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# 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 lecturership/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/.

## 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.

## Papers and drafts

- 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.

- P. Mandal, S. K. Roy, and A. Apte, "Probing robustness of nonlinear filter stability numerically using sinkhorn divergence," arXiv preprint arXiv:2208.10810, under review at Physica D, 2022.

- P. Mandal and A. Apte, "Solving high dimemsional Fokker-Planck equations," in preparation, 2022.