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 representation learning and optimization of training paradigms for these models.

EDUCATION

University of California, Los Angeles (UCLA) — Los Angeles, USA
PhD. in Computer Science — *09/2024 – Present*
. Advisor: 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*
. Mentors: Prateek Jain and 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*
. Mentor: 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*
. Mentor: 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*
. Mentor: 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*
. Mentor: Samira E. Kahou
. Collaborated with a team of PhD students and advisors on the Limits of Multi-modal Meta-Learning [9].

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

Kno.e.sis, Wright State University Dayton, USA
Research Intern *05/2019 – 08/2019*
. Mentors: Amit P. Sheth and 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
U.S. patent

[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.
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).
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.
Google Research: "Algorithms for efficient deep learning" Blog Coverage.

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

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

[9] 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

SELECTED AWARDS AND HIGHLIGHTS

Quad Fellowship, Participated in a summit at the White House to discuss the role of emergent technologies and their policies 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