# Soban Nasir Lone

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## EDUCATION

**Indian Institute of Technology, Delhi**, India — Aug 2022 - June 2024
Master's by Research in Applied Mechanics — Cumulative GPA: 8.706/10

**National Institute of Technology, Srinagar**, India — Aug 2017 - July 2021
Bachelor's of Technology in Civil Engineering — Cumulative GPA: 8.435/10

## ACADEMIC EXPERIENCE

**Indian Institute of Technology, Delhi** — Aug 2022 - Present
*Student Researcher* - System Monitoring, Identification, and Control Research (SMICR) Group
Supervisor: *Dr. Rajdip Nayek*
Thesis:

**Applying Generalised Variational Inference for Robust Uncertainty Quantification in Bayesian DeepONets and Soil Constitutive Modelling**

Projects:

**$\alpha$-Variational DeepONet** — Apr 2023 - Aug 2023

- Developed a Bayesian equivalent of the operator learning framework DeepONet for solving differential equations while quantifying the uncertainty in the predictions. Used the framework to solve multiple ODEs and PDEs.
- Decreased predictive error by 55.3% on the anti-derivative operator and 32% on gravity pendulum from the results in the framework: VB-DeepONet.

**Bayesian neural networks (BNNs) for constitutive modelling** — Oct 2023 - Present

- Researched, analysed, and gained expertise in BNNs for uncertainty quantification in deep learning.
- Applied BNNs for constitutive modelling of soil trained on time-series stress-strain data.

**Physics Informed Neural Networks (PINNs)** — Mar 2023 - May 2023

- Modelled the deformation of a 2D bar subjected to in-plane loading and compared effects of using different forces.
- Implemented codes for forward and inverse problems of a structural dynamical system using PINNs in TensorFlow.

**Bayesian Physics Informed Neural Networks (B-PINNs)** — Dec 2023 - Jan 2024

- Extended the deterministic PINN architecture to include a Bayesian neural network for uncertainty quantification.
- Incorporated a methodology that remedies prior-misspecification for Bayesian neural networks and thus improved predictive performance.

**Parameter Estimation of Dynamical Systems** — Jul 2023 - Oct 2023

- Developed a state-space model to estimate parameters and quantify uncertainty in a structural dynamical system using Markov chain Monte Carlo (MCMC), Kalman Filter and Variational Inference.
- Analyzed advantages, limitations, and computation times of the algorithms for accuracy, convergence, and efficiency.

**National Institute of Technology, Srinagar**
*Undergraduate Research,* Department of Civil Engineering — Dec 2020 - Jun 2021
Supervisor: *Prof. F.A. Mir*
Final year project:

**Site-Specific Landslide Analysis and Correction**

- Collected data, including soil samples and site geography, as part of a comprehensive project on Landslide Analysis.
- Conducted in-depth soil data analysis, utilizing experimental methods and simulations (GeoStudio-GeoSlope) to gain insights into properties and characteristics of the site and propose possible corrections.

**Indian Institute of Technology, Delhi** — Jul 2020
*Research Intern,* Department of Civil Engineering

**Microtremor and multichannel analysis of seismic waves for microzonation of an earthquake prone region**

- Microtremor and multichannel analysis of seismic waves for microzonation of an earthquake prone region

## RESEARCH INTERESTS

- Non-linear system identification using Bayesian methods and Machine Learning.
- Bayesian Neural Networks for Uncertainty Quantification using Variational Inference.
- Operator Learning frameworks for solving ODEs and PDEs.
- Scientific Machine Learning applications in Civil Engineering.

## SELECTED COURSES

**Master's Courses**

- Deep Learning for Mechanics
- Introduction to Machine Learning
- Decision Theory and Design Optimisation
- Engineering Mathematics and Computation
- Dynamics

**Bachelor's Courses**

- Computer Programming (C Programming)
- Mathematics (Linear Algebra, Statistics and Probability, Calculus)
- Structural Analysis I, II, III
- Strength of Materials

## AWARDS AND ACHIEVEMENTS

- Secured a percentile of 98.5 (out of 100,043 candidates) in the **G**raduate **A**ptitude **T**est in **E**ngineering (**GATE**) (Civil Engineering) 2022 for admission to graduate level programmes to the IIT's and IISc.
- Obtained a percentile of 97 (out of 124,000 candidates) in JEE MAINS 2017 for admission to undergraduate level programmes to the IIT's, NIT's and IIIT's.
- **COLOURS (Football)** by Board of Sports Activities (BSA), IIT Delhi (2022-23) for outstanding achievements in sports.
- Post Graduate Scholarship by the Ministry of Human Resource Development (MHRD), Govt. of India for Academic years 2022 to 2024.

## TEACHING EXPERIENCE

**Indian Institute of Technology, Delhi**

- Teaching Assistant for the course Engineering Mechanics (APL100). Fall 2022
- Teaching Assistant for the course Finite Element Methods (AML706). Spring 2023
- Teaching Assistant for the course Applied Mathematics for Engineers (APL101). Fall 2023
- Teaching Assistant for the course Machine Learning for Mechanics (APL405). Spring 2024

## SKILLS

- **Programming:** Python, R, C Programming, MATLAB
- **Frameworks:** TensorFlow, TensorFlow Probability, PyTorch, PYMC3
- **Others:** GitHub, LaTeX, Matplotlib, Scipy

## EXTRACURRICULARS

- Represented Indian Institute of Technology, Delhi at the Inter-IIT Sports Meet (the annual Olympic-style sports tournament of the 23 Indian Institutes of Technology) in 2022 and 2023 as a part of the institute football team, securing 3rd and 4th positions in the overall standings respectively.
- Participated in Udghosh (the Annual Sports Festival of IIT, Kanpur) in 2022 and 2023, winning Gold (Football) in 2023.
- Explored AI Safety concepts as a fellow at the AI Safety Careers Fellowship by FAR AI, Inc. at IIT, Delhi in 2023.

## REFERENCES

**Dr. Radjip Nayek**
*Assistant Professor, Department of Applied Mechanics, Indian Institute of Technology, Delhi, India*
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Scholar Profiles: Group (SMICR) — Google Scholar — LinkedIn

**Dr. Souvik Chakraborty**
*Assistant Professor, Department of Applied Mechanics, Indian Institute of Technology, Delhi, India*
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