Rashmi Ranjan Bhuyan

Curriculum Vitae

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Education

2020 - Present **Doctor of Philosophy**, *University of Southern California*,
Data Science and Operations (Statistics),
Advisor: Dr. Gourab Mukherjee.
Topic of Research: Developing novel methods for inference under heterogeneity

2018-2020 **Master of Statistics**, *Indian Statistical Institute, Kolkata*,
Theoretical Statistics Specialization,
First Division with Distinction.

2015-2018 **Bachelor of Statistics (Honours)**, *Indian Statistical Institute, Kolkata*,
First Division with Distinction.

Papers

Structured Dynamic Pricing: Optimal Regret in a Global Shrinkage Model, *Under Submission, ICML 2023*,
Rashmi Ranjan Bhuyan, Adel Javanmard, Sungchul Kim, Gourab Mukherjee, Ryan A. Rossi, Tong Yu, Handong Zhao.
We consider dynamic pricing strategies in a streamed longitudinal data set-up where the objective is to maximize, over time, the cumulative profit . Since consumers sharing similar characteristics act in similar ways, we consider a global shrinkage structure assuming that the consumers' preferences can be well approximated by an SAR model. We propose a pricing policy based on penalized SGD and analyze the regret of the policy against a clairvoyant policy. Our regret analysis results demonstrates asymptotic optimality of the proposed policy and the importance of shrinkage in the aforementioned setup.

An MCEM algorithm for consistent estimation in Network-linked high-dimensional multinomial Probit, *In Preparation*,
Rashmi Ranjan Bhuyan, Trambak Banerjee, Bhaswar Bhattacharya, Gourab Mukherjee.
The multinomial probit model (MNP) is widely used for analyzing unordered categorical data and we regularly encounter cross-sectional datasets with categorical responses and high-dimensional covariates. In absence of repeated observations from the respondents, we use additional network structure to pool information across similar units to provide significantly better inference. However, estimating the effects of sparse high-dimensional covariates in the presence of network linkages is challenging. We develop a novel Monte Carlo EM algorithm for consistent variable selection in this high-dimensional MNP setup. We demonstrate the application of the proposed method in spatial autocorrelation network structured MNP models.

A Dynamic Bayesian Mixture Model for Fine-grained Promotion Mix Analysis of Digital Coupons, *In Preparation*,
Rashmi Ranjan Bhuyan, Wreetabrata Kar, Gourab Mukherjee.
We develop a novel dynamic mixture model for analyzing the effects of varied marketing components in a digital promotion campaign that uses online coupons. We segment customers based on their purchase history and provides fine-grained estimates of the heterogeneous effects that promotion mix variables have on the different consumer segments. The proposed model not only captures long-term heterogeneous segments in the customer pools but also tracks short term changes in customer engagement of recent coupons through dynamic indices. We conduct Bayesian estimation of the model parameters by using a novel Gibbs algorithm using Polya-Gamma distributions based data augmentation strategy in handling Binomial likelihoods. Finally, through a path-algorithm we provide an integrated framework for providing fine-grained analysis of the promotion component effects at various levels of heterogeneity.

Contributed Presentations

2022 **Estimation in Network-linked High-Dimensional Probit model**.
International Conference on Statistics and Data Science, Dec 13 - 16, 2022

2021 **A Dynamic Bayesian Mixture model: Analysis of Digital Coupons**.
Joint Statistical Meetings, Aug 8 - 12, 2021

2017 **Implications of a Bitcoin Monopoly**.
Statistical Methods in Finance, Dec 16 - 19, 2017

Work Experience

2019 **Data Science Intern**, SymphonyAI.
Worked on dataset of a million cancer patients
- Used topological data analysis (TDA) to cluster patients.
- Built a model to predict ECOG of cancer patients.
- Finally created a model to predict stage of the patients using their vitals.

2017 **Data Scientist Intern**, Impact Analytics.
Data Science Intern
Worked on creating a recommender system and a churn prediction model for a pet-supplies retail chain (an Impact Analytics client)
- Gained extensive experience in R, SQL.
- Got introduced to Google Cloud Platform (mainly Google BigQuery).
- Exposure to basic business sense and business rules.

Academic Achievements

2022 **Invited Talk**, *INFORMS Annual Meeting*.
Invited to present the work 'A Dynamic Bayesian Mixture model: Analysis of Digital Coupons' at 2022 INFORMS Annual Meeting in Indianapolis.

2020 **Marshall School Fellowship**, *University of Southern California*.
Awarded the USC Marshall's fellowship for two years of PhD in the Data Science and Operations department in Marshall School of Business.

2018 **Summer Undergraduate Research Program**, *Johns Hopkins University*.
Summer internship program at Department of Biostatistics, Johns Hopkins University, USA, initiated jointly with Indian Statistical Institute.

2016 **Innovation in Science Pursuit for Inspired Research (INSPIRE)**.
Received the prestigious INSPIRE scholarship by the Ministry of Science and Technology, Govt. of India.

2015 **Indian National Mathematics Olympiad**.
Indian National Mathematical Olympiad(INMO) merit certificate, for being in top 100.

2013 **National Talent Search Examination (NTSE)**.
One of the 1040 students to be awarded the NTSE scholarship by NCERT (organisation of the Government of India).

Technical Skills

Working Knowledge : R, Python, SQL, Excel, LaTeX

Introductory Knowledge : C, SageMath, Git , MATLAB

Reference

Gourab Mukherjee,
Assistant Professor,
Data Science and Operations, USC Marshall School of Business,
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