Harsh Bihany

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Research Interests

Natural Language Processing, Reinforcement Learning, Multi-Agent Systems, Language Model Optimization

Education

Bachelor of Technology, Computer Science and Engineering 2021 - 2025
Indian Institute of Technology Kanpur | GPA: **9.5**/10 *Kanpur, India*

Publications

LoRMA: Low-Rank Multiplicative Adaptation for LLMs Exploration Labs, IIT Kanpur
Harsh Bihany, Shubham Patel, Ashutosh Modi

- *Findings of the Association for Computational Linguistics: ACL 2025*

Ongoing Research Projects

Distributive Multi-Agent Planning over Constrained environments
Prof. Sunil Simon and Prof. Subhajit Roy *Aug '24 - Ongoing*

- **Objective**: To analyze and develop environments in which agents are conditioned to fulfill mathematical specifications.
- Recent studies have shown effective techniques for agent trajectory planning over temporal specification given via LTL or its derivatives.
- To generalize this over a more general distributed setting over a partial/complete knowledge domain.

Selected Projects

EdiReF
Prof. Ashutosh Modi *Jul '23 - Nov '23*

- Worked on a **Semeval-2024** problem which was on Emotion Detection and Emotion Flip Reasoning on textual data involving English as well as English-Hindi mix conversations.
- By refining an existing architecture which integrated **masked-memory networks, transformer encoders, and several context-dependent GRUs**, our model surpassed the performance of GPT3.5 and GPT4 models on the given task. Our refinement produced a **weighted F1** score of **0.92** as opposed to GPT 4's 0.50 over zero-shot inference.

Tinytorch
Self endeavour *Jun '23 - Oct '23*

- Tinytorch is a simple **lightweight CPU-only** illustrative implementation of Pytorch, a popular deep learning library, written in Python.
- The aim was to demonstrate **backpropagation** over vector computations.
- Constructed a custom Tensor object and an autograd engine from scratch. Provided the API for calculating backprop gradients using a simple `loss.backward()`.

Copy-on-Write for EXT4 Linux Kernel Programming
Prof. Debadatta Mishra *Jan '24 - May '24*

- **Objective**: To design, develop and test a prototype for **Copy-on-Write** for the **EXT4 filesystem in Linux**.
- Our work was aimed at enhancing EXT4's capabilities, laying the groundwork for more advanced features like **file snapshots**.
- Significantly enhanced the write performance on accord of the **storage efficiency** by modifying the core filesystem's pipeline which involves **reads and writes**, to manage data updates over an **extent level granularity**.
- Provided the support for the previously unsupported `-reflink` flag over the `cp` system program.

Python Compiler Compiler Design
Prof. Swarnendu Biswas *Jan '24 - May '24*

- Developed a robust **statically typed Python** compiler supporting core language constructs like **recursive functions, object-oriented support**, and generating **x86 assembly code** for execution, using **flex, bison** and **gcc**.
- Designed a comprehensive **multi-stage compiler architecture** incorporating standard practices of **intermediate code** and target code generation for execution, achieving **100% score** on final evaluation metrics

Experience

Quantitative Trading Intern

Optiver B.V., Amsterdam *May '24 - Jul' 24*

- Learnt the basics of **options theory**, and traded on the live European options market, trading **ESX50 Options** on a simulated virtual platform, maintaining positions based on **events, news** and various other market factors.
- Quantified the **impact of large off-market intra-day ETF trades on end-of-day stock price movements**. Conducted in-depth analysis to measure the correlation between market ETF transactions and end-of-day auction changes.

Teaching Assistant, CS656

CSE, IIT Kanpur *Jan '25 - May '25*

- Assisted in Algorithmic Game Theory

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Relevant Coursework

∗ in Spring 2024-25

Statistical Natural Language Processing
Linux Kernel Programming
Algorithmic Game Theory
Principles of Database Systems
Large Language Models ∗
Probabilistic Machine Learning ∗
Design and Analysis of Algorithms
Computational Complexity ∗

Volunteering

Academic Mentor, MTH

Institute Counselling Service, IIT Kanpur *Oct '22 - Jul' 23*

- Served as a dedicated guide for first-year students, providing assistance with the academic challenges they faced in foundational math courses.
- Conducted multiple instructional doubt clearing sessions as well as lectures with a **capacity of over 600 students** specifically designed to help the freshers better understand their coursework.

Volunteer

Prayas, IIT Kanpur *Jan '24 - May '24*

- Volunteer at Prayas, which is an endeavor of IIT Kanpur students, aimed at providing primary and secondary education as well as vocational training to the children from under-privileged families that live in and around the IIT Kanpur campus.

Technical Skills

- **General Tools**: Python, C/C++, Linux Kernel, ReactJS, Django, Git, SQL, LaTeX, Bash
- **Machine Learning Utilities**: PyTorch, Tensorflow, OpenAI-Gymnasium, NLTK, Numpy