Swapnaneel Bhattacharyya

Curriculum Vitae

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▬ Education

2024–2026 **Master of Statistics (M.Stat.)**, *Indian Statistical Institute (ISI)*, Kolkata.
- **First Semester: 93.8 %; Second Semester: 92.6 %;**
- Currently in 2nd year with specialization in *Theoretical Statistics*.
- Dissertation Advisors: Dr. Aaditya Ramdas (CMU) and Dr. Ambarish Chattopadhyay (ISI).

2021–2024 **Bachelor of Statistics (B.Stat.) (Hons.)**, *Indian Statistical Institute (ISI)*, Kolkata.
- **Overall Score: 91.16 %;**
- Secured the **First Position** in the **B.Stat. (Hons.) 2021-2024 Batch**.
- Received **ISIAA - Mrs. M.R.Iyer Memorial Gold Medal Award** for the **outstanding overall performance in B.Stat. (Hons.) 2021-2024 Program.**
- Achieved **perfect scores** in **7** courses.

2019–2021 **Higher Secondary (12th Grade) Examination**, *Mahesh Sri Ramakrishna Ashram Vidyalaya*, Rishra, WB, India
- Scored **97.6 %**, securing **11th** position in the state out of $\sim 600,000$ candidates.

2013–2019 **Secondary (10th Grade) Examination**, *Mahesh Sri Ramakrishna Ashram Vidyalaya*, Rishra, WB, India
- Scored **94 %**, with **perfect score** in **Mathematics**.

▬ Areas of Interest

○ Conformal Prediction
○ Changepoint Detection and Localization
○ Sequential Decision Making
○ Game-Theoretic Statistics

○ Random Matrix Theory
○ Spectral Analysis in Random Fields
○ Causal Inference
○ Reinforcement Learning

▬ Publication

○ **Simultaneous clustering and joint modeling of multivariate binary longitudinal and time-to-event data:** Srijan Chattopadhyay, Sevantee Basu, **Swapnaneel Bhattacharyya**, Manas Pratim Gogoi, and Kiranmoy Das
- **Published in Lifetime Data Analysis (2025).**
- URL: https://link.springer.com/article/10.1007/s10985-025-09664-z

Preprints

○ **Theoretical guarantees for change localization using conformal p-values (2025):** **Swapnaneel Bhattacharyya,** Aaditya Ramdas

- Discovered novel properties of conformal p-value in the distribution-change setup.
- Obtained theoretical guarantees, including set-size analysis for the first proposed distribution-free, finite-sample valid confidence set for the distributional change point.
- Derived a consistent changepoint estimator under mild assumptions, with its rate of consistency.
- Constructed consistent, finite-sample valid tests for changepoint and exchangeability.
- Introduced a novel algorithm to optimize the power of conformal tests.
- **Available at:** https://arxiv.org/abs/2510.08749

○ **Testing Equality of Medians for Multiple Samples (2025):** **Swapnaneel Bhattacharyya**

- Constructed a consistent, distribution-free test for assessing equality of population medians across independent samples, and established additional properties, including its rate of consistency.
- **Available at:** https://arxiv.org/abs/2501.05136

○ **Application of Random Matrix Theory in High-Dimensional Statistics (2024):** **Swapnaneel Bhattacharyya**, Srijan Chattopadhyay, Sevantee Basu

- Established a **CLT of the eigenvalues of Wishart Matrices with Berry–Esseen type bound**, under very mild assumptions, and addressed a large class of high-dimensional inference problems with the help of that CLT. Along with my own contribution, this paper also contains a detailed review of random matrix theory (RMT) in covariance matrix inference, principal component analysis (PCA), signal processing, and changepoint detection.
- **Available at:** https://arxiv.org/abs/2412.06848

○ **A Statistical approach to ecological modeling by a new similarity index (2023):** Srijan Chattopadhyay, **Swapnaneel Bhattacharyya**

- Constructed a randomization-based similarity index, which outperformed the previous indices for having tunable prevalence dependence.
- **Available at:** https://arxiv.org/abs/2304.01944

Academic Achievements

2024–2025   Received the **prize money for outstanding performance** in all semesters (until now) in the **M.Stat.** program at the Indian Statistical Institute.

