

Rajat Sarkar

AI & ML RESEARCHER · TCS RESEARCH

Pune, India

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Education

Indian Institute of Technology(IIT)

Delhi, India

PH.D., APPLIED MECHANICS

July. 2025 - present

- CGPA: 10/10
- **Thesis Title:** Hypergraph Computation for Scientific Machine Learning
- **Advisor:** Dr. Souvik Chakraborty
- **Area of Expertise:** Scientific Machine Learning, Hypergraph Computation, Multiphysics

Indian Institute of Space Science and Technology(IIST)

Thiruvananthapuram, India

M.TECH, AERODYNAMIC AND FLIGHT MECHANICS

July. 2018 - May. 2020

- CGPA: 8.87/10
- **Thesis Title:** Design of a Contour Nozzle for High Enthalpy Shock Tunnel
- **Advisor:** Dr. Satheesh K
- **Area of Expertise:** High-Temperature Gas Dynamics

Hindustan University

Chennai, India

B.TECH, AEROSPACE ENGINEERING

July. 2013 - May. 2017

- CGPA: 8.71/10
- **Thesis Title:** A Study of Fuel Tank Sloshing Using Smooth Particle Hydrodynamic.
- **Advisor:** Dr. Yash Pal

Work Experience

TCS Research

Pune, India

RESEARCHER

Sep. 2020 - present

- Conducted extensive research on the application of Artificial Intelligence (AI) and Machine Learning (ML) in diverse industries like Computational Fluid Dynamics, Material Imaging, and Battery.
- Developed advanced super-resolution techniques, including Mesh-independent PointSAGE and Physics-Informed UNet, to enhance low-fidelity CFD simulations into high-fidelity ones for industrial air preheaters and methane combustion.
- Developed computer vision techniques using GNN and HGNN for Electron Micrograph classification, applied GNN-based Relational Learning for Lithium-ion Batteries (LiBs) life estimation and implemented a Hypergraph-based recommendation system for anomaly detection.

Indian Institute of Space Science and Technology(IIST)

Thiruvananthapuram, India

TEACHING ASSISTANT

July. 2019 - April. 2020

- **Lab:** Aerodynamic and Flight Mechanics Lab
- **Mentor:** Dr.Satheesh K

Vikram Sarabhai Space Center

Thiruvananthapuram, India

RESEARCH INTERN

May. 2019 - June. 2019

- Worked as an aerospace intern in the Gaganyaan project at TERLS(VSSC)
- **Research Area:** Boundary layer transition over re-entry module

Publications

PointSAGE: Mesh-independent superresolution approach to fluid flow predictions

DATA-CENTRIC MACHINE LEARNING RESEARCH (DMLR) WORKSHOP AT ICLR

May 2024

- Authors: **Rajat Sarkar**, Krishna Sai Sudhir Aripirala, Vishal Jadhav, Sagar Srinivas Sakhinana and Venkataramana Runkana

Redefining Super-Resolution: Fine-mesh PDE predictions without classical simulations

MACHINE LEARNING AND THE PHYSICAL SCIENCES WORKSHOP AT NEURAL INFORMATION PROCESSING SYSTEMS (NEURIPS)

Dec. 2023

- Authors: **Rajat Sarkar**, Ritam Mujumdar, Vishal Jadhav, Sagar Srinivas Sakhinana and Venkataramana Runkana
- Paper on [arXiv:2311.09740](#)

Multi-Knowledge Fusion Network for Time Series Representation Learning

MACHINE LEARNING FOR IOT WORKSHOP AT INTERNATIONAL CONFERENCE ON LEARNING REPRESENTATIONS (ICLR)

May. 2023

- Authors: Sagar Srinivas Sakhinana, Shivam Gupta, Sudhir Aripirala, **Rajat sarkar**, Venkataramana Runkana

Vision-HgNN: An Electron Micrograph is Worth a Hypergraph of Hypernodes

PRACTICAL MACHINE LEARNING FOR DEVELOPING COUNTRIES (PML4DC) WORKSHOP AT ICLR

May. 2023

- Authors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, Sreeja Gangasani, and Venkataramana Runkana.

