Gagan Jain

Pre-Doctoral Researcher, Google DeepMind

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Education

Jul 2018 – Aug 2022 | **Indian Institute of Technology, Bombay** | **CPI: 9.33/10**
Bachelor of Technology (with Honors) in Mechanical Engineering | *Dept. Rank 4/126*
Dual Minors: Artificial Intelligence & Data Science | Computer Science & Engineering

Research Experience

May 2024 – Present | **Google DeepMind** | **Bangalore, India**
Pre-Doctoral Researcher | *Advisor: Dr. Prateek Jain*
→ Improving the training and decoding efficiency of Google's flagship models, Gemini and Veo

Sep 2023 – May 2024 | **Google Research** | **Bangalore, India**
Pre-Doctoral Researcher | *Advisors: Dr. Sujoy Paul, Dr. Anurag Arnab, Dr. Arun Suggala*
→ Conducted research on token compression, conditional computation, and low-rank bandits
→ Collaborated with researchers at LMU Munich, Univ. of Washington and Harvard University
→ Resulted in 2 top-tier conference publications [NeurIPS'24, ECCV'24] and 2 in-submission works

Jul 2022 – Sep 2023 | **Microsoft R&D** | **Hyderabad, India**
Data & Applied Scientist | *Advisor: Vidhyasagar Alvarsamy*
→ Worked on extreme classification and collaborative filtering for recommendation systems
→ Recognized for fast-paced quality contributions, promoted within an year

Dec 2018 – Apr 2022 | **IIT Bombay** | **Mumbai, India**
Undergraduate Researcher | *Advisors: Prof. Amit Sethi, Prof. Shivaram Kalyanakrishnan*
→ Worked on multi-task learning, predictive control and online RL for autonomous driving
→ Mentored **50+** students on practical aspects of machine learning, robotics and computer vision
→ Actively contributed to multiple global robotics challenge victories [IARC'21, ASME SDC'21, SDC'19]

Publications and Preprints

[C.2] **Mixture of Nested Experts: Adaptive Processing of Visual Tokens** [🔗]
Gagan Jain*, Nidhi Hegde, Aditya Kusupati, Arsha Nagrani, Shyamal Buch, Prateek Jain, Anurag Arnab, Sujoy Paul*
Thirty-Eighth Annual Conference on Neural Information Processing Systems **[NeurIPS'24]**

[C.1] **LookupViT: Compressing Visual Information to a smaller number of tokens** [🔗]
Gagan Jain*, Rajat Koner*, Volker Tresp, Prateek Jain, Sujoy Paul
Eighteenth European Conference on Computer Vision **[ECCV'24]**

[S.2] **Masked Generative Nested Transformers with Decode Time Scaling** [🔗]
Sahil Goyal, Debapriya Tula, **Gagan Jain**, Prateek Jain, Pradeep Shenoy, Sujoy Paul
Ready for Submission to ICML'25 **[In Submission]**

[S.1] **Bayesian Collaborative Bandits with Thompson Sampling for Improved Outreach in Maternal Health Program** [🔗]
Arpan Dasgupta, **Gagan Jain**, Arun Suggala, Karthikeyan Shanmugam, Milind Tambe, Aparna Taneja
Preprint, Under Review at AAMAS'25 (Positive Reviews) **[In Submission]**

* denotes equal contribution, S = In Submission, C = Conference Publication

Talks

→ **Inference-time Efficiency in Large Generative Models**
UCLA Artificial General Intelligence Lab (hosted by Prof. Quanquan Gu) — Dec 2024
Vision India @ Indian Conf. on Computer Vision, Graphics & Image Processing (Invited Speaker) — Dec 2024
MEDAL Lab, IIT Bombay (hosted by Prof. Amit Sethi) — Oct 2024

→ **Robust Tracking using Model Predictive Control for Self-Driving Cars**
Virtual Research Symposium for Students, NTU Singapore & IIT Bombay — May 2021

Selected Research Projects

Conditional Computation for Visual Modalities
Advisors: Dr. Aditya Kusupati, Dr. Anurag Arnab, Dr. Sujoy Paul

→ Constructed a parameter-efficient Mixture-of-Experts framework using Nested Transformers.
→ Proposed Expert Preferred Routing algorithm, achieving quality-neutral **2x compute savings**. [NeurIPS'24]
→ Discovered effective distillation methods for stable training of nested models.
→ Developed progressive decoding for nested generative models, improving **latency by 3x**. [In Submission]

Token Compression based Sub-Quadratic Attention Mechanism
Advisors: Dr. Sujoy Paul, Dr. Prateek Jain

→ Devised the adaptive **LookupViT** framework with sub-quadratic compute complexity. [ECCV'24]
→ Improved/matched performance on multiple academic benchmarks using significantly lower compute.
→ Achieved **5% boost on adversarial datasets**, indicating higher robustness, validated by analyzing feature quality.

