Harman Singh

CS PhD Student at UC Berkeley

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Education

University of California, Berkeley **Aug 2025 - 2029**
PhD in Computer Science, Advisor: Prof. Kurt Keutzer

Indian Institute of Technology Delhi (IIT D) **July 2018 - May 2022**
B.Tech in Electrical Engineering; GPA: **9.349/10.0**. Department Rank: **6**

Research Experience

Google DeepMind **Aug 2023 - Aug 2025**
Pre-doctoral Researcher | Advisors: Dr. Partha Talukdar, Dr. Sriram Ganapathy, Dr. Trevor Cohn
Projects: Gemini 3.0, Gemini 2.5 Pro Core Contributor, **Gemma 3** Contributor – Causally Robust Reward Models [**S.4**], Multimodal Data-Curation and Evals for low-resource languages, Improving Long-Context Multimodal ICL, IndicGenBench – for evaluating LLMs on 29 Indic Languages [**C.4**], Speech Tokenizer Assessment Benchmark (STAB) – cost effective methodology for evaluation of speech-tokenizers [**S.2**].

FAIR, Meta AI **July 2022 - July 2023**
AI Resident | Advisors: Dr. Pengchuan Zhang, Dr. Hugo Chen, Dr. Wenhan Xiong, Dr. Qifan Wang
Project: Improving the compositionality of contrastively pre-trained vision-language models (MosaiCLIP [**C.5**]).

INKLab University of Southern Califronia **June 2021 - Jan 2022**
Undergraduate Researcher | Advisor: Prof. Xiang Ren
Project: Developed a model (FaiRR) [**C.3**] for deductive reasoning over natural language rulebases.

IBM Research AI and DAIR Lab, IIT Delhi **June 2021 - June 2022**
Undergraduate Researcher/Research Intern | Advisor: Prof. Parag Singla, Dr. Dinesh Garg
Project: Object-centric models for multimodal reasoning, image editing [**C.2**] and generation [**S.1**].

Publications

S=In Submission, C=Conference, J=Journal, T=Tech Report, *=Equal Contribution

[T.2] **Gemini 2.5 Pro Technical Report**
Gemini Team, Google DeepMind (including Harman Singh)

[T.1] **Gemma 3 Technical Report**
Gemma Team, Google DeepMind (including Harman Singh)

[S.5] **Unifying Reasoning with Verification for Improved Parallel Scaling**
Harman Singh*, Xiuyu Li*, Kurt keutzer
In Progress **[In Progress]**

[S.4] **Robust Reward Modeling via Causal Rubrics**
Harman Singh*, Pragya Srivastava*, Rahul Madhavan*, Gandharv Patil, Sravanti Addepalli, Arun Suggala, Rengarajan Aravamudhan, Soumya Sharma, Anirban Laha, Aravindan Raghuveer, Karthikeyan Shanmugam, Doina Precup
ICML DataWorld and ICML MoFA Workshops **[Under Review at ICLR 2026]**

[S.3] **CDLM: Consistency Diffusion Language Models for Faster Sampling**
Minseo Kim, Chenfeng Xu, Coleman Hooper, Harman Singh, Ben Athiwaratkun, Ce Zhang, Kurt Keutzer, Amir Gholami
Under Review at MLSys 2026 **[Under Review at MLSys 2026]**

[C.5] **Coarse-to-Fine Contrastive Learning in Image-Text-Graph Space for Improved Vision-Language Compositionality**
Harman Singh, Pengchuan Zhang, Qifan Wang, Mengjiao Wang, Wenhan Xiong, Jingfei Du, Yu Chen
Conference on Empirical Methods in Natural Language Processing
Oral at CLVL workshop, ICCV 2023; and Oral at SpLU-RoboNLP workshop, EMNLP 2023 **[EMNLP'23]**

[C.4] **IndicGenBench: A Multilingual Benchmark to Evaluate Generation Capabilities of LLMs on Indic Languages**
Harman Singh, Nitish Gupta, Shikhar Bharadwaj, Dinesh Tewari, Partha Talukdar
Annual Conference of the Association for Computational Linguistics
Media: Indian Express | Google Blog | GDM Director's Presentation **[ACL'24]**

[C.3] **FaiRR: Faithful and Robust Deductive Reasoning over Natural Language**
Soumya Sanyal, Harman Singh, Xiang Ren
Annual Conference of the Association for Computational Linguistics **[ACL'22]**

[C.2] **Image Manipulation via Multi-Hop Instructions**
Harman Singh, Poorva Garg, Mohit Gupta, Kevin Shah, Arnab K. Mondal, Dinesh Khandelwal, Dinesh Garg, Parag Singla
Conference on Empirical Methods in Natural Language Processing **[EMNLP'23]**

[C.1] **Cross-Lingual Multi-Hop Knowledge Editing**
Harman Singh*, Aditi Khandelwal*, Hengrui Gu, Tianlong Chen, Kaixiong Zhou
Conference on Empirical Methods in Natural Language Processing **[Findings of EMNLP'24]**

