Shubha Sankar Banerjee

Curriculum Vitae
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Education

2022– **PhD in Statistics**, *University of Pittsburgh*, Pittsburgh, USA.
Grade: 3.932/4

2020–22 **M.Sc. in Statistics**, *Indian Institute of Technology Kanpur*, Kanpur, India.
Grade: 9.5/10 (Class Rank: 1)

2017–20 **B.Sc. (Honors) in Statistics**, *St. Xavier's College*, Kolkata, India.
Grade: 8.2/10

Research Interests

Non-parametric Inference, Robust Analysis, High Dimensional Statistics, Bayesian Analysis.

Publications

1 **Banerjee, S.S.**, Mitra, A. and Mondal, R. (2023) Asymptotic Analysis of Regression Quantile Estimators for Real-Valued Chirp Signal Model. *Circuits, Systems, and Signal Processing.* https://doi.org/10.1007/s00034-023-02504-1

Research Experience

Sum'23 **Graduate Student Researcher**
Advisor: Prof. Satish Iyengar, University of Pittsburgh
- Developing methods to perform detailed power and sensitivity analysis for mediational models adjusted for response-affecting-covariates in projects led by Dept. Psychiatry, Pitt.
- Reviewing and compiling existing R packages dealing with Post-Selective inference on parameters estimated using Elastic-Net.
- These projects were funded by National Institute of Health (NIH) grants.

S'22 **"On Asymptotic Properties of Regression Quantile Estimators for 1-D Chirp Signals"**
Advisor: Prof. Amit Mitra, IIT Kanpur
Proved strong consistency and aymptotic normality of RQE of 1-D Chirp signals. Performed detailed simulations to validate the theoretical results, with a comparison to OLS to highlight the robustness under heavy tailed errors and contaminated data. Developed an algorithm to fit the model to a real-life data on Sound pressure signals.

F'21 **"On Consistency of LAD-LASSO estimators for 1-D Sinusoidal Model"**
Advisor: Prof. Amit Mitra, IIT Kanpur
Discussed consistency properties of LAD-LASSO estimators of parameters of 1-D sinusoidal signal processing models. Obtained an optimal estimate for the penalty term used to obtain parsimonious models

S'20 **A Comparative study between Parametric and Non-parametric Regression (Gaussian Process) Models**
Advisor: Prof. Durba Bhattacharya, St. Xavier's College, Kolkata
Compared Gaussian Process Regression (GPR) and OLS regression by fitting models to simulated data drawn from a variety of stochastic distributions. Fitted GPR model (with appropriate kernels) to the data "GDP of India from 1960 to 2019".

Course Projects

S'23 **Review on the paper: "Conditional Calibration for False Discovery Rate under Dependence"- Fithian, W., Lei, L. (2022)**
Mentor: Prof. Linxi Liu, University of Pittsburgh
- Reviewed the methodology proposed by the paper to adaptively calibrate separate rejection threshold for each p-value to control overall FDR under different dependence structures.

S'22 **A Brief Review of Sparse Principal Components Analysis and its Generalization.**
Mentor: Prof. Minerva Mukhopadhyay, IIT Kanpur
- Reviewed SPCA and *Generalized Adaptive*-SPCA by incorporating concepts from LASSO and Elastic Net. Performed numerical simulations along with application on real-life data set.

S'22 **Bayesian Forecasting of UEFA Champions League under alternate seeding schemes.**
Mentor: Arnab Hazra, IIT Kanpur
- Used Bayesian Poisson Regression model framework for individual matches and simulated the tournament for different seeding regimes based on the data from 2003-2015.

S'22 **Estimating the Distribution of Linear Regression Estimates using Fast and Robust Bootstrap**
Mentor: Prof. Dootika Vats, IIT Kanpur
- Presented the methodology behind Fast bootstrap to estimate the distribution of robust regression estimates, discussed their asymptotic properties and reviewed their breakdown points with a detailed simulation study with comparison to ordinary bootstrap.

S'22 **Efficient High-Dimensional Robust Variable Selection via Rank-based LASSO Methods.**
Mentor: Prof. Subhra Sankar Dhar, IIT Kanpur
- Reviewed properties of RankLASSO in high-dimensional setting ($p \gg n$) along with a superior threshold-ed version for more general scenarios. Performed numerical study demonstrating performance of RankLASSO and LAD-LASSO for robust model selection problems.