Regret Bounds for Clustered Bandits in Multi-Agent Settings
Advisors: Dr. Arun Suggala, Dr. Karthikeyan Shanmugam

→ Studied **low-rank assumptions** in large-scale multi-user bandits from a Bayesian viewpoint. [In Submission]
→ Conducted Eluder dimension analysis for clustered settings, achieving **optimal regret bounds** for proposed method.
→ Established equivalence of 0-Eluder Dimension for low-rank bandits with Zarankiewicz's problem.

Visual Perception and Control for Autonomous Driving [🔗, ▶]
Advisors: Prof. Amit Sethi, Prof. Shivaram Kalyanakrishnan

→ Leveraged multi-task learning for simultaneous detection and segmentation, enhancing both accuracy and speed.
→ Moved from a naive PID-based controller to Model Predictive Control for robust motion tracking.
→ Developed a proof-of-concept Online RL framework for autonomous driving, using Q-learning and tile coding.

Scholastic and Technical Accolades

→ Among **13**, from **18,000+** applicants, selected for Google's Pre-Doctoral Researcher Program 2023
→ Recipient of Technical Citation, Organizational Color, and Technical Special Mention awards at IIT Bombay 2022
→ **World Champions** in IARC'21 and **Asia-Pacific Champions** in ASME SDC'19 global robotics competitions 2019,21
→ All India Rank **572** among **0.15 M** in JEE Advanced and Rank **740** among **1.5 M** in JEE Main 2018
→ **Top 1%** in National Standard Exam in Physics and Chemistry, selected for Indian National Chemistry Olympiad 2018

Notable Positions of Responsibility

→ **Reviewer**: ICLR, AISTATS, AAMAS, ICVGIP, for submissions on efficiency, vision, bandits, and optimization 2024
→ **Team Lead, SeDriCa, IITB**: Managed technical and organizational aspects of the autonomous driving team 2021-22
→ **Teaching Assistant, IITB**: Intelligent & Learning Agents, Machine Learning, Electricity & Magnetism 2019-21
→ **Mentor, SMP, IITB**: Guided **25+** juniors from diverse academic, cultural, and vocational backgrounds 2020-22
→ **Research Coordinator, UGAC, IITB**: Promoted UG research through projects, reading groups, & seminars 2020-21
→ **Teaching Volunteer, NSS, IITB**: Taught basic mathematics to secondary school students at NGO Asha 2018-19

Exploratory Research

→ **Search:** Utilized Rerooting Levin Tree Search for solving 4x4 Rubik's Cube in GDM Hackathon, with Dr. L. Orseau
→ **GAN-BERT:** Fine-tuned BERT in an adversarial setting to improve low-data performance, with Prof. P. Jyothi </>
→ **Lane-MPC:** Implemented potential field-based Model Predictive Controller for lane merging, with Prof. A. Sinha </>
→ **Graph NNs:** Benchmarked link prediction methods (heuristics, embeddings) on networks, with Prof. A. De </>
→ **Blockchain:** Built a peer-to-peer simulator with PoC and delays under selfish mining, with Prof. V. Ribeiro </>
→ **DDQN:** Developed a Breakout-playing agent using Double Deep Q-Learning, achieving 8x boost, with Prof. A. De </>
→ **Adaptive Control:** Simulated a back-stepping control law for tracking under uncertainty, with Prof. S Srikant 🔗
→ **Tabular RL:** Solved MDP tasks using policy/value iteration and LP algorithms, with Prof. S Kalyanakrishnan 🔗

Key Courses Undertaken

Machine Learning Advanced ML, Speech Recognition, Intelligent & Learning Agents, Digital Image Processing, Statistical ML & Data Mining, Adaptive Control, Deep RL (UC Berkeley), Deep Generative Models (Stanford)
CS and Maths Design & Analysis of Algorithms, Operating Systems, Data Structures & Algorithms, Linear Algebra, Blockchain, Calculus, Differential Equations, Numerical Analysis, Optimization, Shape Analysis (MIT)