Kapil Gupta

Research Associate, Department of Statistics and Data Science, NUS Singapore
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Research Interests

Spatial Statistics, House Price Dynamics, Spatio-Temporal Modelling, Clustering and Classification, Sports Analytics, Applications of Variable Selection Methods.

Education

Indian Institute of Management Bangalore, India
Doctoral Candidate in Decision Sciences Area (Cumulative GPA: 3.66/4)   *Aug 2020 – Mar 2025*
Recipient of the Director's Merit List Award in both the years during the coursework

Thesis: Analysing House Price Dynamics using Novel Spatio-Temporal Methods
Committee members: Dr. Soudeep Deb, Dr. Venkatesh Panchapagesan, Dr. Kunal Dasgupta, Dr. Anand Deo

Indian Institute of Technology Delhi, India
Master of Science in Mathematics (Cumulative GPA: 7.52/10)   *Jul 2016–May 2018*
Thesis: Numerical Solutions of Singularly Perturbed Linear Problems in One Dimension, Advisor: Dr. S. Chandra Sekhara Rao

Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram, India
Bachelor of Technology in Computer Engineering (Cumulative GPA: 7.55/10)   *Aug 2012–May 2016*
Thesis: The cd-coloring of bipartite graphs, Advisor: Dr. Shalu M A

Publications

- **Gupta, K.**, Krishnamurthy, V., Deb, S. (2024). What elements of the opening set influence the outcome of a tennis match? An in-depth analysis of Wimbledon data, IIMB Management Review (**ABDC ranking B**). [early view]

- **Gupta, K.**(2022). An integrated batting performance analytics model for women's cricket using Principal Component Analysis and Gini scores, Decision Analytics Journal. [publication]

- **Deb, S., Gupta, K.**(2024). Has there been improvement in Indian Smart Cities towards Quality of Education through Smart Classrooms for Children especially Poor Children, like decline in dropout rate, etc. if any?, Smart City Mission, Ministry of Housing and Urban Affairs. [publication]

Working Papers

- **Gupta, K.**, Deb, S. (2024+) A divide-and-conquer approach for spatio-temporal analysis of large house price data from Greater London. Under revision. [Pre-print]

- Bag, S., **Gupta, K.**, Deb, S. (2024+). A review and recommendations on variable selection methods in regression models for binary data. Under revision. [Pre-print]

- **Gupta, K.**, Deb, S., Panchapagesan, V. CPRI-Office: A new commercial property rental index for Indian cities using spatio-temporal modelling techniques. [Pre-print]

Manuscript in preparation

- **Gupta, K.**, Deb, S., Panchapagesan, V. Residential Real Estate Market Dynamics in Bangalore: Do Residuals Hold the Key?.
Abstract: Our study contributes to recent statistical research in real estate by uncovering spatial and temporal dependence patterns in residential prices. We introduce a novel statistical model that effectively captures these dependencies using a separable Gaussian spatio-temporal process with an additive mean structure and various residual structures. We then compare model fit and predictive accuracy across these different residual choices within Bangalore's residential real estate market.

- **Gupta, K.**, Deb, S., Panchapagesan, V. Spatial Modelling of Residential Real Estate Prices in Bengaluru, India.
Abstract: We propose a Bayesian spatial model to capture the dynamic patterns of real estate prices. By leveraging a Gaussian spatial process, we incorporate an additive mean structure with a random error component to account for spatial dependencies. Initially, key variables are identified using random forest importance scores, followed by the application of a spatially or temporally varying model. When applied to transaction data from Bengaluru's 165 micromarkets and 1,127 projects (2017-2023), the models demonstrates both flexibility and computational efficiency.

Work in progress

- **Gupta, K.**, Deb, S. Unveiling dynamics: A mixture model approach for addressing missingness in spatio-temporal data.
Abstract: This study addresses the challenge of missing spatio-temporal data in housing market analysis, where property transactions occur infrequently. Common assumptions in spatio-temporal analysis do not hold in this context, risking the oversight of valuable insights. We propose a novel spatio-temporal mixture model that distinguishes between observed and unobserved data, incorporating a latent variable to account for missing data points.

- **Gupta, K.**, Banerjee, S. Bayesian Matrix Clustering with Matrix-Variate t-Distribution.
Abstract: We present a Bayesian nonparametric matrix clustering approach using the matrix-variate t-distribution to analyze latent

heterogeneity in matrix data. This method effectively captures heavy tails and correlations, enhancing clustering robustness. We develop a Markov chain Monte Carlo (MCMC) algorithm for posterior sampling, enabling simultaneous inference on the number of clusters and their configurations, with established convergence properties.

