Ramnath Kumar

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Research Interests

Robust, efficient and scalable large-scale deep learning algorithms, especially for representation learning, and their applications in domains like LLMs, meta-learning and dense retrieval.

EDUCATION

BITS Pilani, Hyderabad Campus — Hyderabad, India
Masters of Science in Economics — *Aug 2016 – Aug 2021*
Bachelor of Engineering in Computer Science

. CGPA in Computer Science major: **9.65/10.0** (Top 10 in class of 255)
. Overall CGPA (B.E. Computer Science and Msc. Economics): 8.92/10.0
. Thesis: Worked on malware detection in IoT devices using machine learning techniques [7].

SELECTED RESEARCH/WORK EXPERIENCE

Google — Bangalore, India
Pre-Doctoral Researcher in Machine Learning and Optimization Group & Ads ML Team — *Jul 2022 – Present*
. Advisor: Dr. Prateek Jain and Prof. Inderjit S. Dhillon
. Developed an optimization technique for reweighting gradient descent samples [1], alongside an end-to-end efficient retrieval architecture [2], both slated for integration into various Google products.

Research Associate in Machine Learning and Optimization Group — *Apr 2022 – Jul 2022*
. Advisor: Dr. Dheeraj Nagaraj
. Developed IER, a replay buffer sampler inspired by previous methods like RER, with the potential to enhance the convergence of RL algorithms like DQN, TD3, and more [5].

Mila - Quebec Artificial Intelligence Institute — Montreal, Canada
Consultant — *Jul 2021 – Mar 2022*
. Advisor: Prof. Yoshua Bengio
. Explored the impact of diversity in meta-learning, resulting in an oral presentation at AAAI [3], and delved into the meta-RL, contributing to workshop publications and presentations at the EEML summer school [6].

Amazon ML — Bangalore, India
Applied Scientist Intern — *Jan 2021 – Jun 2021*
. Advisor: Dr. Gokul Swamy
. Published as the first author at Amazon's internal conference (AMLC 2021) and investigated causal attributions and their significance within the Amazon sales model .

Mila - Quebec Artificial Intelligence Institute — Montreal, Canada
Research Intern — *Nov 2020 – Apr 2021*
. Advisor: Prof. Samira E. Kahou
. Worked on theoretical machine learning in the domain of graph neural networks .

CoCo Lab, Université de Montréal — Montreal, Canada
Research Intern — *Jun 2020 – Nov 2020*
. Advisor: Prof. Karim Jerbi
. Worked on Brain based subject identification using EEG data .

Kno.e.sis, Wright State University — Dayton, USA
Research Intern — *May 2019 – Aug 2019*
. Advisor: Prof. Amit P. Sheth and Prof. Krishnaprasad Thirunarayan
. Worked on sybil detection in the darknet markets using an unsupervised multi-view learning framework [4].

PUBLICATIONS

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

[2] 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
Under Review, ICLR 2024.

[3] The Effect of diversity in Meta-Learning
Ramnath Kumar, Tristan Deleu, and Yoshua Bengio
AAAI 2023 (**Oral**; Acceptance Rate: 4.7%).
NeurIPS Workshop on Meta-Learning, 2021.
SyncedReview Blog Coverage.

[4] 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.

[5] Introspective Experience Replay: Look Back When Surprised
Ramnath Kumar and Dheeraj Nagaraj
Transactions on Machine Learning Research, 2024
NeurIPS Workshop on DeepRL, 2022.
Google AI Blog Coverage.

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

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

SELECTED AWARDS AND HIGHLIGHTS

Google Blog, RGD work [1] was highlighted, and well received by the community. 2023

Presentee, *AAAI* Oral Presentation (Acceptance Rate: 4.7%). 2023

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

ACADEMIC SERVICES

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

RELEVANT COURSEWORK AND SKILLS

- **Math, Stats and Machine Learning:** Calculus, Linear Algebra, Probability and Statistics, Differential Equations, Convex Optimization, Foundations of Data Science, Artificial Intelligence, Machine Learning, Information Retrieval.
- **Summer School:** Eastern European Machine Learning Summer School, Vilnius Lithuania (EEML 2022), *ML Foundations*; Research Week with Google, India (2022), Machine Learning Summer School, Taipei (2021), Google AI Summer School, India (2020).
- **Programming Languages and Libraries:** Python, C++, Pytorch, Tensorflow, Jax, OpenCV.