S'22 **Understanding Non-parametric Modal Regression via Kernel Density Estimation**
Mentor: Prof. Subhra Sankar Dhar, IIT Kanpur
- Reviewed Geometric properties of Non-parametric Modal regression and estimated modal sets using Partial Mean-Shift Algorithm. Discussed consistency of Modal Manifold estimates. Obtained point-wise and uniform confidence sets using bootstrap and discussed the coverage of uniform confidence sets and studied bandwidth selection using Prediction sets.

F'21 **Analysis of Indian Market Price Indices during Covid-19 Pandemic**
Mentor: Prof. Amit Mitra, IIT Kanpur
- Fitted ARIMA and GARCH models to stock returns of indices to capture model volatility. Performed Engle-Granger's Co-integration test on stock market closing prices and daily Covid-19 and performed Granger Causality test to check dependence.

S'21 **A Study of Physicochemical Properties of Protein Tertiary Structure**
Mentor: Prof. Sharmishtha Mitra, IIT Kanpur
- Carried out model diagnostics, checked for presence of multicollinearity under linear model fit on CASP dataset of protein tertiary structure. Implemented Ridge and LASSO regression due to presence of near-collinear features. Implemented different Variable Selection techniques.

Teaching & Consulting

University of Pittsburgh

Teaching Fellow
- STAT 1000- Applied Statistical Methods *F'23*

Teaching Assistant
- STAT 1100- Statistics and Probability for Business Management *F'22, S'23*

Grader
- STAT 2730/1731- Stochastic Processes *S'23*

Conferences

1 Poster titled: "Simulated Power Calculations for Mediation Effects with Covariates", Keystone State Statistics Symposium, Penn State University, Oct 7-8, 2023.

Relevant Coursework

Graduate Level
- **Theory:** Probability and Measure theory, Theory of Statistics, Multiple Hypothesis Testing, Asymptotic Methods in Statistics, Robust Statistical Analysis, Multivariate Analysis, Decision Theory.
- **Methods:** Linear Models, Applied Statistical Methods, Applied Bayesian Analysis, Statistical Simulation and Data Analysis, Survival Analysis.

Undergrad level

- **Statistics:** Measure Theory, Regression Analysis, Statistical Inference, Bayesian Analysis, Sampling Theory, Time Series, Stochastic Processes, Econometrics, Non-parametric Statistics.
- **Mathematics:** Real Analysis, Matrix Theory and Linear Estimation, Linear Algebra, Differential Equations, Integral Calculus, Multivariate Calculus, Complex Analysis.
- **Programming:** Data Analysis using R, C programming, Data analysis using Minitab, Computer programming and data structures.

Academic Achievements

2023 University of Pittsburgh Dietrich School of Arts & Sciences Summer Fellowship.

2022 General Proficiency Medal, *for best academic performance among graduating M.Sc. Statistics students.*

2020 Secured All India Rank **45** in Joint Admission Test for Masters among 3473 candidates.

2017-22 *INSPIRE* Scholarship for Higher Education, Department of Science and Technology, Government of India for duration of Bachelors and Masters.

2017 Top 1% (aggregate marks) of CISCE board Class XII examination among 73,633 students all over India.

Language and Technical Skills

Language: English, Bengali, Hindi.

Programming Languages: R, Python, C, C++, Matlab.

Software: R Studio, Minitab, MS-Excel, LaTeX.

Other Activities

Position of Responsibility

2020 Organizing Committee Member of *Epsilon Delta'20*, the annual seminar organized by Department of Statistics, St. Xavier's College, Kolkata (SXC-K).

2020 Convenor of *Proectura'20*, annual paper presentation event organized by Department of Statistics, SXC-K.

2020 Editorial Board member for *Prokarsho'20* annual Department of Statistics maganize, SXC-K.

Non-Academic Activities

2023 Member of *Bengali Student's Organization*, University of Pittsburgh.

2017-20 Volunteered to teach chidren in villages as a member of National Service Scheme, India.