Soumen Kumar Mondal
Center for Machine Intelligence and Data Science (CMInDS)
Indian Institute of Technology Bombay, India
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Qualification	Specialization	Institute (all located in India)	Year	CPI/% (R)
MS by Research	Data Science & Artificial Intelligence	Indian Institute of Technology, Bombay	2023 - 2026	9.83 (1^{st})
MTech	Structural Engineering	Indian Institute of Science, Bangalore	2018 - 2020	9.30 (4^{th})
BTech	Civil Engineering	Jadavpur University, Kolkata	2014 - 2018	8.74 (6^{th})
12^{th} Standard	Science (PCM), Languages	Haldia High School (West Bengal Board)	2012 - 2014	89.60 (1^{st})
10^{th} Standard	Science, Arts, Languages	Haldia High School (West Bengal Board)	2011 - 2012	86.85 (2^{nd})

List of Publications, Google Scholar ID: 154CUKcAAAAJ

1. **Mondal, Soumen K.**, Sen, S., Singhania, A., & Jyothi, P. (2025). **Language-Specific Neurons Do Not Facilitate Cross-Lingual Transfer**. *In Proceedings of the InsightsNLP in NAACL 2025 (oral)*. ArXiv: 2503.17456.
2. Sona, SE., **Mondal, Soumen K.**, Sen, S., Singhania, A., & Jyothi, P. (2025). **LoFTI: Localization and Factuality Transfer to Indian Locales**. *In Findings of the ACL 2025*. ArXiv: 2407.11833.
3. **Mondal, Soumen K.**, Varmora, A., Chanda, P., & Ramakrishnan, G. (2025). **FairPO: Robust Preference Optimization for Fair Multi-Label Learning**. *In Proceedings of the Optimization for ML (OPT) in NeurIPS 2025*. ArXiv: 2505.02433.

M.S. by Research in Data Science and Artificial Intelligence at IIT Bombay

- **Controlling Large Language Models for Low-Resource Languages using RL and Preference Optimization**
  (M.S. Thesis, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Spring 2025 - Present)*
  - Designed and implemented a data-efficient framework to improve low-resource Neural Machine Translation by fine-tuning **Llama 3.1** with **DPO**. Exploring the explainability of DPO for **70%** BLEU score degradation on **Flores-200** dataset. GitHub: soumenkm/ModelEditing
  - Developing an RL fine-tuning framework to replace the linear shortcut and strengthen cross-lingual factual transfer using a step-aware multilingual reward to enforce per-step factuality and guide error-free English to target language conversion. GitHub: soumenkm/MultilingualFactRL

- **Improving Downstream Task Performance in Multi-lingual LLMs by Intervening Language Specific Neurons**
  (M.S. Thesis, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Autumn 2024)*

  Investigated the mechanistic interpretability of language-specific neurons in **LLMs** to assess their utility for cross-lingual transfer. Demonstrated through neuron specific **LoRA** fine-tuning and test-time interventions that neurons are *polysemantic*, yielding **1%** improvement [paper 1]. GitHub: soumenkm/LangSpecificNeurons

- **IIT Bombay - Amazon Collaboration: Localizing Text Across Domains Using RARR Attribution Technique**
  (M.S. R&D Project, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Grade: 10, Spring 2024)*

  Developed **LoFTI**, a novel benchmark of **1,100** factual entity pairs across **99** categories, to evaluate the factual and localization capabilities of **LLMs** in a cross-geographical context. Utilized **RARR** attribution to enhance the performance, boosting factual correctness by **13%** [paper 2]. GitHub: soumenkm/RnD_Project

- **Cross-lingual Factual Knowledge Transfer in Multi-lingual Language Models**
  (M.S. Seminar, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Grade: 10, Spring 2024)*

  Analyzed factual knowledge representation and transfer in **multilingual BERT** and **XLM-R** models across **53** languages using **Probeless** method to inspect internal neuron activity. GitHub: soumenkm/TracingRootFacts

Work Experience

- **Fujitsu Research, Bengaluru, India**
  (AI Research Intern, Project Title: Proactive RCA – A Hypergraph-Abstracted and Mamba-based RAG Framework for Causal Error Prediction in Warrior System Logs) *(May 2025 - July 2025)*
  - Engineered a novel **ProactiveRCA** framework to accurately forecast future system errors by analyzing partial log data (**20-30%** of log). Designed and implemented a multi-stage pipeline using **Hypergraphs** and **PageRank** algorithm to compress massive logs (**500M+** tokens) into a format compatible with **Mamba**.
  - Implemented domain-adaptive pre-training using **LoRA** to adapt the **Mamba** model to logs, improving the BLEU score for next-token prediction by **42%**. Modified the **InstructRAG** pipeline by aligning **hyper-GNN** and text embeddings using **Cross Attention**, achieving a semantic correctness score of **4.4/5.0** by **LLM-as-a-Judge**.