2024   Received **ISIAA - Mrs. M.R.Iyer Memorial Gold Medal Award** for the **outstanding overall performance and securing the first position** in the B.Stat. (Hons.) program (2021-2024) at the Indian Statistical Institute.

2024   Invited speaker at the **D.Basu Memorial Talk**, an honor extended annually to top performers in the B.Stat. (Hons.) program at the Indian Statistical Institute.

2024   Selected for the **Big Data Summer Institute (BDSI)** at the University of Michigan.

2021 – 2024   Received the **prize money for outstanding performance** in all semesters in the **B.Stat.** program (2021 - 2024) at the Indian Statistical Institute.

2021   Secured **National rank 23** out of $\sim 10,000$ candidates in the entrance exam of the Indian Statistical Institute.

2021   Secured **State rank 11** in the Higher Secondary Examination out of $\sim 600,000$ candidates.

2018   Secured **National Rank 3 (Regional Rank 1)** in the Regional Mathematical Olympiad, selected from $\sim 100,000$ participants in the preliminary exam.

Research Internships (On-site)

2025   **Department of Statistics and Data Science, Carnegie Mellon University**

     ○ **Supervisor: Dr. Aaditya Ramdas**, Carnegie Mellon University

     ○ **Brief Description:** Contributed to the research leading to the arXiv preprint Theoretical Guarantees for Change Localization Using Conformal p-values (2025).

2024   **Big Data Summer Institute (BDSI)**

     ○ **Supervisor: Dr. Veera Baladandayuthapani**, School of Public Health, University of Michigan

     ○ **Brief Description:** Joined the **Cancer Data Science** group supervised by Dr. Veera Baladandayuthapani. Using Spatial Multiplex Imaging and the theory of nonparametric inference of point processes, I studied the Lung Cancer dataset, obtained the clustering of the patients, and did cluster-wise survival analysis to understand the variations of individual survival probabilities. The presentation of the whole work is available here.

Talks and Presentations

2024   **(Invited talk) Conformal Prediction: A New Paradigm for distribution-free prediction with coverage guarantee in finite samples**

     - At the D.Basu Memorial talk in ISI, Kolkata

2023   **(Invited talk) Application of Machine Learning in ecological modelling**

     - At National Institute for Biomedical Genomics, Kolkata

2022   **(Invited talk) Ramsey theory and its applications**

     - At Open day, ISI Kolkata

Technical Skills

Programming	R, C, Python
Others	LaTeX, R Markdown, HTML

Selected Course Projects

2024   **Clustering, Onset and Changepoint Detection of West Bengal rainfall data**

- Estimated monsoon onset/departure dates for over a century of West Bengal rainfall data and investigated temporal trends in monsoon timing, duration, and rainfall characteristics.
- Developed a nonparametric, spectral-density-based clustering method for time-series data and applied it to identify structure in rainfall patterns. (Available here)

2023   **A Regression-based approach of Peak Detection in humming audio data**

- Developed a new distribution-free method to identify peaks from audio data. (Available here)

2023   **Predicting GPS Position, Weather, Number of Covid Cases, and Stock Price using Linear Kalman Filter**

- Designed and implemented linear Kalman filter models for the above-mentioned sequential prediction tasks. (Available here)

2022   **Face Recognition using PCA and LDA**

- Used Principal Component Analysis and Linear Discriminant Analysis to make clusters of similar images from a group of 50 photos, each of 200×180 dimensions

Other Information

Languages	English (Full Professional proficiency), Bengali (Native Language)
Teaching	Trained a number of students for Mathematical Olympiads and the entrance examinations of ISI, CMI, and other colleges at undergraduate and master's level.