

DAKSHESH VASAN

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Dept. of Mathematics and Statistics, Indian Institute of Science Education and Research Kolkata

RESEARCH INTERESTS

Probability Theory, Analysis of Stochastic Processes, Related fields and relevant applications in real world.

EDUCATION

Currently Pursuing a Ph.D., Statistics Fall 2023 - Ongoing
[Michigan State University \(MSU\)](#)

Concentration: Probability Theory and Related Topics

Master of Science (MS), Mathematical Sciences Aug 2022 - Jul 2023
[Indian Institute of Science Education and Research \(IISER\), Kolkata](#)

Concentration: Probability Theory | Relevant Coursework: Time Series Analysis, Multivariate Analysis, Differential Geometry, PDE

MS Project: Probabilistic Analysis of Stochastic Processes — Grade: A+

Independent Study: Extreme Value Theory — Grade : A+

GPA: 9.1/10

Bachelor of Science (BS), Mathematical Sciences Aug 2018 - Jul 2022
[Indian Institute of Science Education and Research \(IISER\), Kolkata](#)

Relevant Coursework: Measure Theory, Functional Analysis, Geometry of Curves and Surfaces, Probability Theory, Stochastic Processes

GPA: 8.71/10 | **GPA on US 4.0 Scale as per [Scholaro](#) GPA (Self-)Conversion:** 3.74

RESEARCH EXPERIENCE

Summer Internship Program | Analysis of Alternative Voting Rules Jun 2023-Aug 2023
Electoral Innovation Lab Princeton University, NJ

- Computational research into alternative voting rules: analysis of past ranked-choice elections, and the generation of a model to calculate the outcomes of various voting rules (first-past-the-post, ranked-choice, Top Four, approval) in future elections.
- Crafting future electoral reforms.

Probabilistic Analysis of Stochastic Processes | MS Project Aug 2022 - May 2023
Advisor: [Dr. Anirvan Chakraborty](#); Asst. Professor, Dept. of Mathematics and Statistics *IISER Kolkata*

- Read Robert J. Adler's Monograph titled, '[An Introduction to Continuity, Extrema, and Related Topics for General Gaussian Processes](#)' (1990); which explores the significance of tools like 'entropy' and 'majorising measures' in developing a general theory applicable to all kinds of Gaussian processes.
- Covered the Development of the canonical metric, definition of entropy, establishment of entropy arguments as sufficient conditions for sample path continuity of general Gaussian processes defined on totally bounded parameter spaces, and examples of the result's significance in analysis of Gaussian processes defined on the real line, multidimensional spaces, function-indexed and set-indexed spaces, Borell's Inequality, Kahane's Inequality and its essential corollaries including Slepian's and Sudakov Fernique Inequality, Zero-One Laws, Relationship between Boundedness and Continuity, Majorising Measures, and Proof of an important Entropy Result.
- Cumulative [MS Report](#) Submitted to IISER Kolkata towards fulfillment of the partial requirements for Master of Science Degree in Mathematical Sciences. Presented Autumn [semester-report](#) on 7.12.2022 and Spring [semester-report](#) on 12.05.2023.

Extreme Value Theory | Independent Study

Jan 2023 - May 2023

Independent Study Supervisor: [Dr. Anirvan Chakraborty](#); Asst. Professor, Dept. of Mathematics and Statistics
IISER Kolkata

- Exploring Extreme Value Theory independently with help from supervisor.
- Read and solved exercises from Chapters 1-5 of 'Extreme Value Theory: An Introduction', authored by Laurens de Haan, Ana Ferreira, on Fisher-Tippett-Gnedenko result, domain of attraction, second-order condition, intermediate order statistics, Hill Estimator, Pickand's estimator, etc.

Analysis of Voting Rules

Sep 2022 - Ongoing

Mentor: [Prof. Samuel Wang](#); Director, [Electoral Innovation Lab](#); Prof. of Neuroscience
Princeton University, NJ

- Comparing different voting rules through Python/MATLAB simulations based on real cast-vote records and data from democracies across the world on the basis of their effectiveness in capturing the actual choices of people in a democracy.
- Investigating different rules and modifications that may enable more accurate capture of public opinion while reducing loopholes in the system.
- Investigating the efficiencies of different voting rules in resisting strategic manipulation of the IRV voting rule to favour the win of a non-Condorcet candidate.

Semantics, Mathematical Linguistics

Oct 2021 - Feb 2022

Mentor: [Dr. Lucas Champollion](#); Associate Professor, Dept. of Linguistics
New York University, NYU

- Explored applications of Set theory and Logic in characterizing 'meaning' through reading of 'Invitation to Formal Semantics', by Elizabeth Coppock and Lucas Champollion. Read some literature on Algebraic Models in Linguistics.
- Gained an insight into Mathematical Logic and applications in Natural Language Processing and Artificial Intelligence.

