Soumen Kumar Mondal
Center for Machine Intelligence and Data Science (CMInDS)
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Qualification	Specialization	Institute	Year	CPI/%
MS by Research	Artificial Intelligence & Data Science	Indian Institute of Technology, Bombay	2023 - 2026	9.70
MTech	Structural Engineering	Indian Institute of Science, Bangalore	2018 - 2020	9.30
BTech	Civil Engineering	Jadavpur University, Kolkata	2014 - 2018	8.74
12^{th} Standard	Science (PCM), Languages	Haldia High School (West Bengal Board)	2012 - 2014	89.60
10^{th} Standard	Science, Arts, Languages	Haldia High School (West Bengal Board)	2011 - 2012	86.85

TECHNICAL SKILLS

- **Programming & Scripting Languages:** Python, C, C++, MATLAB
- **Tools and Technologies:** PyTorch, HuggingFace, NumPy, Pandas, TensorFlow, Keras, Scikit-Learn
- **Other Skills:** LaTeX, Git & GitHub, Linux

M.S. BY RESEARCH

- **IIT Bombay - Amazon Collaboration: Localizing Text Across Domains Using RARR Attribution Technique**
  (M.S. R&D Project, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Jan 2024 - April 2024)*
  - **Problem of localization:** Can we generalize the process of text generation in controlled environment applied to new domains? E.g., "Show me CNN news" → "Show me NDTV news".
  - Code and Report: https://github.com/soumenkm/RnD_Project

- **Cross-lingual Knowledge Transfer in Multi-lingual Language Models**
  (M.S. Seminar, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(Jan 2023 - April 2024)*
  - Carried out the literature survey of fine-tuning methods of LLM such as adapter based methods (MAD-X) and sparse fine-tuning methods (Composable SFT). Inspected the representation of facts in multi-lingual LLM for cross-lingual knowledge transfer using neuron-probe analysis.
  - Code and Report: https://github.com/soumenkm/TracingRootFacts

- **Improving Downstream Task Performance in Multi-lingual LLMs by Intervening Language Specific Neurons**
  (M.S. Thesis, Advisor: Prof. Preethi Jyothi, CSE, IIT Bombay) *(May 2024 - Present)*
  - Identification language specific neurons using the existing methods in the literature such as LAPE, SAE, activation based and gradient based methods.
  - Intervention of the LLM activation using the summary statistics of neurons for a language to check if the task performance is improved. This involves finetuning LLM for a source language for a task such as NLI and then intervening the target language neurons in the finetuned LLM to improve the performance in target language.
  - Code: https://github.com/soumenkm/LangSpecificNeurons (Currently *Private*)

MACHINE LEARNING COURSE PROJECTS

- **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)* *(July 2023 - Nov 2023)*
  - Developed a calorie estimation system from food images across 19 different food items by integrating YOLOv8 for food item detection in images and GrabCut algorithm for segmentation. Achieved the average **mean absolute error of 7.6%** over the 19 food classes using the YOLO algorithm.
  - Code and Report: https://github.com/soumenkm/CS725-FML-Project

- **Image Deblurring Using Stripformer**
  (*Course Project, Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(Jan 2024 - April 2024)*
  - The task of image deblurring involves removing the blurring portion from images to restore the original, sharp content. Obtained best PSNR-parameter trade-off (**33% test PSNR with just 3.8 million parameters**) in Stripformer.
  - Code and Report: https://github.com/soumenkm/GNR-638-miniproject2

- **Learning to classify images under noisy labels using Turtle**
  (*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(July 2024 - Nov 2024)*

- The task of label noise learning involves learning to classify images with correct labels even if the image had a noisy label tagged with it during training. After majority voting on CLIP+DINO trained ViT, we finetune the ViT model using approximate true labels, which gives best **accuracy of 88%** on test set of CIFAR-100 dataset.
- Code and Report: https://github.com/soumenkm/IITB-GNR650-ADLCV/tree/main/Project1

