

SHASHANK KUMAR ROY

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Citizenship: India

Research interests

Sequential state estimation, modeling and simulation, bayesian data assimilation, gaussian processes, markov chain monte-carlo methods, machine learning, generative modeling for probability distributions, optimal transport applications, dynamical systems, time series analysis and prediction

Education

PhD in Physics, International Center for Theoretical Sciences Bangalore, India

Advisors: Prof. Amit Apte and Prof. Samriddhi Sankar Ray July 2020 – Present

Title: Computational approach to demonstrating filter stability and the sensitivity of covariant lyapunov vectors of a dynamical system for their possible applications in data assimilation.

International Center for Theoretical Sciences Bangalore, India

Masters in Physics, *GPA: 7/10* July 2017 – December 2020

Mentors: Prof. Amit Apte, Prof R. Loganayagam

University of Delhi New Delhi, India

Bachelors in Physics (Honours) *Percentage: 87 %* July 2014 – July 2017

Publications

[1] **Sensitivity of Covariant Lyapunov Vectors and their reconstruction using Data Assimilation**, Shashank Kumar Roy, Amit Apte. *In Preparation, 2022.*

[2] **Probing robustness of nonlinear filter stability numerically using Sinkhorn divergence** Pinak Mandal, Shashank Kumar Roy, Amit Apte, *Submitted, Physica D, 2022.*

[3] **Stability of nonlinear filters - numerical explorations of particle and ensemble Kalman filters** Pinak Mandal, Shashank Kumar Roy, Amit Apte, *Indian Control Conference 2020, Published in IEEEExplore, 2021.*

Research Experience

A generative adversarial network model for distribution of Sea Surface Temperature

Ecole Polytechnique, BNP Paribas and Fondation de l'Ecole polytechnique and Mercator Ocean
Modeling distribution of the sea surface temperature at 6 different locations Oct – Dec 2022

Sequential state estimation for high-dimensional chaotic system with partial and noisy observation, Mentor: Prof. Amit Apte, Semester Project, ICTS August – Dec 2019
Implementing ensemble kalman filter for Lorenz-96 ode to compute conditional distribution.

LSTM model to predict spatial time series for climate model emulation

3rd NOAA AI Workshop - Climate Informatics Joint Hackathon 7- 14 Sep 2021
Predict annual mean global distributions of temperature and precipitation given emissions and concentrations of key anthropogenic climate forcing: SO₂, BC, CH₄, and CO.

	<p>Cytoplasmic streaming driven by Surface flows using Vector Spherical Harmonics Mentor: Prof Vijay Kumar Krishnamurthy, Biophysics Group at ICTS Analytical solution of Stokes equation for spherical geometry for bulk flow inside a sphere driven by a surface flow May – August 2018</p>
	<p>An Interdisciplinary Study of Light Pollution in Indian Context (Extension) Dr.N.Rathnasree(Ex-Director,Nehru Planetarium), Dr Ashok Kumar (Ramjas College). University of Delhi under Innovation Project Scheme 2015-2016 (RC302) Oct 2015 – Nov 2016</p>
Teaching experience	<p>Teaching assistant, Department of Data Science, IISER Pune, India, DS4233: Time Series Course on basic time series analysis and modelling. Curating Jupyter notebooks for demonstrations and taking tutorial sessions. Jan-April 2023</p> <p>Advanced Physics Subject Matter Expert (Chegg.com) July 2020- July 2021</p> <p>Freelance Tutor for solving university level doubts and problems for students.</p>
Licences and Certifications	<p>NVIDIA, Deep Learning Institute Summer 2022</p> <p>[1] Applications of AI for Anomaly Detection Issued on July 2022</p> <p>[2] Accelerating Data Engineering Pinelines Issued on Feb 2022</p> <p>[3] Fundamentals of Deep Learning Issued on Feb 2022</p> <p>IBM, Qiskit</p> <p>[1] Quantum Computation -Certified Associate Developer Januray 2022</p> <p>[2] IBM Quantum Challenge 2021 Achievement - Advanced June 2021</p> <p>Neuromatch Academy - Deeplearning Course and Project view August 2021</p> <p>Imperial College London-Online course on Data Assimilation view 11-15 July 2022</p>
Achievements	<p>Secured 10th best score in IBM Quantum Challenge 2021</p> <p>Department of Atomic Energy Fellowship for pursuing PhD in Physics 2019</p> <p>Joint Entrance Screening Test AIR-95, Percentile-98.8 and IIT-JAM 2017, AIR-259 2017</p> <p>Awarded ISC-2014 Science School Topper and 3rd topper at district level 2014</p>
Conferences and Workshops	<p>Conference on Nonlinear Systems and Dynamics 2022, IISER Pune, India, Presented a poster titled, "<i>Reconstructing Covariant Lyapunov Vectors using Nonlinear Filtering</i>" Dec 2022</p> <p>ECMWF–ESA Machine Learning for Earth Observation and Prediction 14-17 Nov 2022 Workshop on machine learning and data assimilation on using earth observations data.</p> <p>Qiskit Global Summer School on Quantum Machine Learning, IBM July-August 2021 Summer School focusing on quantum machine learning formalisms and algorithms with hands-on experiemnts via ibm-quantum lab.</p> <p>ICTS Workshop on Climate Studies July-Aug 2021 Name of conference, workshop, seminar, venue, etc., or a description</p> <p>Indo-US Workshop on Recent Advances in AI ML for Climate Sciences Nov 13-15 2021</p>

Technology Innovation Hub, Indian Statistical Institute, Kolkata and IEEE GRSS Kolkata Chapter, on the problems and applications in climate data science

Meta- Heuristic Optimization, Machine Learning and AI-Workshop March 8-12 2021

Talks and tutorials organized by SAMSI, on the theory and practical applications of metaheuristic optimization methods in statistics such as swarm and evolutionary algorithms.

Numerical Analysis in Data Science Workshop

August 26-27 2021

Workshop on inverse problems and uncertainty quantification, sensitivity analysis, Reinforcement Learning and dimension Reduction in time series.

The Fields Institute Second Symposium on Machine Learning and Dynamical Systems

On the intersection of machine learning and dynamical systems theory to solve problems in representation learning, analysis and prediction.

September 2020

Technical Skills

Programming languages and frameworks

Experienced with Python, Numpy, Pandas, Scipy, Pytorch, Tensorflow, Jax, Mayavi, FEniCS

Familiar with Matlab, C++, Fortran

Experienced with Latex, Linux, Windows, MS Office

Languages

English (advanced), Hindi (fluent)

References

Prof. Amit Apte, ICTS Bangalore and IISER Pune

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Prof. Vishal Vasan, ICTS Bangalore

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Prof. Samriddhi Sankar Ray, ICTS Bangalore

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