Market Research and Analysis

Jun 2021 - Jul 2021

Supervisor: Mr. George Christodouildes, Senior VP
Market-i Research Services and Consultancy Company, Dubai

- Two Month Internship Program at Market-i, a FreeZone Company based in Dubai Media City, Dubai that offers market research and consultancy services to a diverse clientele.
- Gained first-hand experience in market analytics and statistical consultancy by working on client projects in a team, under supervision.
- We conducted different real-time client-specific customer surveys; Analysed and appropriately cleaned Data; Prepared Summary Reports with overview and client requirement-specific advice based on inferences and conclusions derived appropriately from survey data.

ACADEMIC PROJECTS

Presented a [report](#) on Temperature Time Series Analysis and Forecast over Kolkata Nov 2022

Course Instructor: Dr. Anirvan Chakraborty; Assistant Professor, Dept. of Mathematics and Statistics
IISER Kolkata

- Performed an exploratory time series analysis of temperature data from weather station 42809(WMO ID), Kolkata.
- Selected an appropriate ARMA model to the data obtained by differencing to remove trend and seasonality.

- Used ARMA Fit to verify an in-sample prediction and forecast temperatures for next week. Compared with actual temperature data as they were recorded.
- Performed a multivariate VARMA model fit for temperature data from Kolkata and two weather stations near to Kolkata. Forecasted temperature at Kolkata based on this and compared it with the forecast obtained by univariate ARMA analysis and actual temperature.

Presented a [Talk](#) on 'Support Vector Machine'

Nov 2022

Course Instructor: Dr. Satyaki Mazumder; Assistant Professor, Dept. of Mathematics and Statistics *IISER Kolkata*

- Covered the motivation behind SVM, a highly useful machine learning algorithm, its mathematical basis, a few examples to help visualize, and briefly mentioned accommodations developed to extend SVM to non linearly separable cases.

A brief study of different ML Techniques

Mar 2022 - Apr 2022

Course Instructor: Dr. Koel Das; Associate Professor, Dept. of Mathematics and Statistics *IISER Kolkata*

- Implemented Random Forest, XGBOOST, and Multi Layer Perceptron algorithms on two different datasets, and analysed the classification networks from all the three algorithms to compare the classification accuracy. Tried an original ensemble and analysed its accuracy, additionally.

Flight Reservation System

Nov 2021 - Dec 2021

Course Instructor: Dr. Kripabandhu Ghosh; Asst. Professor, Dept. of Comp. & Data Sci. *IISER Kolkata*

- Wrote an extensive C code, in a group of students, to design and run a 'flight reservation system' that allowed users to search and book flights suitably and admin to modify flight information.

Reading on Calculus on Manifolds

May 2021 - Oct 2021

Mentor: Dr. Sushil Gorai; Associate Professor, Dept. of Mathematics and Statistics *IISER Kolkata*

- Read and solved problems from 'Calculus on Manifolds' by Michel Spivak.

Reading on Infinite Series

Jun 2020 - Oct 2020

Mentor: Dr. Sushil Gorai; Associate Professor, Dept. of Mathematics and Statistics *IISER Kolkata*

- Read 'Theory and Application of Infinite Series' by Konrad Knopp.

TEACHING EXPERIENCE

Teaching Assistant, [MA2202: Probability I](#), *IISER Kolkata*

Jan 2023 - May 2023

Course Instructor: Dr. Soumya Bhattacharya, Assistant Professor, Dept. of Mathematics and Statistics

Course offered by: Dept. of Mathematics and Statistics, *IISER Kolkata*

- Undergraduate Course offered to second year students of the BS-MS Dual Degree Program at *IISER Kolkata*, in the Autumn (odd) Semester. Covers Probability Spaces, Axioms of Probability, distribution functions, different distributions, limit theorems, laws of large numbers, stochastic processes, Markov Chain Processes
- Number of Students: 59 | Duties: Instructional, Doubt-solving, Grading

Teaching Assistant, [MA1101: Mathematics I](#), *IISER Kolkata*

Nov 2022 - Mar 2023

Course Instructor: Dr. Saugata Bandyopadhyay, Associate Professor, Dept. of Mathematics and Statistics

Course offered by: Dept. of Mathematics and Statistics, *IISER Kolkata*

- Undergraduate Course offered to first year students of the BS-MS Dual Degree Program at *IISER Kolkata*, in the Autumn (odd) Semester. Covers Set Theory, Theory of Real Numbers, Theory of Equations, and an Introduction to Calculus.
- Number of Students: 228 | Duties: Instructional, Doubt-solving, Grading

Teaching Assistant, [MA2103: Mathematical Methods II](#), IISER Kolkata Aug 2021 - Dec 2021
Course Instructor: Prof. Amit Ghoshal, Dept. of Physical Sciences
Course offered by: Dept. of Mathematics and Statistics, IISER Kolkata

