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

. Achieved overall distinction in Computer Science courses.
. 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*
. Research Supervisor: 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*
. Research Supervisor: 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 – March 2022*
. Research Supervisor: 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*
. Mentor: Dr. Gokul Swamy
. Topic: Stochastic Insight into Neural Networks
. 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*
. Research Supervisor: Prof. Samira E. Kahou
. Affiliated University: École de technologie supérieure
. 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*
. Research Supervisor: Prof. Karim Jerbi
. Worked on Brain based subject identification using EEG data

Kno.e.sis, Wright State University Dayton, USA
Research Intern *May 2019 – August 2019*

. Research Supervisor: 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] **Ramnath Kumar**, Kushal Alpesh Majmundar, Dheeraj Mysore Nagaraj, and Arun Suggala. "Stochastic Re-weighted Gradient Descent via Distributionally Robust Optimization". In: *ICLR 2023 Workshop on Pitfalls of limited data and computation for Trustworthy ML. In preparation ICML 24*. Google AI Blog Coverage.

[2] **Ramnath Kumar***, Anshul Mittal*, Nilesh Gupta, Aditya Kusupati, Inderjit Dhillon, and Prateek Jain. "EHI: End-to-end Learning of Hierarchical Index for Efficient Dense Retrieval". In: *arXiv preprint arXiv:2406.09222. Under Review*, ICLR 2024.

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

[4] **Ramnath Kumar**, Shweta Yadav, Raminta Daniulaityte, Francois Lamy, Krishnaprasad Thirunarayan, Usha Lokala, and Amit Sheth. "eDarkFind: Unsupervised Multi-view Learning for Sybil Account Detection". In: *Proceedings of The Web Conference 2020*, pp. 1955–1965. .

[5] **Ramnath Kumar** and Dheeraj Nagaraj. "Look Back When Surprised: Stabilizing Reverse Experience Replay for Neural Approximation". In: *NeurIPS Workshop on DeepRL* (2022). *Under Review*, TMLR. Google AI Blog Coverage .

[6] **Ramnath Kumar**, Tristan Deleu, and Yoshua Bengio. "Rethinking Learning Dynamics in RL using Adversarial Networks". In: *NeurIPS Workshop on DeepRL* (2022). Also, Presented work at the poster session at EEML 2022..

[7] **Ramnath Kumar** and G Geethakumari. "Temporal Dynamics and Spatial Content in IoT Malware detection". In: *TENCON 2019 IEEE Region 10 Conference (TENCON)*. IEEE. 2019, pp. 1590–1595. .

SELECTED AWARDS AND HIGHLIGHTS

Awardee, INSPIRE Scholar (Awarded to Top 1 Percentile) 2016-2021

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

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

MISCELLANEOUS

- **Reviewer:** ICLR (2023) and NeurIPS (2022, '23), ICML (2022), AutoML (2022) and ICWSM (2020, '21, '22, '23)
- **Volunteer:** COLT (2023)
- **Languages:** English (Native/Fluent), Hindi (Experienced), Tamil (Experienced), Japanese (Beginner)