Afrin Dange

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Education

Indian Institute of Technology Bombay Jul '22 – Jun '25
MS by Research | *Artificial Intelligence & Data Science* CPI: 8.97/10
Thesis: In-context Learning and Adaptation of Foundation Models for Time Series
Advisor: Prof. Sunita Sarawagi

University of Mumbai Jul'18 – May '22
BE | *Computer Engineering* CPI: 9.61/10

Publications

[1] **Afrin Dange**, Sunita Sarawagi, *TFMAdapter: Lightweight Instance-Level Adaptation of Foundation Models for Forecasting with Covariates*, ACM International Conference on Information and Knowledge Management (CIKM), 2025

[2] **Afrin Dange**, Vaibhav Raj, Praneeth Netrapalli, Sunita Sarawagi, *Transformer Designs for In-context Learning in Foundation Models for Time Series Forecasting with Covariates*, ICML Workshop on Theoretical Foundations of Foundation Models, 2024

Research Experience

Pattern-based Time Series Retrieval | Research Assistant Mar '25 – Present
Advisor: Prof. Sunita Sarawagi (IIT Bombay)

- Curated QA dataset for evaluation of pattern-based retrieval of time series snippets.
- Implemented a tag-scoring mechanism for annotating time series snippets with common pattern-based tags.
- Explored LLM-based mechanisms to translate natural language questions to structured ElasticSearch queries.

Adapting Foundation Models for Covariate-Aware Forecasting | Research Assistant Oct '24 – Feb '25
Advisor: Prof. Sunita Sarawagi (IIT Bombay)

- Designed a two-stage instance-level adaptation to equip foundation models for forecasting with covariates.
- Generated pseudo-forecasts to train an adapter based on Gaussian Processes, enabling low-overhead and plug-and-play integration with foundation models.
- Benchmarked the adaptation method against state-of-the-art foundation models and supervised baselines, achieving a 24-27% gain in forecast accuracy.

In-context Learning for Regression | Research Assistant Jan '24 – Sep '24
Advisors: Prof. Sunita Sarawagi (IIT Bombay), Dr. Praneeth Netrapalli (Google DeepMind)

- Analyzed loss convergence of transformer variants on regression tasks to identify mechanisms that facilitate ICL.
- Proposed a modification to causal attention enabling in-context learning with a single transformer layer.
- Evaluated length generalization across transformer variants and introduced techniques like position-weighted loss and distillation along sequence length to improve performance.

ICL-enabled Foundation Model for Forecasting | Research Assistant May '23 – May '24
Advisors: Prof. Sunita Sarawagi (IIT Bombay), Dr. Praneeth Netrapalli (Google DeepMind)

- Designed a hybrid-transformer architecture for a time series foundation model, equipped with in-context learning for zero-shot forecasting on unseen datasets.
- Evaluated ICL-enabled foundation model, achieving zero-shot performance comparable to supervised baselines.
- Implemented distributed pretraining pipeline using PyTorch Fully Sharded Data Parallel for foundation models.

Selected Projects

Ranking in Sports Tournaments Using LLMs | Spring '25
CS 6103: Human-Centered AI | Instructor: Prof. Arpit Agarwal

- Surveyed ML algorithms and LLM-based methods for rank aggregation using pairwise preferences.
- Evaluated inference-time LLM techniques for rank aggregation on ICC and NFL match outcomes.
- Compared LLM rank aggregation performance against algorithms like Elo Rating, Trueskill, Bradley-Terry-Luce (BTL) model, achieving performance comparable to BTL.

Regret Minimization in Multi-Armed Bandits | Spring '25
CS 747: Foundations of Intelligent and Learning Agents | Instructor: Prof. Shivaram Kalyanakrishnan

- Implemented and compared UCB, KL-UCB, and Thompson Sampling algorithms for regret minimization in stochastic multi-armed bandit problems.
- Determined optimal epsilon parameter ranges for minimizing regret in epsilon-greedy algorithm by analyzing exploration-exploitation tradeoffs.