- Undergraduate Course offered to second year students of the BS-MS Dual Degree Program at IISER Kolkata, in the Autumn (odd) semester. Covers basic applications of Linear Algebra, Differential Equations, and Fourier Series; and basic Probability.
- Number of Students: 214 | Duties: Invigilation, Grading and Assessment

SCHOLARSHIPS AND FELLOWSHIPS

- [KVPY Fellowship 2019-23](#), awarded by IISc Bangalore and Dept. of Science and Technology, Government of India upon securing an All India Rank 94 in the Screening Process.
- [DST-INSPIRE Scholarship for Higher Education](#) 2018-23, awarded to students who are in the top 1% of all students clearing school-leaving examinations. [Declined after 2018-19 to receive KVPY Fellowship]

TALKS, PRESENTATIONS AND CONFERENCES

- Delivered a [talk](#) titled, "Probabilistic Analysis of Stochastic Processes" as part of the Graduate Student Seminar Thesis Talk 2023, DMS, IISER Kolkata 12 May 2023
- Delivered a talk titled: "The Little Hero of Haarlem (A peek at Extreme Value Theory and its Applications)" in the DMS Symposium 2023, IISER Kolkata.
Abstract: This talk introduces extreme value theory - an area of probability theory dedicated to understanding the maxima of a random sample. We will present an intriguing result that characterizes all possible distributional limits of the maxima and also show a few interesting applications of extreme value theory in several fields.
- Attended the [NYU Math and Democracy Seminar](#) on 'Ranked Choice Voting and the Spoiler Effect', by Jennifer Wilson, The New School; and David McCune, William Jewell College. Nov 2022
- Delivered a [talk](#) on Basic Statistical Analysis for Research Purposes, directed at Master Students at Loyola College, Chennai Sep 2022
- Delivered a [talk](#) on some Statistical Tools and Python Resources, directed at senior school students at AAIS, Chennai Jul 2022
- Attended the [Inter IISER-NISER Mathematics Meet](#), held at IISER Kolkata Jun 2022
- Attended a mini-course on basic topology, offered by Dr. Subhojay Gupta, Asst. Professor, Dept. of Mathematics, at the Indian Institute of Science Bangalore. May 2020
- Invited to the [National Science Camp \(VIJYOSHI\)](#), held at IISER Kolkata Dec 2019
- Invited to the [National Science Camp \(VIJYOSHI\)](#), held at IISER Bhopal Dec 2018

SKILLS

Technical Skills Comfortable in Python [scipy, numpy, matplotlib, scikit.learn],
Working knowledge of MATLAB, GNUPlot, BrandMap

Languages Known English, Tamil, Hindi, French, Arabic

EXTRA-CURRICULAR

- Fest Coordinator, Inquivesta X - The tenth edition of IISER Kolkata's annual student festival. Jan 2023 - Apr 2023
- Represented IISER Kolkata in the Debate event at the annual Inter IISER Cultural Meet 2022, IISER Pune. Won a Gold in the same. 29 Dec 2022
- Student Representative to the UG Academic Committee and Senate of IISER Kolkata Dec 2021 - Aug 2022
- Academic General Secretary (BS-MS), [Student Council](#) Dec 2021 - Aug 2022
- Cultural General Secretary (BS-MS), [Student Council](#) Sep 2020 - Aug 2022
- Advisor, [Identity](#)-The Math Club of IISER Kolkata Sep 2021 - Dec 2021
- Founder, Fest Coordinator of [Revival](#), an online cultural fest Mar 2021
- Sponsorship Executive, [Inquivesta](#) - IISER Kolkata's annual student festival Aug 2019 - Aug 2020
- Represented IISER Kolkata in the 400m Athletic Event at the annual Inter IISER Sports Meet, held at IISER Pune. Dec 2019

OUTREACH

- Scientific Communication : Publicity and Outreach Manager, [Cogito137](#) - IISER Kolkata's Scicomm initiative Mar 2020 - Feb 2021
- Volunteer at the [Ek Pehal](#) - IISER Kolkata's student run community initiative to expose underprivileged children to science, and provide supplementary education free of cost Oct 2018 - May 2023

REFERENCES

- Academic Referees:
 1. MS Project Supervisor: Dr. Anirvan Chakraborty, Assistant Professor, Dept. of Mathematics and Statistics, IISER Kolkata | Email: anirvan.c@iiserkol.ac.in
 2. Course Instructor & Mentor: Dr. Satyaki Mazumder, Assistant Professor, Dept. of Mathematics and Statistics, IISER Kolkata | Email: satyaki@iiserkol.ac.in
- Project Referee:
 3. Summer Project Supervisor: Mr. George Christodouilles, Sr. Vice President, Market-i | Email: george.c@market-i.com
- Extra-Curricular Referee:
 4. Former Director, IISER Kolkata: Prof. Sourav Pal, Ashoka University | Email: sourav@ashoka.edu.in