[S.2] **Speech Tokenizer Assessment Benchmark (STAB)**
Harman Singh*, Shikhar Vashishth*, Shikhar Bharadwaj*, Sriram Ganapathy, Chulayuth Asawaroengchai, Andrew Rosenberg, Kartik Audhkhasi, Ankur Bapna, Bhuvana Ramabhadran
Under Review **[Under Review]**

[S.1] **GraPE: A Generate-Plan-Edit Framework for Compositional T2I Synthesis**
Ashish Goswami, Satyam K. Modi, Santhosh R. Deshineni, Harman Singh, Prathosh A P, Parag Singla
Under Review at TMLR **[Under Review at TMLR]**

[J.2] **Unlocking capacities of viral genomics for the COVID-19 pandemic response**
Sergey Knyazev, Karishma Chhugani, Harman Singh*, Varuni Sarwal*, Ram Ayyala*, ..., Alex Zelikovsky, Rob Knight, Keith A. Crandall, Serghei Mangul
Nature Methods **[Nature Methods'22]**

[J.1] **A Novel Network Representation of SARS-CoV-2 Sequencing Data**
Sergey Knyazev, Daniel Novikov, Mark Grinshpon, Harman Singh, Ram Ayyala, Varuni Sarwal, Roya Hosseini, Pelin Icer Baykal, Pavel Skums, Ellsworth Campbell, Serghei Mangul, Alex Zelikovsky
International Symposium on Bioinformatics Research and Applications **[ISBRA'21]**

Selected Projects

Gemini 2.5, Gemini 3.0 April 2024 – May 2025
Advisors: Dr. Partha Talukdar, Dr. Jason Riesa — Google DeepMind

- Developed data-curation techniques for improving performance on low-resource languages.
- Researched and developed improved evaluations for measuring robustness of low-resource text and speech understanding.
- Awarded Spot Bonus by GDM CTO koray kavukcuoglu and GDM Senior Staff RS for contributions to **Gemini 2.5**.
- See Gemini 2.5 Blog, Gemini 2.0 Blog, Gemma 3 Tech Report and Gemma 3 Blog

Improving Compositionality of Vision Language Models (VLMs) Oct 2022 – July 2023
Advisors: Dr. Pengchuan Zhang, Dr. Hugo Chen, Dr. Wenhan Xiong, Dr. Qifan Wang — FAIR, Meta AI

- Improved compositionality of VLMs, e.g., 16.5% improvements in relation understanding over strong baselines [**C.5**].
- Developed a scene-graph-based hierarchical contrastive learning method aligning sentences of varying semantic complexity to images using text-scene graphs for fine-grained and compositional alignment.
- Created hard-negative sub-graphs for data augmentation during contrastive learning to improve compositionality.
- Conducted large-scale pre-training and fine-tuning experiments of CLIP models on up to 100M image-text examples.

IndicGenBench: Generative Evaluation of LLMs on 29 Indic Languages Aug 2023 – May 2024
Advisors: Dr. Partha Talukdar, Dr. Nitish Gupta — Google DeepMind

- Largest benchmark for Indic evaluation of LLMs in 29 of Indic languages, 13 scripts and 4 language families [**C.4**].
- 5 user-facing tasks including cross-lingual summarization, multilingual and cross-lingual QnA and Machine Translation.
- Studied transfer from high-resource languages, deficiencies in tokenization, improvements with in-context learning and quantifying when in-context learning is better than fine-tuning.

In-context Learning with Long-context Multimodal LLMs Sep 2024 – Present
Advisors: Dr. Partha Talukdar, Dr. Sriram Ganapathy, Dr. Trevor Cohn — Google DeepMind

- Demonstrated significant differences in scaling text-only ICL vs multimodal ICL in long-context models like Gemini.
- Analyzed few and many-shot in-context learning (ICL) effectiveness in a long-context setting, observing inverted U-shaped scaling curves and quick performance saturation for multimodal tasks such as Audio QA and Visual QA.
- Demonstrated that retrieval with long-context models improves Visual QA by 8-23% for knowledge-intensive tasks.
- Developing scaling laws for performance vs increased inference time compute allocated to ICL, RAG, and CoT.

STAB: Speech Tokenizer Assessment Benchmark Dec 2023 – March 2024
Advisors: Dr. Partha Talukdar, Dr. Sriram Ganapathy, Dr. Bhuvana Ramabhadran — Google DeepMind

- Developed a low-cost methodology for evaluating speech tokens without pre-training speech foundation models [**S.2**].
- STAB measures properties like compressibility of tokens, strongly correlated with downstream task performance.

Faithful and Robust Deductive Reasoning over Natural Language June 2021 – Jan 2022
Advisors: Prof. Xiang Ren, Soumya Sanyal InkLab USC

- Designed a 3-step modular architecture for interpretable and robust deductive reasoning over natural language [**C.3**].
- Modeled rule selection, fact selection, and conclusion generation using individual RoBERTa and T5 transformer models.
- Improved robustness to linguistic perturbations by 2.2% and consistency of predictions by 3%.