Fact Verification via Dense Retrieval and Fine-Tuning GPT-2 for NLI | Spring '24
CS 728: Organization of Web Information | Instructor: Prof. Soumen Chakrabarti

- Utilized BM25-based sparse document-level retrieval in the first level, and Dense Passage Retrieval (DPR) on the top-k documents in the second level for extracting evidence from Wikipedia pages.
- Fine-tuned a GPT-2 model for NLI on claim-evidence pairs with negative sampling.
- Enhanced the two-stage retrieval by indexing named entities at the document level, leading to a 10.29% increase in label accuracy and a 15.29% improvement in evidence F1 score.

Cross-lingual In-context Learning in Multilingual LLMs | Spring '24
CS 728: Organization of Web Information | Instructor: Prof. Soumen Chakrabarti

- Conducted cross-lingual in-context learning experiments on XNLI and SMiLER entity-relation extraction tasks using encoder-decoder (Flan-T5) and decoder-only (Llama-3) models.
- Utilized semantically aligned few-shot examples leveraging cosine similarity on mBERT embeddings.
- Achieved a 19.5% and 6.5% average increase in macro F1 scores for cross-lingual transfer from English to French and English to Russian on XNLI and SMiLER tasks, through semantically aligned few-shot examples.

Knowledge Graph Based Question Answering | Autumn '23
CS 635: Indexing, Retrieval and Learning for Text and Graphs | Instructor: Prof. Soumen Chakrabarti

- Developed a multihop KGQA module on the IMDb dataset by creating a knowledge graph using ComplEx for entity representation and fine-tuning RoBERTa to represent multihop relations based on the question.
- Achieved Mean Reciprocal Rank with MRR@1 of 0.25 and MRR@10 of 0.35.

Structured Decoding of Relational Algebra Tree in LLMs for Text-to-SQL | Spring '23
CS 726: Advanced Machine Learning | Instructor: Prof. Sunita Sarawagi

- Generated RA tree from SQL queries and used post-order traversal to create a flattened representation.
- Fine-tuned T5 for text-to-RA task using flattened RA tree representation on the Spider dataset.
- Applied beam search for better inference quality and conducted qualitative analysis on generated RA trees.

Teaching and Mentoring

Graduate Teaching Assistant | *IIT Bombay* | Spring '25
CS726: Advanced Machine Learning

- Designed a lab assignment on LLM inference-time algorithms and developed an autograder, invigilated weekly quizzes, and evaluated homework and final exams.

Department Coordinator | *IIT Bombay* | Jul '23 – Jun '24
Institute Student Companion Programme (ISCP)

- Organized department-level induction under ISCP; led a team of three student mentors and personally mentored two incoming graduate students throughout their first year.

Selected Academic Programs

2025 Armenian LLM Summer School, Yerevan, Armenia

2025 Google DeepMind Research Symposium, Bangalore, India

2025 Reinforcement Learning Workshop, IISc Bangalore, India

Invited Talks

Conditional Generation Using GANs and Diffusion Models Aug '24
ISTE Program at VESIT | Mumbai, India

Generative AI for Vision Feb '24
ISTE Program at FCRIT | Mumbai, India

Technical Skills

Programming: Python, C++, Bash, SQL

ML Libraries: PyTorch, Hugging Face, Scikit-learn, NumPy, Pandas, Matplotlib

Tools: Git, Docker, Jupyter, VS Code, Weights & Biases, TensorBoard

Documentation: LaTeX

Professional Service

- Reviewer for ICML 2025 Workshop on Foundation Models for Structured Data
- Reviewer for ICLR 2025 on Time Series Forecasting, In-context Learning

Relevant Coursework

Mathematics
Introduction to Probability & Random Processes; Applied Linear Algebra; Optimization in Machine Learning

Machine Learning
Foundations of Machine Learning; Advanced Machine Learning; Speech, NLP and the Web; Deep Learning for NLP; Information Retrieval & Mining for Hypertext & the Web; Organization of Web Information; Human-Centered AI; Introduction to AI, Data & Policy; Advanced LLM Agents (UC Berkeley)

Achievements

2022 Secured AIR 521 among 77,257 candidates in GATE CSE

2020 1st Place in HackerEarth Hackathon: GAME JAM 1.0

2020 Awarded Best Female Volunteer at NSS Camp

References

Available upon request.