○ **Gupta, K.** A Robust Multilevel Modeling Approach to Ranking Women's Batting Performances in Cricket.

Abstract: Historically, women's cricket has received less attention than men's. This study introduces an advanced ranking system for women batters in ODIs, utilizing a two-level negative binomial model to account for runs, strike rates, and variables like not-out status and opposition strength. This model provides a more accurate and equitable ranking compared to simpler approaches, offering valuable insights for enhancing the recognition of women's contributions.

Teaching Experience at IIM Bangalore

Course Instructor

○ *Introduction to Regression Models (Foundations of Management course for undergraduates)* — *Apr 2024*
  - Overall Rating: 3.83/5 (No. of respondents: 35)
○ *Probability and Statistics (Pre-doctoral course)* — *Sep–Nov 2023*
  - Overall Rating: 4.25/5 (No. of respondents: 12)
○ *Quantitative Techniques (PGP preparatory course)* — *Jun 2023*
  - Overall Rating: 4.5/5 (No. of respondents: 26)
○ *R for Data Science (PGPBA preparatory course)* — *Jun 2023*
  - Overall Rating: 4.3/5 (No. of respondents: 65)
○ *Calculus (PhD preparatory course)* — *Jun 2023*
  - Overall Rating: 3.6/5 (No. of respondents: 11)

Teaching Assistant

○ *Sports Analytics (PGP)* — *Jun–Aug 2023, 2024*
○ *Multivariate Data Analysis (PGPBA)* — *Jun–Aug 2023*
○ *Data Science Doctrines: Prediction, Inference, and Causality (PGPBA)* — *Oct–Dec 2022*
○ *Decision Sciences II (PGP)* — *Oct–Dec 2022*
○ *Decision Sciences I (PGP)* — *Jul–Sep 2022*

Research and Industry Experience

○ **National University of Singapore** — **Singapore**
  Research Associate — *Jan 2025–Present*
  - Working on the development of a spatial skewed Gaussian factor model.
○ **Smart City Mission, Ministry of Housing & Urban Affairs, India** — **New Delhi, India**
  Research Consultant — *Feb 2024–Jul 2024*
  - Analysing the improvement in quality of education through smart classrooms.
○ **Real Estate Research Initiative(IIMB-RERI)** — **Bangalore, India**
  Research Consultant — *Mar 2023–Present*
  - Working on the development of a commercial rental index through spatio-temporal modeling.
○ **Indxx, LLC** — **Gurgaon, India**
  Senior Data Analyst, Engineering Division — *Jun 2018–Jul 2020*
  - Developed and calculated In-house and client based indices using SQL.
○ **Indian Institute of Science Education & Research** — **Bhopal, India**
  Summer Research Intern, Department of Mathematics — *May 2014–Jun 2014*
  - Reading project in ordinary differential equations under the guidance of Dr. Ashish Gupta.

Presentation and Talks

○ **IISA 2024 Conference, Cochin University of Science and Technology, India**
  "Spatial Modelling of Residential Real Estate Prices in Bengaluru, India". — *Dec 2024*

○ **MathSport Asia 2024, IIM Udaipur, India**
  "A Robust Multilevel Modeling Approach to Ranking Women's Batting Performances in Cricket". — *Dec 2024*

○ **India Management Research Conference 2024, IIM Ahmedabad, India**
  "Spatial Modelling of Residential Real Estate Prices in Bengaluru, India". — *Dec 2024*
  "A divide-and-conquer approach for spatio-temporal analysis of large house price data from Greater London". — *Dec 2024*

○ **Doctoral Colloquium on Management and Development, Institute of Rural Management Anand**
  "A divide-and-conquer approach for spatio-temporal analysis of large house price data from Greater London". — *Nov 2024*

○ **BNP Networking Workshop 2024, National University of Singapore**
  "A divide-and-conquer approach for spatio-temporal analysis of large house price data from Greater London". — *Aug 2024*

○ **(Poster) BAYSM 2024, Ca' Foscari University of Venice, Italy**
  "A mixture model approach for addressing missingness in spatio-temporal data". — *Jun 2024*

