Pranamya Prashant Kulkarni

Pre-doctoral Researcher, Google DeepMind

pranamyakulkarni.github.io | pranamyakulkarni@gmail.com | Google Scholar | +917400395798

Education

Indian Institute of Technology Bombay (IIT B) *[Interdisciplinary Dual Degree Program]* **Jul 2019 - Jun 2024**
Bachelor of Technology (with Honors) in Electrical Engineering — CPI (Overall): **9.67/10**
Master of Technology in Artificial Intelligence and Data Science — Dept. Rank (M.Tech): **3**/28

Research Experience

Google DeepMind, India **Jul 2024 - Present**
Pre-doctoral Researcher | Advisors: Dr. Prateek Jain, Dr. Pradeep Shenoy, Dr. Karthikeyan Shanmugam, Dr. Arun Suggala

Adobe Research India **May 2022 - Jul 2022**
Research Intern | Advisors: Dr. Vishwa Vinay, Dr. Aparna Garimella, Dr. Abhilasha Sancheti, Dr. Apoorv Saxena

Indian Institute of Technology Bombay (IIT B) **May 2023 - Jun 2024**
Teaching Assistant (Master's Thesis) | Advisors: Prof. Soumen Chakrabarti, Prof. Abir De

Publications

S=In Submission, J=Journal, C=Conference, P=Patent, *=Equal Contribution

[S.1] **ROPES: Robotic Pose Estimation via Score-based Causal Representation Learning**
Pranamya Kulkarni*, Puranjay Datta*, Emre Acartürk, Burak Varici, Karthikeyan Shanmugam, Ali Tajer
Embodied World Models for Decision Making Workshop, NeurIPS 2025 [**EWM @ NeurIPS'25**]
Under review at International Conference on Learning Representations 2026 [**In Submission @ ICLR'26**]

[S.2] **Compressing Many-Shots in In-Context Learning**
Devvrit Khatri, Pranamya Kulkarni, Nilesh Gupta, Yerram Varun, Liqian Peng, Jay Ygnik, Praneeth Netrapalli, Cho-Jui Hsieh, Alec Go, Inderjit S Dhillon, Aditya Kusupati, Prateek Jain
Under review at ACL Rolling Review [**In submission @ ARR**]

[J.1] **Harnessing Shared Relations via Multimodal Mixup Contrastive Learning for Multimodal Classification**
Raja Kumar*, Raghav Singhal*, Pranamya Kulkarni, Deval Mehta, Kshitij Jadhav
Transactions on Machine Learning Research (TMLR), May 2025 [**TMLR**]
UniReps: Unifying Representations in Neural Models Workshop @ NeurIPS 2024 [**UniReps @ NeurIPS'24**]

[C.1] **IndiBias: A Benchmark Dataset to Measure Social Biases in Language Models for Indian Context**
Nihar Sahoo, Pranamya Kulkarni, Narjis Asad, Arif Ahmad, Tanu Goyal, Aparna Garimella, Pushpak Bhattacharyya
North American Chapter of the Association for Computational Linguistics, 2024 [**NAACL'24**]

[P.1] **Imagist: Image Description Generation with Varying Levels of Detail**
Pranamya Kulkarni*, Akshay Iyer*, Kanad Pardeshi*, Nikunj Goyal*, Apoorv Saxena, Praneetha Vaddamanu, Abhilasha Sancheti, Aparna Garimella, Vishwa Vinay
U.S. Patent Application No. 2025/0028911 A1 [**2023**]

Selected Projects

ROPES: Robotic Pose Estimation via Score-based Causal Representation Learning[S.1] Sep'25
Advisors: Dr. Karthikeyan Shanmugam, Prof. Ali Tajer — Google DeepMind

- Developed **ROPES**, a novel and scalable method for estimating a robot's pose from images in a fully **unsupervised** manner.
- Disentangled angles with a 3-stage **score-based CRL** pipeline, using distributional shifts from targeted joint interventions.
- Achieved performance **comparable** to SOTA supervised method (RoboPEPP), proving data efficiency and practical viability.

Compressing Many-Shots in In-Context Learning [S.2] Jul'25
Advisors: Dr. Prateek Jain, Dr. Praneeth Netrapalli, Dr. Aditya Kusupati — Google DeepMind

- Devised **MemCom**, technique to compress long, example-filled prompts, making In-Context Learning **memory-efficient**.
- Designed a compressor model that creates a **compact summary** of the prompt's information for each layer of the LLM.
- Attained high accuracy at **8x compression**, outperforming baselines and enabling efficient deployment on edge devices.

Composite Vocabulary for Efficient LLM Tokenization Feb'25
Advisors: Dr. Prateek Jain, Dr. Pradeep Shenoy Google DeepMind

- Created a more efficient tokenizer with **multi-word tokens** to reduce standard subword tokenization overhead.
- Designed **Weighted-BPE algorithm** to merge tokens by scoring pairs with model's next-token prediction probabilities.
- Achieved **2x improvement** in token efficiency, enabling faster inference while maintaining net downstream performance.

