Ramnath Kumar

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RESEARCH INTERESTS & SUMMARY

My research interests broadly cover deep learning, focusing on designing **robust** and **efficiency** techniques for designing practical deep learning systems. I am specifically interested in applications surrounding dense-retrieval, and large language models.

EDUCATION

University of California, Los Angeles (UCLA) — Los Angeles, USA
PhD. in Computer Science — *09/2024 – Present*
. Advisor: Prof. Cho-Jui Hsieh , UCLA Samueli School of Engineering

BITS Pilani, Hyderabad Campus — Hyderabad, India
B.E. in Computer Science, MSc. in Economics — *08/2016 – 08/2021*
. CGPA in Computer Science major: **9.65/10.0** (Top 10 in class of 255)
. Overall CGPA: 8.92/10.0

SELECTED RESEARCH/WORK EXPERIENCE

Google DeepMind — Bangalore, India
Pre-Doctoral Researcher in MLO Group & Ads ML Team — *07/2022 – 08/2024*
. Advisors: Dr. Prateek Jain and Prof. Inderjit S. Dhillon
. Developed an end-to-end efficient retrieval architecture (EHI) [3], that improved upon prior retrieval benchmarks by up to **1.45%** at a fixed compute budget. This effort is slated for integration into various Google products.
. Led a cross-functional team in developing and deploying RGD [2] solutions in product-driven research, improving performance of ViT by up to **1.01%** on ImageNet-1K.
. Received recognition for efforts in improving related product retrieval for users across the world. Took initiative in proposing a novel end-to-end retrieval architecture, improving efficiency and robustness in ongoing projects, with contributions recognized in .

Google Research — Bangalore, India
Research Associate in Machine Learning and Optimization Group (MLO) — *04/2022 – 07/ 2022*
. Advisor: Dr. Dheeraj Nagaraj
. Devised Introspective Experience Replay (IER), a replay buffer sampler inspired by other reverse-experience-replay (RER), with potential to enhance convergence of RL algorithms such as DQN, TD3, and more [6] by up to **7x** speedup.

Mila - Quebec Artificial Intelligence Institute — Montreal, Canada
Consultant — *07/2021 – 03/2022*
. Advisor: Prof. Yoshua Bengio
. Initiated and led a project exploring the impact of diversity in meta-learning, collaborating closely with another PhD student. Designed and executed experiments, leading to an oral presentation at AAAI [4] that challenged the conventional wisdom of diversity being strictly useful to meta-learning.

Amazon ML — Bangalore, India
Applied Scientist Intern — *01/2021 – 06/2021*
. Advisor: Dr. Gokul Swamy
. Published at Amazon's internal conference (AMLC 2021) and investigated causal attributions and its significance within the Amazon sales model at capacity of first-author.

Mila - Quebec Artificial Intelligence Institute Montreal, Canada
Research Intern *11/2020 – 04/2021*
. Advisor: Prof. Samira E. Kahou
. Collaborated with a team of PhD students and advisors on the Limits of Multi-modal Meta-Learning [7].

CoCo Lab, Université de Montréal Montreal, Canada
Research Intern *06/2020 – 11/2020*
. Advisor: Prof. Karim Jerbi
. Studied Brain based subject identification using EEG data .

Kno.e.sis, Wright State University Dayton, USA
Research Intern *05/2019 – 08/2019*
. Advisor: Prof. Amit P. Sheth and Prof. Krishnaprasad Thirunarayan
. Collaborated with a large team from multiple time-zones and worked on a research project at the capacity of a first-author. Developed a sybil detection system in darknet markets using an unsupervised multi-view framework [5].

PUBLICATIONS

[1] Towards Building efficient Routed systems for Retrieval
Ramnath Kumar, Prateek Jain, and Cho-Jui Hsieh
Under Review, ICML 2025

[2] Stochastic Re-weighted Gradient Descent via Distributionally Robust Optimization
Ramnath Kumar, Kushal Alpesh Majmundar, Dheeraj Mysore Nagaraj, and Arun Suggala
Transactions on Machine Learning Research, 2024.
ICLR 2023 Workshop on Pitfalls of limited data and computation for Trustworthy ML.
Google AI Blog Coverage.

[3] EHI: End-to-end Learning of Hierarchical Index for Efficient Dense Retrieval
Ramnath Kumar*, Anshul Mittal*, Nilesh Gupta, Aditya Kusupati, Inderjit Dhillon, and Prateek Jain
Transactions on Machine Learning Research, 2024.

[4] The Effect of diversity in Meta-Learning
Ramnath Kumar, Tristan Deleu, and Yoshua Bengio
AAAI 2023 (**Oral** Paper).
NeurIPS Workshop on Meta-Learning, 2021.
SyncedReview Blog Coverage.

[5] eDarkFind: Unsupervised Multi-view Learning for Sybil Account Detection
Ramnath Kumar, Shweta Yadav, Raminta Daniulaityte, Francois Lamy, Krishnaprasad Thirunarayan, Usha Lokala, and Amit Sheth
The Web Conference (WWW), 2020.

[6] Introspective Experience Replay: Look Back When Surprised
Ramnath Kumar and Dheeraj Nagaraj
Transactions on Machine Learning Research, 2024
NeurIPS Workshop on DeepRL, 2022.
Google Research: "Algorithms for efficient deep learning" Blog Coverage.

[7] On the Limits of Multi-modal Meta-Learning with Auxiliary Task Modulation Using Conditional Batch Normalization
Jordi Armengol-Estapé, Vincent Michalski, **Ramnath Kumar**, Pierre-Luc St-Charles, Doina Precup, and Samira Ebrahimi Kahou
NAACL Workshop on Insights from Negative Results, 2024

[8] Rethinking Learning Dynamics in RL using Adversarial Networks
Ramnath Kumar, Tristan Deleu, and Yoshua Bengio
NeurIPS Workshop on DeepRL, 2022.

[9] Temporal Dynamics and Spatial Content in IoT Malware detection
Ramnath Kumar and G Geethakumari
TENCON 2019.

SELECTED AWARDS AND HIGHLIGHTS

Quad Fellowship, Participated in a summit at the White House to discuss the role of emergent technologies and the policies surrounding these technologies. 2024

Graduate Dean's Scholars Award, UCLA scholarship of $15,000. 2024

Google Blog, RGD work [2] was highlighted, and well accepted. 2023

Awardee, NTSE Scholar (Awarded to 775 students amongst 0.5 million candidates). 2014-2020

ACADEMIC SERVICES

- **Reviewer:** NeurIPS (2022, '23, '24) and ICML (2022, '23), ICLR(2023), AutoML (2022) and ICWSM (2020, '21, '22, '23)
- **Volunteer:** COLT (2023)

RELEVANT COURSEWORK AND SKILLS

- **Math, Stats and Machine Learning:** Large-Scale Machine Learning, Convex Optimization, Calculus, Linear Algebra, Probability and Statistics, Differential Equations, Foundations of Data Science, Artificial Intelligence, Machine Learning, Information Retrieval
- **Programming Languages and Libraries:** Python, C++, Pytorch, Tensorflow, Jax, OpenCV