

# Zehaan Naik

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## Education

|                  |   |                            |
|------------------|---|----------------------------|
| <b>BS</b>        | <b>Indian Institute of Technology Kanpur</b> , Statistics and Data Science  | 2022 – 2026                |
|                  | <ul style="list-style-type: none"> <li><b>Awards:</b> Academic Excellence Award (2022 &amp; 2023)</li> <li><b>Honors Track Student</b></li> <li><b>Minors:</b> Machine Learning and Applications; English Literature</li> </ul> | <b>GPA:</b> 8.9/10         |
| <b>Grade XII</b> | <b>Delhi Public School, Surat</b>   | <b>Score:</b> 97.6%   2022 |
| <b>Grade X</b>   | <b>Delhi Public School, Surat</b>   | <b>Score:</b> 98.4%   2020 |

## Preprints

|   |                           |
|---|---------------------------|
| <b>Z. Naik</b> , D. Kundu;  | Manuscript in preparation |
| <b>Coordinate Descent Algorithm for Least Absolute Deviations Regression</b>  |                           |
| <b>Z. Naik</b> , M. Chow, S. Mitra;   | Manuscript in preparation |
| <b>Automated Label Imputation and Robust Optimization for SWAP Regression</b> |                           |

## Work Experience

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| <b>Boston Consulting Group</b> , Associate Intern   📍 Mumbai, India  | May'25 – Jul'25 |
| <i>Received a full-time job offer to join as an associate at the Mumbai office for outstanding performance</i>   |                 |
| <ul style="list-style-type: none"> <li>Partnered with <b>Gujarat Administrative Reforms Commission</b> as knowledge partners for policy modernisation</li> <li><b>Benchmarked global best practices</b> (Estonia, Singapore, UK) to design strategic digital governance interventions</li> <li>Analyzed utilization across <b>1400+</b> PHCs to <b>optimize healthcare service</b> coverage and streamline delivery statewide</li> <li>Re-imagined <b>5+ best-in-class workflows</b> to enable <b>data-driven governance</b>, improve accountability and impact</li> <li>Implemented e-governance policy, impacting <b>60M+</b> citizens through enhanced digital access and service efficiency</li> </ul>           |                 |
| <b>IIM Bangalore</b> , Research Intern   Prof. Sharkarsan Basu   <a href="#">LOR</a>   📍 Bengaluru, India  | May'24 – Jul'24 |
| <i>Got research featured in the <b>Research Symposium on Finance and Economics 2024</b> by IFMR</i>  |                 |
| <ul style="list-style-type: none"> <li><b>Optimized lending strategies</b> &amp; establish equity trends for public and private sector banks in economic crises</li> <li>Analyzed public and private lending data for over <b>100,000</b> firms and top <b>50</b> banks to train a <b>predictive model</b></li> <li>Validated the state double-engine government hypothesis on economic growth through <b>discriminant analysis</b></li> <li>Analyzed <b>dividend stickiness</b> by analyzing agency cost issues with large shareholders and corporate governance</li> <li>Analyzed executive structures of <b>17,000</b> firms to assess their impact on <b>company growth &amp; dividend stickiness</b></li> </ul> |                 |

## Teaching Experience

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|--|---------------------------|
| <b>IIT Kanpur</b>   <b>MTH208</b> - Data Science Lab-1   Fall 2024 | <b>Teaching Assistant</b> |
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## Research Experience

|  |                 |
|--|-----------------|
| <b>SWAP Regression</b>   Prof. Sharmishtha Mitra   IIT Kanpur   <a href="#">LOR</a>  | Aug'23 – Sep'25 |
| <ul style="list-style-type: none"> <li>Developed an EM based <b>Label-imputation mechanism</b> to predict response – predictor roles for SWAP regression</li> <li>Implemented a <b>weighted LAD M-step</b> (<math>L_1</math> loss) with <b>MAD-based scale updates</b> for a stable fit robust to outliers</li> <li>Validated the approach on <b>USD/INR – SENSEX</b> data outperforming standard model with <b>81.6%</b> reduction in RMSE</li> <li>Auto-imputed alternating <b>causality regimes</b> that align with established <b>empirical findings and economic theory</b></li> </ul>  |                 |
| <b>Coordinate Descent for LAD Estimation</b>   Prof. Debasis Kundu   IIT Kanpur   <a href="#">LOR</a>  | Aug'25 - Nov'25 |
| <ul style="list-style-type: none"> <li>Developed a novel <b>coordinate-wise descent strategy</b> to compute <b>LAD estimates</b> for linear regression parameters</li> <li>Demonstrated stability in <b>high-dimensional regimes</b> (<math>p &gt; n</math>) and performed on-par with simplex-based solvers</li> <li>Achieved a worst-case efficiency of <math>O(pn \log(n))</math> outperforming all state-of-the-art simplex counterparts</li> <li>Established <b>convergence guarantees</b> under standard OLS regularity conditions and validated <b>empirical stability</b></li> </ul> |                 |

