Pinak Mandal

Glebe - 2037, NSW
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Education and Employment

- **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

Projects

I have worked on a broad range of applied problems with a recent focus in fundamental machine learning.

- **Unlearning via orthogonalization in generative models, USyd**   2025
  Developed fast algorithms for forgetting sensitive data in generative models.
  Gained expertise in generative architectures such as VAE, GAN, WGAN and WGAN-GP
  as well as low rank adaptations, and gradient surgery.

- **Learning dynamical systems from data with Random Feature Maps, USyd**   2024
  Developed a data-driven method for sampling the non-trainable parameters of tanh
  random feature maps. Conceptualized and implemented deep and local variants
  of random feature maps to achieve state-of-the-art forecast times for chaotic
  dynamical systems. Developed expertise in writing GPU-optimized PyTorch code
  using boolean tensors and efficient matrix-tensor operations.

- **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. Gained in-depth understanding
  of TensorFlow's automatic differentiation by using it to execute custom training
  pipelines.

- **Data Assimilation, ICTS**   2020-2021
  Developed a method for assessing the stability of numerical filters, including
  EnKF and particle filters, and demonstrated exponential stability in both cases.

- **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.

Conferences and Seminars

- Co-organized the minisymposium: 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
- Applied math seminar - **USyd | Talk**: Unlearning via orthogonalization in generative models   2025
- Numerical methods for complex high dimensional systems - **Jervis Bay | Talk**: From Random to Reliable: Good sampling for random features in ML   2024
- 6th workshop on sequential Monte Carlo methods - **ICMS, Edinburgh | Poster**: Numerical explorations of nonlinear filter stability using Sinkhorn divergence
                                        2024
- New directions for stochastic differential equations 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
- In-house symposium - **ICTS, Bengaluru | Talk**: Grid-free solutions of Fokker-Planck equations   2022
- 7th Indian Control Conference - **IIT Bombay | Talk**: Stability of nonlinear filters - numerical explorations of particle and ensemble Kalman filters 2021
- In-house symposium - **ICTS, Bengaluru | Poster**: Can implicit particle filters avoid weight collapse?   2020

Awards

- 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

- I have several first-author articles accepted in leading 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 some of my projects is available on my **GitHub page**.

Software Development

I have authored multiple software packages in Python, and bring several years of experience with Python's scientific computing and machine learning stack, including expertise in TensorFlow and PyTorch. My projects focus on building scalable systems that perform reliably across platforms. Most of my software projects, such as **DeepRFM** and **forget**, are publicly available on **GitHub**.