Image Manipulation via Complex Instructions June 2021 – May 2022
Advisors: Prof. Parag Singla, Dr. Dinesh Garg DAIR, IIT Delhi and IBM Research

- Designed NeuroSIM, a weakly supervised, modular, neuro-symbolic architecture for text-guided image manipulation, trainable without output image supervision [**C.2**].
- The model is data efficient, interpretable by design, and can generalize to complex text instructions and scenes.

Cross-Lingual Multi-hop Knowledge Editing in LLMs June 2023 - June 2024
Advisors: Dr. Tianlong Chen, Dr. Kaixiong Zhou Collab w/MIT, Microsoft

- Proposed cross-lingual multi-hop knowledge editing and created a parallel benchmark for the task in 8 languages [**C.1**].
- Enhanced cross-lingual retrievers with novel contrastive losses improving retrieval-augmented knowledge editing.
- Achieved up to 30% accuracy gains over state-of-the-art methods on diverse LLMs, languages, and datasets.

Selected Honors and Awards

Google DeepMind Internal Awards: Awarded **4 Spot Bonuses** and **6 peer bonuses** by GDM Director, Senior Staff RS, and colleagues for contributions to Gemini 2.0 multilinguality, Gemini i18n Summit, [**C.4**] etc.

Oral paper acceptance at Closing the loop between vision and language workshop at ICCV 2023.

Oral paper acceptance at SpLU-RoboNLP workshop at EMNLP 2023.

Outstanding Reviewer Award, MLRC 2022 (Received GCP credits worth $5k USD).

Media Coverage: IndicGenBench [**C.4**] covered by Indian Express, Google Blog, GDM Director's presentation.

One of 12, of 20k applicants to be selected for the Google Pre-doctoral program 2023-25.

One of 4 from India and 27 globally to be selected for the AI Residency position at Meta AI, 2022-23.

Selected for CIFAR Deep Learning Reinforcement Learning Summer School, 2022.

IIT-Delhi Semester Merit Award for being amongst **top 7%** students in 4 out of 8 semesters at IIT Delhi.

All India Rank 170 in IIT JEE Mains 2018 and **All India Rank 751** in IIT JEE Advanced amongst 10 million candidates.

KVPY Scholarship with All India Rank 160 in 2016-17 by Department of Science and Technology Govt. of India.

Recipient of **Professor S.K Saha award** for the **best robotics team** in IIT Delhi.

Placed in **top 0.1%** students in India by **securing 100%** in Mathematics and Computer Science in class 12.

Represented IIT Delhi National (India) **ABU Robocon 2019** as a first year undergraduate.

Teaching and Academic Service

Reviewing

- COLM 2024-25, ICLR 2024, ACL-ARR 2024 (3 cycles), NeurIPS 2023, EMNLP 2023, MLRC 2022 (Outstanding Reviewer).

TA for Machine Intelligence and Learning Aug - Dec 2021
Instructors: Prof Sumeet Agarwal and Prof Jayadeva IIT Delhi

- Responsible for conducting problem-solving and programming (Python and PyTorch) tutorials, grading assignments, taking vivas for projects and course assignments, and creating assignment questions.

TA for Introduction to Electrical Engineering Nov 2021 - Mar 2022
Instructor: Prof Anuj Dhawan IIT Delhi

- Responsible for conducting problem solving tutorials, creating exam questions, and grading exam copies.

Co-organiser, NLP Reading Group, Google DeepMind India 2024 - Present

- Organized weekly presentations by researchers on topics such as language modeling, inclusivity, and multimodality.

Demo Leader, NeurIPS Education Outreach Program 2022

- Gave a demo on compositional generalization in large ML models to 240+ high school students.

Volunteer, BiNDI Summit (Biases in NLP models and Data for the Indian Context) at Google Research 2023

Secretary, Electrical Engineering Society IIT Delhi 2021-22

Selected Talks

“Robust Reward Modeling via Causal Rubrics”

- Mila/McGill NLP Reading Group — Oct 2025
- Machine Learning and Optimization team, Google DeepMind — June 2025
- Languages team, Google DeepMind India — June 2025

“Multimodal In-context Learning for Cultural and Linguistic Adaptation”

- Gemini i18n Summit, Google DeepMind 🏆Awarded Spot Bonus from Google DeepMind Director — Dec 2024

“Coarse-to-fine Contrastive Learning for Vision-Language Compositionality”

- FAIR, Meta AI — May 2023
- 5th Workshop on Closing the Loop Between Vision and Language, ICCV 2023 (Oral) — Oct 2023
- 3rd SpLU-RoboNLP Workshop, EMNLP 2023 (Oral) — Dec 2023

“IndicGenBench – Generative Evaluations of LLMs on Indic Languages”

- Multilinguality Research Forum, Gen AI, Google DeepMind — May 2024