Dynamic Model Routing for Efficient Inference Nov'24
Advisors: Dr. Prateek Jain, Dr. Pradeep Shenoy Google DeepMind

- **Reduced latency** in **Google AI Overviews** with a dynamic router that selects the most optimal-sized model per query.
- Optimized the serving pipeline by using the largest model for compute-intensive prefill, while the router offloaded **80% of queries** to a smaller model for the decode stage, achieving significant latency reduction without performance loss.

Imagist: Detail-Controllable Image Description Generation [P.1] Jul'22
Advisors: Dr. Vishwa Vinay, Dr. Aparna Garimella, Dr. Abhilasha Sancheti, Dr. Apoorv Saxena Adobe Research

- Conducted research to describe images at user specified levels of granularity by formalizing underlying concept of **detail**.
- Created **DenseDetail** model which classifies image regions based on user specified input to control caption granularity.
- Built a **dataset** for training by adapting Stanford Image Paragraph corpus which contained corresponding detail scores.

Harnessing Shared Relations via Multimodal Mixup Contrastive Learning for Multimodal Classification[J.1] May'25
Advisors: Dr. Kshitij Jadhav, Prof. Deval Mehta IIT Bombay

- Devised a novel contrastive method using **mixup** to teach models cross-modal relationships between images and text.
- Designed a framework where the model is trained to **align** a synthetically mixed data point (e.g., a combined image) with its original, separate components (e.g., individual text descriptions), forcing it to learn more **generalizable** features.
- Proved effectiveness by outperforming previous state-of-the-art models on benchmarks like **N24News** and **ROSMAP**.

IndiBias: A Benchmark Dataset to Measure Social Biases in Language Models for Indian Context [C.1] Apr'24
Advisors: Prof. Pushpak Bhattacharya IIT Bombay

- Developed **IndiBias**, a dataset to measure social and intersectional biases in LLMs, specifically designed for **Indian context**.
- Built a dataset of **800** sentence pairs by culturally adapting **CrowS-Pairs** corpus and augmenting it with new examples.
- Curated a corpus for intersectional bias analysis and used the complete benchmark for evaluating **ten** multilingual LLMs.

Compact Subgraph Jun'24
Advisors: Prof. Soumen Chakrabarti, Prof. Abir De Master Thesis, IIT Bombay

- Architected a **GNN-based** method to extract the most compact, relevant subgraph that answers a given keyword query.
- Utilized **random walk with restarts** to score node relevance, iteratively pruning the graph to isolate the final subgraph.
- Built a unified toolbox integrating six graph matching algorithms for standardized evaluation and easy experimentation.

Passage-based Question-Answering Feb'23
Advisors: Prof. Pushpak Bhattacharya Inter-IIT Tech-Meet 2023

- Engineered an efficient, multi-stage QA pipeline to first retrieve relevant documents, and then extract the precise answer.
- Implemented a two-stage retrieval system: **bi-encoder** for document selection and precise **cross-encoder** for reranking.
- Fine-tuned an **ELECTRA** model for extracting the final answer, achieving a **96.8% F1-score** within tight latency constraints.

Achievements and Notable Positions of Responsibilities

- Selected as **one of 12 from 20,000** applicants for Google's Pre-Doctoral Program [2024–'26]
- **Teaching Assistant** - Programming for Data Science course under Prof.Vinay Kulkarni in CMInDS department, IIT B [Aug'23]
- Inter IIT Tech Meet 11.0: Secured **Bronze medal** while representing IIT B in Retrieval and QA problem statement [Feb'23]
- **Mentored** 2 teams on Deep Learning and Control Theory projects, providing technical guidance and assessing reports [Jun'22]
- **Teaching Assistant** - Differential Equations course under Prof.Prachi Mahajan in Mathematics department, IIT B [Jun'21]
- Recorded a perfect **10/10 SPI** in the 8th and 10th semester, reflecting consistent academic excellence.
- Served as NSS **Green Campus** volunteer, driving tree-plantation, biodiversity initiatives and energy-saving drives. [Apr'20]
- Secured in Engineering Entrance Exam JEE Mains: **99.48** percentile and JEE Advanced: **top 1.5% of 170k students**

Key Courses Undertaken and Technical Skills

Machine Learning & Computer Science	Optimization, Programming for Data Science, Information Theory & Coding, Machine Learning with Graphs, Advanced Image processing, Data Structures and Algorithms, Speech Processing, Computer Programming and Utilization, Medical Image Computing, Automatic Speech Recognition
Mathematics	Calculus, Linear Algebra, Complex Analysis, Probability and Random Processes, Differential Equations, Number Theory and Cryptography
Technical Skills	*Languages*: Python, C/C++, MATLAB, LaTeX, HTML, Bash, SQL | *Libraries and Tools*: JAX, PyTorch, Keras, TensorFlow, Git, HuggingFace