

Bengaluru - 560097, India

Phone: (+91) 9051614370

Email: [pinak.mandal@icts.res.in](mailto:pinak.mandal@icts.res.in)

Website: <https://pinakm9.github.io/>

## PINAK MANDAL

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### Some Academic Highlights

- 2nd place at national level mathematics exam IIT-JAM(2014)
- 9-th place at national level mathematics exam (for my current employment) TIFR-GS(2016)
- 15-th place at national level math exam (for lectureship/professorship in India) - NET(2016)
- Selected for Future Research Talent program hosted by Australian National University (2021)

### Education

International Centre for Theoretical Sciences (ICTS) - Tata Institute of Fundamental Research, Bengaluru – *Research Scholar*

2017 - Present

I work under professor Amit Apte on data assimilation and machine learning approaches for solving PDEs.

Jadavpur University, Kolkata – *Msc (Mathematics)*

2014 - 2016

Jadavpur University, Kolkata – *Bsc (Mathematics)*

2011 - 2014

### Some Past Projects

Data Analytics and other projects, Indian Institute of Science (2018)

At the Indian Institute of Science I have worked on several projects. Some of them are

- analyzing Prof Ramesh Hariharan's chromosome data and determining the most likely gene configurations that cause color blindness
- finding social structures in a group of dolphins that reside in Doubtful sound, a fjord in New Zealand
- music genre classification with machine learning
- approximately solving computationally challenging problems with genetic algorithms eg the travelling salesman problem

Atmospheric plume modelling, ICTS (2019)

Under Prof Vishal Vasan I have worked on atmospheric plume modelling which included solving a PDE model and integrating the solution on the road network obtained from OpenStreetMap data to estimate air pollution caused by traffic around Peenya, Bengaluru.

### Predicting images from fMRI data, Neuromatch Academy (2021)

I worked with several other international students with varied backgrounds (ranging from neuroscience to chemistry) and we showed that fMRI data can be used to predict images seen by human subjects.

## Current Projects

### Data Assimilation, ICTS

I have written my own module (available at <https://github.com/pinakm9/filters>) for simulating generic stochastic processes, Markov chains and implementing popular filtering algorithms eg Particle and Kalman filters with many different variations.

### Non-linear filter stability, ICTS

- Under Prof Amit Apte I devised an efficient way to compute stability of non-linear filters which I presented at the 7th Indian control conference, 2021 <https://ieeexplore.ieee.org/document/9703185>.
- In a separate paper, we showed that filter stability is related to filter convergence <https://arxiv.org/abs/2208.10810>.

### Solving Fokker-Planck equations with machine learning, ICTS

I have written my own module for solving Fokker-Planck equations (<https://github.com/pinakm9/fp-solvers>) which is applicable to dimensions traditionally thought of as challenging (tested in 10 dimensions) (in preparation).

### Solving variational problems with machine learning, ICTS

In 2022 I was selected as a part of the Future research talent program hosted by Australian National University. In collaboration with them I am exploring the possibility of solving magnetohydrodynamics equations written in an augmented Lagrangian form.

### A gallery of examples from my current projects

A gallery of examples from my current projects is available at my Github page <https://pinakm9.github.io/gallery22/>.

## Publications

- P. Mandal, S. K. Roy, and A. Apte, "Stability of nonlinear filters-numerical explorations of particle and ensemble kalman filters," in 2021 Seventh Indian Control Conference (ICC), pp. 307–312, IEEE, 2021.
- Pinak Mandal, Shashank Kumar Roy, and Amit Apte. Probing robustness of nonlinear filter stability numerically using sinkhorn divergence. Physica D: Non- linear Phenomena, 451:133765, 2023.

- P. Mandal and A. Apte, Learning zeros of Fokker-Planck operators, 2023, <https://arxiv.org/abs/2306.07068>.

## Referees

- [Vishal Vasan](#) (email: [vishal.vasan@icts.res.in](mailto:vishal.vasan@icts.res.in))
- [Amit Apte](#) (email: [apte@iiserpune.ac.in](mailto:apte@iiserpune.ac.in))
- [Sreekar Vadlamni](#) (email: [sreekar@tifrbng.res.in](mailto:sreekar@tifrbng.res.in))
- [Vijaykumar Krishnamurthy](#) (email: [vijaykumar@icts.res.in](mailto:vijaykumar@icts.res.in))

## Skills

- A very competent Python coder. Most of the projects mentioned here can be found at my Github <https://github.com/pinakm9>.
- Fluent in English, Bengali, Hindi.
- A decent chess player. Winner of the annual chess tournament at ICTS (2022).
- A decent long-distance runner.