- **Zero shot learning for image classification on AwA2 dataset**
(*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(July 2024 - Nov 2024)*
  - ZSL is a challenging problem in machine learning, where models are required to generalize to classes that are not present in the training data. After training the NN classifier model (following the principle of Class Normalization) on ZSL loss, we obtained best **test accuracy of 40%** on AwA2 dataset (with 50:50 train, test split).
  - Code and Report: https://github.com/soumenkm/IITB-GNR650-ADLCV/tree/main/Project2

- **Vision transformer model fine-tuning with MillionAID dataset using LoRA**
(*Course Project, Advanced Deep Learning for CV, Prof. Biplab Banerjee, CSRE, IIT Bombay)* *(July 2024 - Nov 2024)*
  - This project focuses on fine-tuning a DINOv2 pretrained ViT model with LoRA (Low-Rank Adaptation) and layer unfreezing techniques on the MillionAID dataset. This project was a coding project to write the LoRA code for training a ViT model from scratch.
  - Code and Report: https://github.com/soumenkm/IITB-GNR650-ADLCV/tree/main/CodingProject

MACHINE LEARNING "FROM SCRATCH" PROJECTS

- **Build GPT2 and BERT from scratch**: Coded the multi head self attention layers and MLP blocks of GPT2 and BERT model from scratch. Wrote the trainer class from scratch for multi GPU pre-training, LoRA finetuning for classification and instruction tuning dataset. Code: https://github.com/soumenkm/Build-LLM-from-scratch and https://github.com/soumenkm/Build-BERT-from-scratch
- **Build FFNN from scratch**: Coded the forward and backpropagation of a neural network model from scratch using NumPy only. Wrote the minibatch SGD training loop from scratch to train the network. Code: https://github.com/soumenkm/ML-Algorithms/tree/main/FFNN
- **Build Diffusion Model from scratch**: Coded the forward, reverse and sampling process of a diffusion model (DDPM) from scratch. Wrote the trainer for training a DDPM on CelebHQ dataset and a sampler to generate samples. Code: https://github.com/soumenkm/Diffusion-Model-from-Scratch/tree/main/DDPM

WORK EXPERIENCE

- **General Electric (GE Vernova), Bengaluru**
(Edison Engineering Development Program) *(Aug 2020 - July 2022)*
  - Involved in the development of Python based modules to mitigate the fatigue and extreme exceedances for mechanical components of wind turbines.

  (System Value Optimisation Engineer) *(July 2022 - July 2023)*
  - Contributed as a developer in a Python based prototype tool to reduce the cost of simulation as a part of fatigue simulation optimisation efforts.

MAJOR COURSES AT IIT BOMBAY

- CS 725: Foundations of Machine Learning, Prof. Sunita Sarawagi, CSE (*Grade: 10, Autumn 2023*)
- EE 635: Applied Linear Algebra, Prof. Dwaipayan Mukherjee, EE (*Grade: 9, Autumn 2023*)
- IE 621: Introduction to Probability & Stochastic Process I, Prof. KSM Rao, IEOR (*Grade: 9, Autumn 2023*)
- SC 607: Optimisation, Prof. Avishek Ghosh, SysCon (*Grade: 10, Spring 2024*)
- GNR 638: Deep Learning for Computer Vision, Prof. Biplab Banerjee, CSRE (*Grade: 10, Spring 2024*)
- GNR 650: Advanced Deep Learning for Computer Vision, Prof. Biplab Banerjee, CSRE (*Grade: 10, Autumn 2024*)

POSITIONS OF RESPONSIBILITY

- **Teaching Assistant, IIT Bombay**
  - DS 303: Introduction to Machine Learning *(Spring 2024)*
  - CS 725: Foundations of Machine Learning *(Autumn 2024)*

ACHIEVEMENTS

- Received **Institute Academic Prize** for best academic performance at IIT Bombay *(2024)*
- Received a **GE spotlight impact award** for reducing cost of business operation at GE Vernova *(2022)*
- Won the **Innovate 2021 AI/ML challenge** organized by GE *(2021)*

HOBBIES

- Reading novels, Listening to music, Watching movies and TV series, Playing Cricket and Badminton.