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Shivam Kumar

Education

University of Notre Dame — Notre Dame, USA
Ph.D. Statistics — 2020 - 2025 *(expected)*
- Advisors: Prof. Lizhen Lin, Prof. Daren Wang.
- Research Focus: Statistical ML, Non-parametric Statistics, Change point.

University of Notre Dame — Notre Dame, USA
M.S. Applied Mathematics and Statistics — 2020 - 2022
- GPA: 3.97/4.00.

Visva Bharati — Santiniketan, India
Integrated M.Sc. Mathematics — 2015 - 2020
- Advisors: Prof. Swapan Kumar Pandit, Prof. Issan Patri.
- GPA: 7.78/10.00.

Research Interests

Functional data analysis, statistical learning theory, change point detection in time series, network analysis, non-parametric statistics, and Bayesian statistics.

Publications or Preprints

1. **Shivam Kumar**, Haotian Xu, Haeran Cho, Daren Wang. *Estimation and Inference for Change Points in Functional Regression Time Series*. **Under Review**, arXiv preprint arXiv:2405.05459, 2024.
2. **Shivam Kumar**, Yun Yang, Lizhen Lin. *A Likelihood Based Approach to Distribution Regression Using Conditional Deep Generative Models*. **Under Review**, arXiv preprint arXiv:2410.02025, 2024.
3. **Shivam Kumar**, Yixin Wang, Lizhen Lin. *Statistical Foundation of Matching Flow Based Generative Models*. **In Progress**, 2024+.
4. **Shivam Kumar**, Shitao Fan, Lizhen Lin. *Adaptive Online Variational Bayes*. **In Progress**, 2024+.
5. **Shivam Kumar**, Carlos-Misael Madrid-Padilla. *Additive Temporal-spatial model via Trend Filtering*. **In Progress**, 2025+.

Teaching

Instructor:

Statistics for Life Sciences	Undergraduate [Class Size: 65]	Spring 2024
Applied Math Methods Tutorial	Undergraduate [14]	Spring 2023

Assistant:

Applied Probability	Graduate [Class Size: 14/32/27/28]	Fall 2024/3/2/1
Actuarial Modeling I	Graduate [15]	Fall 2024
Ethics and Policy in Data Science	Graduate (Online Masters) [31]	Summer 2024
Time Series Analysis	Graduate [37]	Fall 2023
Artificial Neural Networks	Undergraduate [48]	Spring 2023
Applied Bayesian Statistics	Undergraduate [11]	Fall 2022
Introduction to Probability	Undergraduate [46/73]	Fall 2022, Spring 2021
Mathematical Statistics	Undergraduate [25/35]	Spring 2022, Fall 2021
Probability and Statistics	Undergraduate (Engineering) [171]	Spring 2022

Professional Experiences

IBM Research Lab | Dublin — Summer 2024
- Developed and enhanced statistical models for multimodal longitudinal time series.
- Implemented these models on healthcare datasets to perform multitask inference for biomedical research (on the SUERO Project).

Indian Institute of Engineering Science and Technology | Shibpur — Summer 2019
- Modeled heavy metal pathways in anaerobic bacteria from harsh environments.
- Computed energetics and pathways for acetylene conversion to acetaldehyde via DFT-based methods.

Chennai Mathematical Institute | Chennai — Summer 2018
- Reproduced static and dynamic models for Gram-negative bacterial cell walls.
- Designed multilayer models to study and validate the mechanical properties of Gram-positive bacterial cell walls.

Bose Institute | Kolkata — Summer 2017
- Developed and implemented model to simulate shock waves with FCT algorithm.
- Extended the research to explore applications in Magneto Hydrodynamics.

Jawaharlal Nehru Center of Advanced Scientific Research | Bengaluru — Summer 2016
- Conducted an investigative reading project on the Integer Quantum Hall Effect.
- Examined theoretical concepts and mathematical frameworks of the phenomenon.

