

Abhishek Singh

Bhubaneswar, India

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Personal Profile

A physics undergraduate fascinated by complex systems across diverse domains like neural networks, developmental biology. Eager to learn about frameworks of statistical physics, dynamical systems and information theory so as to develop tools for modeling the dynamics of these complex systems.

Education

National Institute of Science Education and Research

Bhubaneswar, India

BSMS Major in Physical Science

Aug. 2021 -

- Minor in Computer Sciences
- Current GPA: 8.64/10
- **Relevant Coursework:**
Classical Physics, Quantum Mechanics, Statistical Mechanics, Non-equilibrium Statistical Mechanics, Computational Physics
Theory of Computation, Graph Theory, Algorithm Design, Complexity Theory, Machine Learning

Research Experience

Simons Centre for the Study of Living Machines @ NCBS

Bangalore, India

Summer internship | Ising-like Interaction Model for Cell Fate Decisions

May 2024 - July 2024

- Under the supervision of Dr. Archishman Raju
- Developed and analyzed a model based on Ising-like interactions to study population-level dependent cell-fate decisions.
- Performed stability analysis of fixed points and studied their dependence on cell population size.
- Simulated bifurcations and robustness analysis to understand how noisy parameters affect emergent cell-fate decision.
- Report can be found [here](#).
- **Technical Skills:** Mathematica, Python with NumPy, Matplotlib, Nonlinear Dynamics

Indian Institute of Science Education and Research

Thiruvananthapuram, India

Summer internship | HNN

May 2023 - July 2023

- Under the supervision of Dr. Chandrakala Meena
- Studied various Physics-informed ML algorithms for prediction of dynamics of non-linear systems.
- Implemented Hamiltonian Neural Network for prediction of dynamics of systems like simple pendulum, Van der Pol oscillator. Report can be found [here](#).
- **Technical Skills:** Python with PyTorch, NumPy, SciPy, Matplotlib

University Projects

Secure communication with Chua circuit

NISER

Aug. 2024 - Nov. 2024

- Project as a part of Open Lab Course at NISER.
- Design and Analysis of Chaotic circuits like Lorenz and Chua using easily available electronics item.
- Synchronization of two Chua circuit using passive element and study of its stability at various paramter values.
- Use of synchronized Chua circuits to securely communicate digital and analog information.

ML for solving advection and diffusion equations

NISER

Oct. 2023 - Nov. 2023

- Project as a part of course on Computational Physics.
- Use PINN to solve the advection and diffusion equations in 1-D. The PDEs can impose strong constraint on Loss function and can be used optimize the solution to replicate physics.
- Codes can be accessed from [GitHub Repository](#) and report can be found [here](#).

Workshops Attended

Spins, Games & Networks	Chennai, India
<i>Understanding Collective Coordination in Complex Systems</i>	December 2024
The Institute of Mathematical Sciences	

Skills

Programming	Python (Pandas, PyTorch, NumPy, Scipy, Matplotlib), Mathematica (<i>beginner</i>)
Soft Skills	Time Management, Teamwork, Problem-solving, Engaging Presentation, Scientific Writing.
Miscellaneous	LaTeX, Microsoft Office.

Highlights

2024	Chief Co-ordinator , Yantriki, Club Magazine of RTC, NISER	India
2023	Speaker , Talk on ‘PINN to learn Physics from data’ at Physics Club, NISER	India
2022	Editor , Yantriki, Club Magazine of RTC, NISER	India
2021	Scholarship , DAE- DISHA	India
2021	AIR 251 , National Entrance Screening Test(NEST)	India

Interests

Sci. Comm.	Contributed to outreach activities, sharing complex ideas in simple manner to high-school students.
Robotics	Active member in RoboTech Club (RTC) at NISER.
Debating	I am member of Debating Club ‘Vaktavya’ at the institute and participate in various events through the club.

Reference

Dr. Archishman Raju
Faculty, Simons Centre for the Study of Living Machines, NCBS
Bangalore, India