**Tempered Hamiltonian Monte Carlo (THMC)** | Prof. Dootika Vats | IIT Kanpur | 

Jan'25 - May'25

- Designed a **novel variant of HMC** to enhance sampling efficiency in complex **multi-modal distributions**
- Incorporated **adaptive tempering** into leapfrog integrators, **improving mode traversal** over high energy barriers
- **Proved theoretical guarantees** of reversibility and volume preservation under the proposed THMC dynamics
- Achieved **superior sampling coverage** across 20-mode targets and Neal's Funnel, **outperforming standard HMC**

**The Knight and Bishop Algorithm** | Research Project | 


Jan'25 - May'25

- Developed a **hyperparameter tuning scheme** for Magnetic HMC using dual averaging and recursive exploration
- Proved the **invariance and ergodicity** of the Magnetic HMC kernel, necessary for a valid MCMC sampler
- Identified **critical gradient-based failure modes** by benchmarking the algorithm on complex multi-modal targets

**No U-Turn Sampler** | Prof. Dootika Vats | IIT Kanpur | 

Jul'24 - Nov'24

- Built a solid foundation in advanced MCMC and implemented the **No-U-Turn Sampler (NUTS)** from first principles
- Mastered the recursive algorithm for **adaptive path-length construction** for hyper-parameter tuning
- Validated the sampler by **replicating experiments** on complex targets, confirming its efficiency over HMC

**PHASR** | Prof. Indranil Saha | ERA | IIT Kanpur | 

Sep'23 - Apr'24

**First Indian team** to qualify for the RoboCup MSL Challenge out of **100+** international applicants

- Designed & developed robots capable of **autonomously** playing football using real-time vision and swarm robotics
- Developed subsystems such as **solenoid based kicking mechanism** and **automated ball handling mechanism**

## Ongoing Projects

**Barker's DP-SGD** | Prof. Dootika Vats | IIT Kanpur

Jul'25 - Present

- Developed a **differentially private SGD variant** using a Barker's proposal-inspired robust gradient scaling
- Established **convergence guarantees** of the proposed algorithm **without Lipschitz assumption** on gradients
- **Improved utility-privacy tradeoffs** in model training, achieving faster convergence on similar privacy guarantees

## Scholarships

**Nalanda Merit Scholarship 2020:** Fee waiver worth **INR 3,00,000** for securing 98.4% marks in AISSE

**BYJU's Merit Scholarship 2020:** Fee waiver worth **INR 1,50,000** for excellent academic performance

## Technical Skills

**Languages:** R, Python, C, C++,  $\LaTeX$ , MATLAB, HTML, JavaScript, CSS, SQL

**Technologies:** Bloomberg Terminal, Fusion360, Gazebo, SKLearn, Matplotlib, Quarto, RShiny, PyTorch, TensorFlow

## Relevant Course Work

| Machine Learning & Algorithms  | Applied Statistics  | Theoretical Courses  |
|--|---|--|
| Data Structure and Algorithms<br>Fundamentals of Computing<br>Introduction to Machine Learning<br>Probabilistic Machine Learning<br>Techniques in AI & Data Mining<br>Markov Chain Monte Carlo | Data Science Labs<br>Computational Statistics<br>Time Series Analysis<br>Linear Regression and Anova<br>Non-Linear Regression<br>Non-parametric Inference | Linear Estimations and Modeling<br>Applied Stochastic Processes<br>Theory of Statistics<br>Real Analysis<br>Complex Variables<br>Multivariate Analysis |

## Positions of Responsibility

**Editor, Vox Populi** | Writing and Investigative Journalism

Apr'24 - Apr'25

- Led a **3-tier** team of **40+** Core Group Members & **20+** Asst. Editors working on reports, infographics & videos

**Coordinator, Debating Society** | Media and Culture Council, IIT Kanpur

Apr'24 - Apr'25

- Led a 3-tier team of **40+** students; training for competitive **national and international** debate tournaments