Aditya Ghosh

Curriculum Vitae

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Education

2020–Present **Masters of Statistics (M.Stat)**, *Indian Statistical Institute (ISI)*, Kolkata, India
Scored **94.4%** in the first year.

2017–2020 **Bachelor of Statistics (B.Stat)**, *Indian Statistical Institute (ISI)*, Kolkata, India
Scored **93.9%** in aggregate.

2015–2017 **Higher Secondary (12th Grade) Examination**, *Ramakrishna Mission Boys' Home, Higher Secondary School, Rahara*, Kolkata
Scored **91%** in aggregate, with 100 in Mathematics and 99 in Statistics.

2005–2015 **Secondary (10th Grade) Examination**, *Ramakrishna Mission Boys' Home, Higher Secondary School, Rahara*, Kolkata
Scored **87.1%** in aggregate, with 100 in Mathematics.

Academic achievements

2021 **ISIAA – Mrs. M.R.Iyer Memorial Gold Medal** for the highest aggregate in the B.Stat course at ISI, Kolkata.

2021 **Nikhilesh Bhattacharyya Memorial Gold Medal** for outstanding performance in Statistics and Probability in the B.Stat course at ISI, Kolkata.

2020 Selected for a prestigious **Summer Research Program** at the *Duke University, Dept. of Statistical Science*. The program was cancelled later due to Covid-19.

2019, 2018 Selected for the prestigious **Madhava Nurture Camp** at the *Chennai Mathematical Institute*, Siruseri, Chennai (2019) and *St. Xavier's College,* Kolkata (2018).

2018 Received prizes from ISI for performing well in the **Simon Marais Mathematics Competition 2018**.

2017 Ranked **2nd** in the B.Stat entrance examination of ISI, and also cleared the B.Sc entrance examination of Chennai Mathematical Institute (CMI).

2016 Achieved a **certificate of merit** for performing at a promising level in **Indian National Mathematical Olympiad (INMO) 2016**, organized by the NBHM, Govt. of India. This is awarded to the top 75 participants in the country.

2016 Selected for the **INMO 2016 training camp** at ISI, Kolkata.

Publications

1. Ghosh, A. (2019). An asymptotic formula for the Chebyshev theta function. *Notes on Number Theory and Discrete Mathematics*, 25(4), 1-7. DOI: 10.7546/nntdm.2019.25.4.1-7

Master's dissertation

Title **Rank and Matching based estimation of Average Treatment Effect in Causal Inference**

Supervisor Dr. Bodhisattva Sen (Department of Statistics, Columbia University)

Description Several covariate adjustment methods have been proposed in the literature of causal inference to estimate the average treatment effect (ATE) in randomized trials by fitting an ANCOVA model. However, Rosenbaum (2002) advocated for a robust method using the Hodges-Lehmann estimator that inverts a rank test (e.g., the Wilcoxon rank sum test). The asymptotic properties of this estimator have not been formally studied yet. We derive the asymptotic distribution of this estimator, both with or without covariate adjustments, and give a proof of the efficiency gain for using covariates over the unadjusted estimator. Further, we establish an efficiency lower bound that mimics the celebrated result of Hodges and Lehmann (1956). We also propose consistent estimators of the large sample variances of these rank-based estimators that readily yield confidence intervals for the ATE. Finally, we illustrate through extensive simulations that unlike the ANCOVA based estimators, these rank-based estimators are efficient and robust against heavy-tailed distributions, contamination, and various model misspecifications.
Matching is another method of adjusting for covariates when estimating the ATE, especially in observational studies. Despite its popularity, the large sample properties of nearest-neighbor matching estimators with a fixed number of matches are not very attractive (Abadie and Imbens, 2006). We also plan to explore this area of research and believe that by undertaking a more systematic and complete study of nearest-neighbor matching estimators, including ideas from Stein's method for exchangeable pairs, we can improve some of the existing theoretical results in this area.
Status: A manuscript is being written.

Summer projects/internships

Summer 2021 **Rank and Matching based estimation of Average Treatment Effect in Causal Inference**
Guide: Dr. Bodhisattva Sen (Department of Statistics, Columbia University)
Status: Continued the project as Master's dissertation.

Summer 2019 **Method of Moments in Probability Theory.**
Guide: Dr. Arijit Chakrabarty (SMU, ISI, Kolkata)
Description: Derived on my own some known results, e.g., Hoeffding's CLT for U-statistics, Wigner's semi-circle law in Random Matrix Theory, etc.

Summer 2019 **Summer Internship in Cryptology**, offered by the *R. C. Bose Centre for Cryptology and Security*, ISI, Kolkata.
Guide: Dr. Rana Barua (SMU, ISI, Kolkata)
Description: Did a reading project on (i) Elliptic Curve Cryptography, (ii) Pseudo-random objects (PRPs, PRFs, etc.) and (iii) Hash functions.

Spring–Summer 2018 An **independent study** on Analytic Number Theory.
Description: Obtained a new asymptotic formula for the Chebyshev ϑ function.
Status: Published in a journal. DOI: 10.7546/nntdm.2019.25.4.1-7

Talks

Fall 2021 **(Upcoming talk)** D. Basu Memorial Lecture, ISI, Kolkata

Summer 2021 **(Invited talk)** Online Reading Group on Functional Data Analysis
Title: *Two-sample testing of the equality of mean functions*.

Spring 2021 **(Invited talk)** Students' Learning Seminar, ISI, Kolkata
Title: *Matching Estimators in Causal Inference*.

Summer 2020 Presented the paper 'What we look at in paintings : a comparison between experienced and inexperienced art viewers' (Ylitalo, Särkkä, and Guttorp. (2016). *Ann. Appl. Stat.* 10 (2) 549 - 574), as a part of the Statistics Comprehensive course in B.Stat 3rd Year.

Class projects

Fall 2020 **On Age-dependent Branching Processes with/without Immigration**, a group project with classmates Wribhu Banik and Shouvik Middey, as a part of the Stochastic Processes course in M.Stat 1st Year.
Guide: Dr. Soumendu Sundar Mukherjee (ISRU, ISI, Kolkata)

Fall 2020 **Analyzing a Lower Back Pain Data**, a group project with classmates Anik Burman and Soham Das, as a part of the Regression Techniques course in M.Stat 1st Year.
Guide: Dr. Kiranmoy Das (ISRU, ISI, Kolkata)

Summer 2020 **Finding Anomalies in a Coal Quality data of Coal India Limited**, a group project with classmates Soham Das and Arjama Das, as a part of the Statistics Comprehensive course in B.Stat 3rd Year.
Guide: Dr. Debashis Sengupta (ASU, ISI, Kolkata)

Spring 2020 **Typical Distance between Two Randomly Selected Vertices of a Erdős-Rényi Binomial Random Graph**, a joint project with classmate Sayak Chatterjee, as a part of the Random Graphs course in B.Stat 3rd Year.
Guide: Dr. Antar Bandyopadhyay (SMU, ISI, Delhi)

Technical skills

Programming Proficient in R and C.

Markup/Web LaTeX (proficient), R markdown (basic), HTML (basic).

Other information

Languages Bengali (mother tongue), English (fluent) and Hindi (conversational).

Teaching
- Trained a number of students for Mathematical Olympiads and the entrance examinations of ISI, CMI, and other colleges.
- Maintaining a blog ghoshadi.wordpress.com aimed at helping high-school students prepare for Mathematical Olympiads and similar competitions.

I hereby declare that all the information provided above are true to the best of my knowledge.

Aditya Ghosh.

October 30, 2021