Ajit Mahata, Ph.D.

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Research Interests

Machine learning in complex systems, Extreme events, Data analysis, and Stock market modeling.

Academic Qualifications

2022	Ph.D. in Physics	National Institute of Technology Sikkim, Sikkim, India
2016	M.Sc. in Physics	National Institute of Technology Durgapur, West Bengal, India
2014	B.Sc. in Physics	University of Calcutta, West Bengal, India

Research/Scientific Experience

Sep, 2024–
Present

Postdoctoral Fellow

The project focused on: (a) the development of methods for predicting extreme events based on a combination of machine learning and partial model identification. Reservoir computing technique has been applied to different dynamical systems, as well as experimental data, which exhibit extreme event dynamics, to check the effectiveness of the machine learning technique. (b) Identification of coexisting dynamic states (chimeric, coherent, incoherent) based on machine learning methods. The study aims to identify the coexisting dynamics and predict cluster and global synchronization based on a network using reservoir computing with partial observations of the input.

Research Advisors: Prof. Tomasz Kapitaniak, Division of Dynamics, Department of Mechanical Engineering, Lodz University of Technology, Poland

Nov, 2023–
Sep, 2024

Research Associate-II

The study focused on assessing the bone age of various age groups from the hand-wrist X-ray image using machine learning techniques. Image segmentation, image registration techniques, and Siamese networks are applied to execute the project.

Research Advisors: Dr. Pranay Goel, Department of Biology, Indian Institute of Science Education and Research Pune, Maharashtra, India

Dec, 2021–
Nov, 2023

Postdoctoral Fellow

Research focused on predicting the full states of the dynamical systems using a partial observation based on the reservoir computing technique. Numerical data generated from Chaotic Chua's and Lorenz 63 systems and experimental data from Chua's oscillator have been used in this study.

Research Advisors: Prof. Amit Apte, Prof. and Chair, Department of Data Science, Indian Institute of Science Education and Research Pune, Maharashtra, India

2016–2021	***Doctoral Dissertation*** Title: Time Scales and Characteristics of Stock Markets Research Advisor: Dr. Md. Nurujjaman, Ph.D., Associate Professor, Department of Physics, NIT Sikkim, Sikkim, India
2015-2016	***Post-graduate Semester Project*** Project title: Synthesis and Characterization of $YFeO_3$ Nanoparticles Research Advisor: Dr. Soumen Basu, Ph.D., Associate Professor, Department of Physics, NIT Durgapur, West Bengal, India

TEACHING EXPERIENCE

Jan, 2023 – April, 2023	***Teaching Assistance at IISER Pune*** Subject: DS4233/DS6233-Time Series Analysis
Jan, 2024 – April, 2024	Subject: DS3214/BI3424-Statistical learning and data science
Aug, 2017 – Dec, 2021	***Teaching Assistance at NIT Sikkim*** Subject: Basic electrical science Subject: Engineering Physics Subject: Engineering Physics Laboratory (PH11201)

TECHNICAL SKILLS

- Python
- MATLAB

PUBLICATIONS

1. **Ajit Mahata,** SL Kingston, S Ghosh, SK Dana and T Kapitaniak. “Learning transitions to extreme events using reservoir computing.” Physical Review E 112, no. 5 (2025): 054207.
2. **Ajit Mahata,** Reetish Padhi, and Amit Apte. "Variability of echo state network prediction horizon for partially observed dynamical systems." Physical Review E 108, no. 6 (2023): 064209.
3. Anish Rai, **Ajit Mahata,** Md Nurujjaman, Sushovan Majhi, and Kanish Debnath. "A sentiment-based modeling and analysis of stock price during the COVID-19: U-and Swoosh-shaped recovery." Physica A: Statistical Mechanics and its Applications 592 (2022): 126810.
4. Anish Rai, **Ajit Mahata,** Md Nurujjaman, and Om Prakash. "Statistical properties of the aftershocks of stock market crashes revisited: Analysis based on the 1987 crash, financial-crisis-2008 and COVID-19 pandemic." International Journal of Modern Physics C 33, no. 02 (2022): 2250019.
5. **Ajit Mahata,** Anish Rai, Md Nurujjaman, and Om Prakash. "Modeling and analysis of the effect of

COVID-19 on the stock price: V and L-shape recovery." Physica A: Statistical Mechanics and its Applications 574 (2021): 126008.

6. **Ajit Mahata,** Anish Rai, Md Nurujjaman, Om Prakash, and Debi Prasad Bal. "Characteristics of 2020 stock market crash: The COVID-19 induced extreme event." Chaos: An Interdisciplinary Journal of Nonlinear Science 31, no. 5 (2021).
7. **Ajit Mahata,** Debi Prasad Bal, and Md Nurujjaman. "Identification of short-term and long-term time scales in stock markets and effect of structural break." Physica A: Statistical Mechanics and its Applications 545 (2020): 123612.
8. **Ajit Mahata,** and Md Nurujjaman. "Time scales and characteristics of stock markets in different investment horizons." Frontiers in Physics 8 (2020): 590623.

CONFERENCE/WORKSHOP

1. Poster presented at the International Conference on the "XLV Dynamics Days Europe", Thessaloniki, Greece, June 23-27, 2025.
2. Poster presented at the International Conference on the "Data and Dynamic Summit 2024," organized by IISER Pune, India, in 2024.
3. Poster presented at the International Conference on the "Perspective of Nonlinear Dynamics," organized by IIT Madras, India, in 2023.
4. Poster presen at the International Conference on the "Complexity and Nonlinear Dynamics in Science Technology, Engineering, and Mathematics," organized by IIT Hyderabad, India, in 2023.
5. Attended the International Workshop on "Statistical Data Analysis using Python," organized by the Institute for Statistics and Analytical Research, Chennai-600 102, India, in 2021.
6. Participate in the "Networks and Dynamical Systems" event, organized by the Indian Institute of Technology Madras, India, in 2021.
7. Poster presented at the International Conference on "Nonlinear Systems and Dynamics," organized by the Indian Institute of Technology Kanpur, India, in 2019.
8. Attended the International Conference on "Complex Dynamical Systems and Applications," organized by the Indian Institute of Technology Guwahati, India, in 2017.