science/article/doi/10.3934/fods.2025006 | |
| • Solving partial differential equations and constrained optimization problems with deep learning, ICTS | 2021-2023 |
| Developed deep learning algorithms for solving high-dimensional Fokker-Planck equations and problems in calculus of variations and identified a special failure mode of physics-informed neural networks for parabolic equations. | |
| https://arxiv.org/pdf/2306.07068.pdf , | |
| https://arxiv.org/pdf/2401.01292.pdf | |
| • Data Assimilation, ICTS | 2020-2021 |
| Developed a fast, scalable method for assessing the stability of numerical filters, including EnKF and particle filters, and demonstrated exponential stability in both cases. | |
| https://www.sciencedirect.com/science/article/abs/pii/S0167278923001197 , | |

<https://ieeexplore.ieee.org/document/9703185>

- Predicting Visual Stimuli from fMRI Data, Neuromatch Academy 2021
Used fMRI data to predict images seen by human subjects (in collaboration with an international group of graduate students).
- Atmospheric Plume Modelling, ICTS 2019
Developed a PDE-based model for atmospheric plume, and combining with it open-source data from OpenStreetMap, estimated air pollution levels in [Peenya](#).
- I have also worked as a consultant for [Adam Spencer](#). 2024

Selected Conferences and Seminars

- Mathematical and Computational Foundations of Climate Modeling - **BIRS, CMI** | **Talk**: Unlearning via orthogonalization in generative models 2025
- Co-organized minisymposium titled: Data-driven reconstruction and forecasting of dynamical systems - **SIAM DS25, Denver** 2025
- Machine learning seminar - **USyd** | **Talk**: Learning dynamical systems with hit-and-run random feature maps 2025
- Numerical methods for complex high dimensional systems - **Jervis Bay** | **Talk**: From Random to Reliable: Good sampling for random features in ML 2024
- New directions for SDE and machine learning - **ICMS, Edinburgh** | **Poster**: Success and failure of PINNs and solving Fokker-Planck equations 2024
- Variational principles of plasma confinement in 3D magnetic fields - **ANU** | **Talk**: Deep learning for stellarator design (with Zhisong Qu) 2023
- 7th Indian Control Conference - **IIT Bombay** | **Talk**: Stability of nonlinear filters - numerical explorations of particle and ensemble Kalman filters 2021

Achievements

- 2nd place at national level mathematics exam IIT-JAM 2014
- 9th place at national level mathematics exam TIFR-GS 2016
- 15th place at national level math exam (for lecturership in India) NET 2016
- Future Research Talent Fellow (Australian National University) 2021
- Recipient of Infosys-TIFR Leading Edge travel grant 2023

Publications and Visualizations

- First author of several articles in high-impact journals, including **Nature Communications**, **Foundations of Data Science**, **Physica D**, and **IEEE**. A list of my research articles can be found [here](#).
- A gallery of visualizations illustrating snippets from my projects is available on my [GitHub page](#).

Technical Skills

- **Languages:** Python (primary), C, MATLAB, SQL
- **Libraries:** PyTorch, TensorFlow, NumPy, SciPy, Pandas, Matplotlib
- **AI/ML:** Deep Learning (AutoDiff, SGD, LSTM, CNN), Generative Models (VAE, GAN, WGAN, WGAN-GP, Diffusion Transformer, Flow Matching), Fine-tuning (LoRA), Model Compression (Quantization, Mixed Precision Training)
- **Other:** Git, GPU Computing, Data Visualization, Google Colab, Hugging Face
- **Some open-source GitHub projects authored by me:** [DeepRFM](#), [forget](#), [fp-solvers](#) and more. DeepRFM has garnered significant [interest from the climate modelling community](#), and is slated for integration with other climate modelling systems.

Referees

Georg Gottwald

University of Sydney, Sydney

Vishal Vasan

ICTS, Bengaluru

Tarun Malviya

Commonwealth Bank, Sydney

Amit Apte

IISER Pune, India

Sreekar Vadlamani

TIFR-CAM, Bengaluru