Mayank Bharati

Indian Institute of Information Technology, Allahabad

+91 6306893302 | MayankBharati | MayankGithub | bharati.mk000@gmail.com

Indian Institute of Information Technology Allahabad **2020-2024**
Bachelors of Technology in Electronics and Communication *GPA : 8.23/10.0*

Research & Work Experience

Improving upper bounds of Policy Iteration Algorithm in RL [paper] **Feb-June 2023**
Guide: Prof. O.P. Vyas *IIIT Allahabad*

+ Proved exponentially better upper bounds for number of steps taken by Policy Iteration Algorithm determine the optimal policy in deterministic Markov Decision Processes by counting tadpole subgraphs
+ Partially resolved a conjecture about Howard's PI taking at most order Fibonacci steps on 2-action MDPs by establishing upper bounds for DMDPs

Towards validation of RTL passes of the GCC compiler **Jan-June 2023**
Guides: Prof. O.P. Vyas *IIIT Allahabad*

+ Analysed the various Register Transfer Language (**RTL**) optimization passes in **GCC-4.7.2** and implemented a **block-by-block** validation technique to validate program transformations done by the passes
+ Realized obligations based on the return values, heap memory and function calls of programs in the **Z3 Theorem Prover** tool to prove semantic equivalence between different control flow graphs (**CFGs**)
+ Studied the internal workings of GCC-4.7.2 compiler and developed various plugin tools for analysis

Shipping and Distribution Demand Forecasting **Jan-May 2022**
Guide: Prof. Sunny Sharma *IIIT Allahabad*

+ Build data pipelines for data coming from multiple like the Quandl API and a SQL database.
+ Performed an exploratory data analysis on the built dataset, derived insights, and presented it to the stakeholders on Jupyter Notebook and Tableau.
+ Modelled the data using decision tree-based regression models.

Factor Timing and Sector Allocation using Regime Switching Models **Jan-May 2022**
Guide: Prof. Sunny Sharma *IIIT Allahabad*

+ Used Hidden Markov models for asset allocation in sectors and dynamic factor ETFs under the assumption of 2 regimes.
+ Pioneered an easy-to-use strategy building framework to support dynamic deployment & modification of strategies during live trading using trader inputs in C++. Used the factory pattern to extend the reflection system for all strategy components.
+ Backtested portfolios had higher Sharpe, lower skew, kurtosis, drawdown compared to benchmark and baseline models.

Technical Skills

Programming	C++, C, Python, Java, PostgreSQL, Latex
Web Development	HTML5, CSS3, JavaScript, Django, PHP, Bootstrap, jQuery
Softwares	Kubernetes, MATLAB, Simulink, Git, Android Studio, AWS, Amazon EC2, Docker, Git
Libraries	Numpy, Pandas, Grafana, Transformers(GPT)
Key Courses:	Advanced Operating Systems, Distributed Systems, Computer Security, ML for Signal Processing, Efficient & Predictive Vision, Knowledge-driven Natural Language Generation, Advances in Intelligent and Learning Agents, Advanced Machine Learning, Functional Programming Languages, Web Search & Information Retrieval, Digital Image Processing, Artificial Intelligence, Computer Graphics, Graph Theory

Teaching & Mentoring Experience

+ **Teaching Assistant, Distributed Systems** - Manage the course website, grading and assignments. Conduct weekly office hours to handle doubts in person.
+ **Teaching Assistant, Applied Machine Learning**- Manage the course forum and clear doubts of the students in the online course. Conduct weekly office hours to handle doubts in person.
+ **Teaching Assistant** - Selected to manage and clear doubts in a class of 100 first-year students for the basic undergraduate course on Computer Programming and Utilization. Coordinated with the Computer Science Department to conduct regular **lab sessions** & **evaluate exam papers**

Other Notable Projects

Self-Supervised Embedded Speech Emotion Recognition **Aug-Dec 2021**

Guide: Prof. O.P. Vyas *IIIT Allahabad*

+ Implemented and trained a **Siamese NN** to distinguish emotions between 2 input speech samples with **test accuracy** 82% on the **CREMA-D** speech dataset
+ Used the trained Siamese neural network to identify emotions of unseen classes with upto 54% accuracy
+ Trained a classifier based on embeddings learned from the Siamese NN with upto 81% validation accuracy

Plausible Password Generation using Generative Models **Jan-June 2020**

Guides: Prof. Shiv Ram Dubey *IIIT Allahabad*

+ Explored and analysed the latest methods used to evaluate and guess passwords
+ Devised and implemented methods to evaluate a password based on the metrics of **guessability** and **memorability** and used them to compare the generative models developed
+ Designed methods to take old passwords as input and generate new stronger passwords using different generative models implemented using **RNNs**, variational autoencoders (**VAEs**) and **Grammar VAEs**

Near-Optimal Arm Identification in Continuum-Armed Bandits **July-Nov 2019**

Guide: Prof. Shiv Ram Dubey *IIIT Allahabad*

+ Derived a general lower bound for the probability of choosing an epsilon-optimal arm from the continuous-armed bandits problem, based on simple regret for any mean probability distribution of the arms
+ Explored various fixed and adaptive sampling strategies and experimented empirically over various mean functions to observe simple regret

Awards and Scholastic Achievements

+ Secured **All India Rank 575, 354, 658** in Codeforces contests, out of 12,000 competitors (2023)
+ Secured **All India Rank ~8000** in **IIT JEE Mains** among 1.2 million candidates (2020)
+ **Got rank in 1000** in Meta-Hackercup Round 1 2023. (2023)
+ **Global Rank 221** in Google Kick Start Round E 2022 (2022)
+ **Ranked 300th in a** electronic trading contest(Python) held by Jane Street at UNSW in 2022 (2022)

Relevant Coursework

* Computer Networks
* Computer Organization
* Distributed Systems
* Adv. Compiler Optimizations
* Operating Systems
* Modern Cryptology
* Functional Programming
* Computer Architecture
* Compiler Design
* Data Structures and Algos
* Programs Proofs and Types
* Computer Systems Security