Battery GraphNets: Relational Learning for Lithium-ion Batteries (LiBs) Life Estimation

GRAPH LEARNING FOR INDUSTRIAL APPLICATIONS: FINANCE, CRIME DETECTION, MEDICINE, AND SOCIAL MEDIA WORKSHOP AT NEURIPS

Dec. 2022

- Authors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, and Venkataramana Runkana.

EMCNet: Graph-Nets for Electron Micrographs Classification

MACHINE LEARNING FOR MATERIALS WORKSHOP AT ACM SIGKDD

Aug. 2022

- Authors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, and Venkataramana Runkana.

Patents

High-Resolution Simulation Prediction For Computational Fluid Dynamics

INDIAN PATENT APP. 202421037547

May. 2024

- Inventors: **Rajat Sarkar**, Krishna Sai Sudhir Aripirala, Vishal Jadhav, Sagar Srinivas Sakhinana and Venkataramana Runkana

System and method for generating mixed variable type multivariate temporal synthetic data

US PATENT APP. 17/994,580

Dec. 2023

- Inventors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, and Venkataramana Runkana.

Privacy preserving generative mechanism for industrial time-series data disclosure

US PATENT APP. 17/804,682

May. 2023

- Authors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, and Venkataramana Runkana.

Congeniality-preserving generative adversarial networks for imputing low-dimensional multivariate time-series data

US PATENT APP. 17/815,316

May. 2023

- Authors: Sagar Srinivas Sakhinana, **Rajat Sarkar**, and Venkataramana Runkana.

Achievements

2018 **All India Rank 71**, Graduate Aptitude Test in Engineering (GATE) for Aerospace Engineering

2013 **Finalist**, Lunar Rover Challenge 2K13 at Shastra

2013 **Runner-Up, Human Settlement in Venusian Clouds** at INTERSTELLAR (GRAVITAS 2K15)

IIT Madras, India

VIT, India

Projects

Design of a Contour Nozzle for High Enthalpy Shock Tunnel

M.TECH THESIS

Jun. 2019 - May. 2020

- Developed a **Mach 4 contoured nozzle for a high enthalpy Shock Tunnel** that utilizes a **thermochemical equilibrium model** and employs Nelder-Mead optimization. The objective was to generate a flow with significantly reduced non-uniformity compared to a conical nozzle design. Mach number variation $\geq 1\%$, Flow angularity variation $\geq 0.18\%$, Temperature variation $\geq 1.52\%$, Static and Pitot pressure variation $\geq 7\%$

Model to predict turbulent boundary layer transition in Re-entry module

VSSC INTERNSHIP

May. 2019 - June. 2019

- Created a physics model using MATLAB to **predict the transition of the boundary layer to turbulence on an axisymmetric re-entry module** during re-entry. Additionally, estimated the maximum thermal heating near the transition region.

Study of Fuel Tank Sloshing Using Smooth Particle Hydrodynamic.

B.TECH PROJECT

Sept. 2016 - April. 2017

- Conducted a meshless Computational Fluid Dynamics (CFD) analysis to simulate sloshing in an aircraft fuel tank using **Smooth Particle Hydrodynamics**.
- Explored and compared the **impact of varying baffle plate thicknesses on mitigating the sloshing effect** within the tank.

Sounding rocket stabilizing platform

EMBEDDED SYSTEMS DEVELOPER

Apr. 2016 - Apr. 2017

- Designed a **stabilizing platform for electronics within a sounding rocket** to address rotational g-forces during stabilization, preventing saturation and false readings, particularly for sensitive components like accelerometers. Developed under the guidance of **Dr. Murgesan, an Ex-ISRO scientist**.

Skills

AI & ML Algorithms	Graph Neural Network, Vision Transformers, Generative Adversarial Network, Diffusion Models, Random Forest, XGBoost
Programming	Python, C, MATLAB, LaTeX
Software	OpenFOAM, ANSYS-Fluent, Paraview, Microsoft Office
Languages	English, Hindi, Bengali