- **(Poster) ISBA satellite workshop**, Università della Svizzera italiana, Lugano
  "A mixture model approach for addressing missingness in spatio-temporal data". — Jun 2024
- **JOINT EVENT: 2023-ORSI & 2023-ICBAI**, IISC Bangalore, India
  "A Novel Spatio-Temporal Statistical Model to Analyze Real Estate Market in Bengaluru, India". — Dec 2023
- **Annual International Research Conference (AIRC)**, IIM Lucknow, India
  "A Novel Spatio-Temporal Statistical Model to Analyze Real Estate Market in Bengaluru, India". — Dec 2023
- **Indo-German workshop on Data Mathematics and Scientific Computing**, IIT Tirupati, India
  "Efficient Divide-and-Conquer Approach for Spatio-Temporal Modeling of Real Estate Data". — Sep 2023
- **Invited Talk: 6th International Conference on Econometrics and Statistics**, Tokyo, Japan
  "Efficient Divide-and-Conquer Approach for Spatio-Temporal Modeling of Real Estate Data". — Aug 2023
- **IMR Doctoral Conference, 2023**, IIM Bangalore, India
  "What elements of the opening set influence the outcome of a tennis match? An in-depth analysis of Wimbledon data". — Feb 2023
  - One of the 10 papers accepted out of 98 submissions.
- **Management Doctoral Colloquium Shodh Samagam**, IIM Visakhapatnam, India
  "Measuring Batting Performance in Women's Cricket - An In-Depth Analysis of One-Day International Matches". — Dec 2021
- **8th MathSport International Conference**, University of Reading, UK
  "Does the outcome of a tennis match hinge on the opening set? An in-depth analysis of the Wimbledon data". — Jun 2021

Awards and Honours

- **Best Research Paper in Real Estate (Less Developed Countries) Award in Real Estate Track**
  India Management Research Conference, IIM Ahmedabad (IMRC 2024) — Dec 2024
- **Honorable Mention for Best Research Paper in Data Science & Artificial Intelligence Track**
  India Management Research Conference, IIM Ahmedabad (IMRC 2024) — Dec 2024
- **Special Prize Award : Advance Research Paper Track**
  DOCMAD, IRMA, Anand, India — Nov 2024
- **The Florintree Scholarship Award, Indian Institute of Management Bangalore**
  - The aim of the award is to promote excellence in management research. — Sep 2024
- **Doctoral Student Research Paper Awards of 2024, Indian Institute of Management Bangalore**
  - The award aims to recognize good journal papers in the field of management research. — Sep 2024
- **ISBA Travel Award: BNP Networking Workshop 2024**
  - Awarded 800 USD travel support by the Bayesian Nonparametric Section of ISBA. — Jul 2024
- **First Best Paper Award : PhD Scholar Category**
  JOINT EVENT: 2023-ORSI & 2023-ICBAI, IISC Bangalore, India — Dec 2023
- **Director's Merit List Award**
  Indian Institute of Management Bangalore — Jun 2021 & 2022
- **Employee of the Year - Entrepreneurship**
  Indxx, LLC — Nov 2019

Professional Memberships

- *The International Society for Bayesian Analysis (ISBA)* — Jan 2024-Present
- *The junior section of the International Society for Bayesian Analysis (j-ISBA)* — Jan 2024-Present
- *International Indian Statistical Association (IISA)* — Dec 2022-Present
- *Institute of Mathematical Statistics (IMS)* — Dec 2021-Present

Positions of Responsibility

- **Reviewer:**
  Research in Transportation Business & Management Journal — Jan 2024
  Scientific Reports — Nov 2024
- **Session Moderator (Young Researchers from India)** — Online
  International Day of Women in Statistics and Data Science — Oct 2023
- **Session Chair (Spatial Statistics Session)** — Tokyo, Japan
  6th International Conference on Econometrics and Statistics — Aug 2023
- **Indian Institute of Management Bangalore** — Bangalore, India
  PhD Students Academic Representative — Nov. 2020–Oct. 2021
- **Indian Institute of Technology Delhi** — Delhi, India
  MSc Mathematics Class Representative — Jul 2016–May 2018

Media Coverage

- Smart cities boost: IIM-B study shows 22% rise in school enrolments, faster crime-solving, **The Indian Express** — Dec 27, 2024
- Whitefield, Outer Ring Road, and South Bengaluru drive office rental boom in IT capital, **The Indian Express** — Nov 29, 2024
- India's office rentals see 3.6% growth; Pune, Chennai, Bengaluru top performers, **The Hindu** — Nov 29, 2024
- Office rentals rising steadily in top 10 Indian cities, Pune leads: Report, **The Economic Times** — Nov 30, 2024
- Pune tops commercial property rental rental index 2024, **The Times of India** — Nov 30, 2024
- Bengaluru scores above all on positive office rent growth on most quarters, **Deccan Herald** — Nov 30, 2024

Computer Skills

R, SQL, LaTeX, Python, MATLAB, C, C++, Microsoft Office.

References

Prof. Soudeep Deb
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Indian Institute of Management, Bangalore
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Prof. Venkatesh Panchapagesan
Professor
Finance & Accounting Area
Indian Institute of Management, Bangalore
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Prof. Rishideep Roy
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