- **General Electric (GE Vernova), Bengaluru, India**
  (System Value Optimization Engineer) *(Aug 2020 - July 2023)*

  Engineered end-to-end wind turbine load optimization strategies by implementing **CatBoost** model for predictive load assessments, reducing extreme load by **70%**, leading to a *GE Spotlight Impact Award*.

Machine Learning Course Projects at IIT Bombay

- **FairPO: Robust Preference Optimization for Fair Multi-Label Learning**
  (*Course Project, Optimization for ML, Prof. Ganesh Ramakrishnan, CSE, IIT Bombay)* *(Spring 2025)*

  Proposed **FairPO**, a novel framework to address label fairness in Multi Label Classification using **DPO, CPO, SimPO,** and **GRPO**, achieving a **3.44%** mAP gain on **MS-COCO** dataset [paper 3]. GitHub: soumenkm/FairPO

- **Vision Transformer (ViT) Model Fine-Tuning with MillionAID Dataset using LoRA**
  (*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(Autumn 2024)*

  Implemented **LoRA** from scratch for efficient fine-tuning of a **DINO-ViT** on **Million AID** dataset, achieving **97%** classification accuracy. GitHub: soumenkm/IITB-GNR650-ADLCV/CodingProject

- **Learning to Classify Images under Noisy Labels using Turtle**
  (*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(Autumn 2024)*

  Achieved **88%** accuracy on **CIFAR-100** with **40%** label noise by implementing a **CLIP & DINO-ViT** framework for label denoising and subsequent supervised fine-tuning. GitHub: soumenkm/IITB-GNR650-ADLCV/Project1

- **Zero Shot Learning (ZSL) for Image Classification on AwA2 Dataset**
  (*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(Autumn 2024)*

  Designed a ZSL pipeline with **ViT**, **FastText** and **Class Normalization**. Attained **40%** test accuracy on AwA2 with a challenging **50:50** train-test split. GitHub: soumenkm/IITB-GNR650-ADLCV/Project2

- **Deep Learning based System to Estimate the Calorie Content in Food from Images**
  (*Course Project, Foundations of Machine Learning, Prof. Sunita Sarawagi, CSE, IIT Bombay)* *(Autumn 2023)*

  Developed an automated calorie estimation system using **YOLOv8** (detection) and **GrabCut** (segmentation), achieving **7.6%** mean absolute error across **19** food classes. GitHub: soumenkm/CS725-FML-Project

Machine Learning "From Scratch" Self Projects

- **Build GPT2 and BERT from Scratch**: Developed all the core components of **GPT-2** and **BERT** (multi-head self-attention, MLPs, trainer class, pre-training and instruction fine-tuning) from scratch without **HuggingFace**. GitHub: soumenkm/Build-LLM-from-scratch, GitHub: soumenkm/Build-BERT-from-scratch *(Autumn 2024)*
- **Build Diffusion Model from Scratch**: Developed a **DDPM** from scratch, implementing diffusion/ reverse processes and sampling. GitHub: soumenkm/Diffusion-Model-from-Scratch *(Autumn 2024)*

Technical Skills

- **Programming & Scripting Languages:** Python, C, C++
- **Tools and Technologies:** PyTorch, HuggingFace, LangChain, TensorFlow, Scikit-Learn, LaTeX, Git, Linux

Courses at IIT Bombay

CS 725: *Foundations of Machine Learning* (*Grade: 10*)
SC 607: *Convex Optimization* (*Grade: 10*)
CS 601: *Algorithms and Complexity* (*Grade: 10*)
EE 635: *Applied Linear Algebra* (*Grade: 9*)
IE 621: *Probability and Stochastic Process* (*Grade: 9*)
GNR 638: *Deep Learning for CV* (*Grade: 10*)
GNR 650: *Advanced Deep Learning for CV* (*Grade: 10*)
CS 769: *Optimization for Machine Learning* (*Grade: 10*)
GNR 602: *Advanced Satellite Image Processing* (*Grade: 10*)
BB 610: *Biomedical Microsystems (Inst. Elec.)* (*Grade: 10*)

Teaching Assistant Positions at IIT Bombay

IITB e-PG Diploma in AI: *Statistics (Class Size: 150)*
CS 725: *Foundations of Machine Learning (Class Size: 180)*
CS 6106: *Statistical Learning Theory (Class Size: 50)*
DS 303: *Introduction to Machine Learning (Class Size: 180)*

Achievements

- *Maintained a perfect 10/10 CGPA* across three consecutive academic semesters at IIT Bombay. *(2025)*
- *Awarded the Institute Academic Prize* for outstanding academic performance (department rank 1) at IIT Bombay. *(2024)*
- *Received the GE Spotlight Impact Award* for reducing operational costs at GE Vernova. *(2022)*
- *Won the Innovate 2021 AI/ML Challenge* hosted by GE Vernova. *(2021)*