Awards and Honors

- **Edison Innovation Fellowship** 2024.08-2025.05
  Notre Dame IDEA Center fellowship supporting training in research innovation, entrepreneurship, and the principles of deep-tech commercialization, focusing on generating real-world impact from academic research.
- **IISA Student Paper and Poster Competition** 2024.12
  Competitive grant awarded by International Indian Statistical Association to support attendance and presentation at the 2024 conference.
- **SIAM Student Travel Award** 2024.08
  Competitive grant awarded by SIAM to support attendance and presentation at the Mathematics of Data Science (MDS) 2024 conference.
- **ACMS | GSG Professional Development Award** (twice) 2024.05
  Awarded financial support to present at the Joint Statistical Meetings 2024 in Portland.
- **ISBA Student Travel Award** 2024.03
  Competitive grant awarded by NSF to support presentation at the ISBA World Meeting.
- **CSIR Junior Research Fellowship**, Govt. of India (unclaimed) 2019, 2020
  Awarded through a competitive exam, achieving 99.78 percentile (twice) among 40,000 examinees to support doctoral education in mathematics in India.
- **INSPIRE Scholarship for Higher Education**, Govt. of India 2015-2020
  A merit-based scholarship for less than 1% of high school students nationwide for college education, with additional funding for undergraduate research.
- **Science Academies Summer Research Fellowship** 2019
  Awarded jointly by the three national science academies of India.

Presentations and Talks

- International Indian Statistical Association Conference, CUSAT (India). 2024.12
- SIAM Conference on Mathematics of Data Science, Atlanta (USA). 2024.10
- SIAM Great Lakes Annual Meeting, Hammond (USA). 2024.10
- Joint Statistical Meeting, Portland (USA). 2024.08
- IBM Dublin Research Lab, Dublin (Ireland). 2024.07
- ISERC Dissertation Seminar, Santiniketan (India). 2020.07
- ISERC Undergraduate Presentation Series, Santiniketan (India). 2018.04

Selected Short Projects

Knowledge Conflict Evaluation | Dublin, Ireland — Summer 2024
- Contributed to the first stage of a two-stage pipeline to evaluate knowledge conflicts in a Wikipedia-based dataset using the IBM Granite Foundation model.
- Developed evaluation metrics to assess the accuracy and reliability of detected conflicts, ensuring robust model performance.

Patterned Vegetation Modeling | Notre Dame, USA — Spring 2021
- Built a reaction-advection-diffusion stochastic PDE model to investigate patterned vegetation dynamics.
- Analyzed the resilience of these patterns in response to climate variability and environmental stressors.

Signboard Transliteration | Notre Dame, USA — Spring 2021
- Developed a two-stage signboard text transliteration system from vernacular languages to English using attention models.
- Integrated and optimized the first stage of the transliteration pipeline to improve overall system performance.

Knowledge Graph Alignment | Notre Dame, USA — Fall 2020
- Collaborated on cross-lingual knowledge graph alignment using Graphlets and a Graph Matching Neural Network on the DBP15K dataset.
- Developed alignment strategies, analyzed model performance, and presented findings to collaborators.

Technical Skills

Languages: Hindi, English, Bengali.

Programming: Python, R, C, FORTRAN, LaTeX, C++.

Scientific Computing: MATLAB, Mathematica, Matplotlib, NumPy, PyTorch, scikit-learn.

Professional membership

- American Statistical Association.
- Society for Industrial and Applied Mathematics.
- International Indian Statistical Association.
- Institute of Mathematical Statistics.
- Institute for Operations Research and the Management Sciences.

Service

- **Mentoring**: Mentored over 10 undergraduates in transitioning to quality graduate programs at Notre Dame and Visva Bharati.
- **Leadership**: As Vice-President for SIAM at ND, organized workshops, discussion panels, and fostered interdisciplinary collaboration within the SIAM community at Notre Dame. As a Graduate Orientation Ambassador, planned and implemented comprehensive introductions to campus and graduate studies. Advised and judged for the American Statistical Association Data Fest at Notre Dame.
- **Volunteer**: Tutor at Robinson Community Learning Center, Notre Dame.
- **College Council**: Student member, College of Science, University of Notre Dame.
- **Academic Referee**: ICLR, EJoS, Bernoulli.

References

- **Prof Lizhen Lin,**
  Department of Mathematics,
  University of Maryland,
  College Park, MD, USA.
  lizhen01@umd.edu
- **Dr. Daren Wang**
  Department of ACMS,
  University of Notre Dame,
  Notre Dame, IN, USA.
  dwang24@nd.edu
- **Prof. Yun Yang**
  Department of Mathematics,
  University of Maryland,
  College Park, MD, USA.
  yy84@umd.edu
- **Prof. Fang Liu**
  Department of ACMS,
  University of Notre Dame,
  Notre Dame, IN, USA.
  Fang.Liu.131@nd.edu